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Applying TOC Principles to Enhance the Competitiveness of Small and Medium Sized Enterprises in Developing Countries

Case study from a Peruvian SME

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* The name was changed on request of the owners in order to protect the company's reputation.

The company's background

The company was founded in the 1970's as a manufacturer for kitchen stoves and public lighting appliances. It operated under high tariff protection and reached a maximum of approx. 300 employees during its best years.

Due to the government's import liberalization policy in the early 1990's, the company lost its lighting business to international competitors and began to concentrate on the production of kitchen stoves while being gradually downsized to a mere 35 employees by 2005. A few years earlier, the founder's two sons had started to co-manage the company. While the founder was a self-made entrepreneur, his elder son underwent a professional training as business administrator and the younger son graduated as an industrial engineer from one of the top local universities.

The company is a family business typical for SMEs in many developing countries.

The problem situation

During the last years the company was facing a decline in profitability mainly due to increasing costs of raw materials and a market price decline caused by imports. In order to save the company, the two sons started to implement the following cost saving measures:

- Partial outsourcing of workforce by letting the foreman hire the required personnel on its own account as an outsourced labor contractor. This measure saved the company from paying social insurance contributions and taxes.
- Buying materials of lesser quality and changing the design in order to use thinner steel plates.
- Instituting economic batch size production policies.

The above cost saving measures resulted in a further decline of the company's competitive and financial position for the following reasons:

- Product quality problems began to rise due to cost saving materials and constantly changing workforce. With increasing customer complaints, the dealers began to turn away from the company and orders started to dwindle.
- Lead times increased and product availability went down due to economic batch size production policies and loss of control over production capabilities to the foreman and his informal workforce. All of this resulted in missed sales opportunities.
- Costs for rework and overtime began to soar as a consequence of quality problems and the new batch size policies.

As the company began experiencing more and more cash-flow problems due to declining sales and increasing costs, banks and other creditors like suppliers began to cut down on credit lines, which in turn started to jeopardize the company's operating base. The vicious cycle of not having enough

money to buy enough supplies for production was leading to more declining sales due to delivery difficulties. As the company results were deteriorating, the creditors were tightening even more the supply of money and materials, thus sending the company down the drain.

The turn-around process

In 2005 one of the founder's sons attended a TOC course offered by the German Development Cooperation and then convinced his father and brother to implement TOC at the company with the help of a trained expert.

To start the process, management and part of the workforce attended a one-day-seminar to understand the basic principles of TOC and its practical implications for the company.

Figure 1: Sensitizing seminar

Figure 2: Diagnostic session

It was followed by a diagnosis of the company's situation using the corresponding TOC analysis tools. In a first step, members of the company together with an expert constructed a picture of the current situation by using a cause and effect logic to determine the root causes that were responsible for the existing problems. Once the most important root causes were established, it was possible to define a course of action to start changing the negative situation into a positive one.

The analysis shown below unveiled a dangerous vicious cycle that was caused by the erroneous assumption that optimal batch sizing would improve a company's production costs and thus increase its margins.

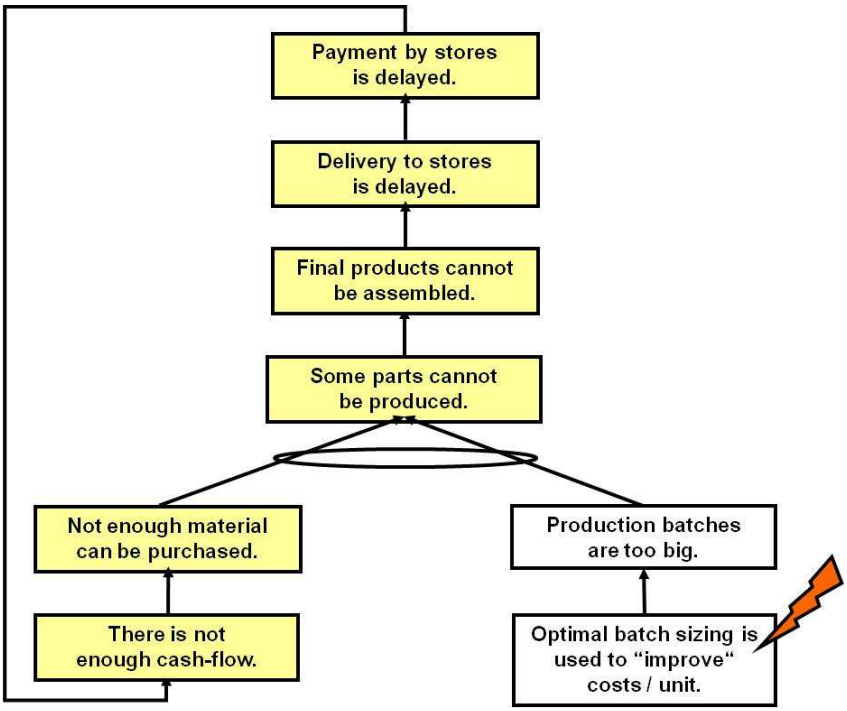

Figure 3: Root cause analysis

In order to understand what was happening, the production flow of one of the company's main products – the stove model 860 – was analyzed.

Figure 4: Stove model 860

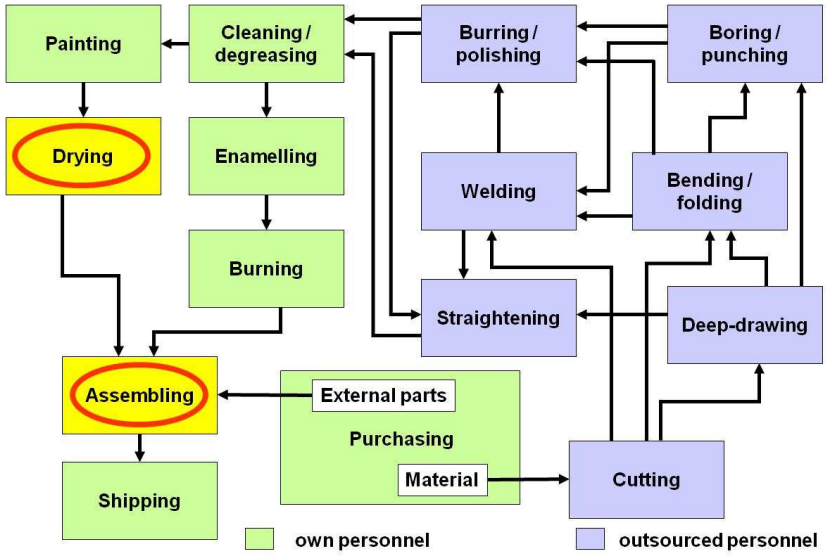

Figure 5: Production flow diagram

The optimal or most cost-efficient .production run size for this stove had been established at 400 units. Due to this, parts were flowing through the different workplaces in batches of 400, regularly clogging some of the workplaces. Final assembly for delivery could only be completed when all 63 made-in-house parts of the 76 required for the oven went through the production process. Two big regular bottlenecks had been previously identified by the company's management: the limited capacity of the paint drying furnace and the limited floor space for assembly.

In order to overcome the furnace bottleneck, the company had recently bought a continuous drying furnace powered by cheaper gas to replace the more expensive to operate electrical batch type one with limited capacity.

Figure 6: Batch type electrical furnace

Figure 7: Gas powered continuous furnace

However, as the analysis turned out, the root cause for the existing bottlenecks was not primarily a physical but a management policy constraint: the huge batch size of 400 caused the flooding of the drying oven and the assembly area like a tsunami. Therefore, the bottleneck at the old furnace was an apparent one and the new furnace an unnecessary investment of approx. $ 40,000.

Figure 8: Parts flooding the production floor ....

.... while assembly is waiting for the right parts.

In order to accelerate the flow of parts through the production area and eliminate clogging, a transfer batch policy of 100 units was implemented. For an easy understanding of the effects, the following graphs will show the simulation for 2 parts going through 5 resources instead of 63 parts going through 13 main processes. The times shown in both cases are based on results for the real production process.

Comparing both graphs, it can be seen that the final assembly with the improved flow will start earlier and the first delivery of 100 ovens will take place after 2.9 weeks while it took 5.6 weeks to do the same with the “optimal” batch size policy. Earlier deliveries, as a result, improve the cash flow situation and product availability to increase sales opportunities in the stores.

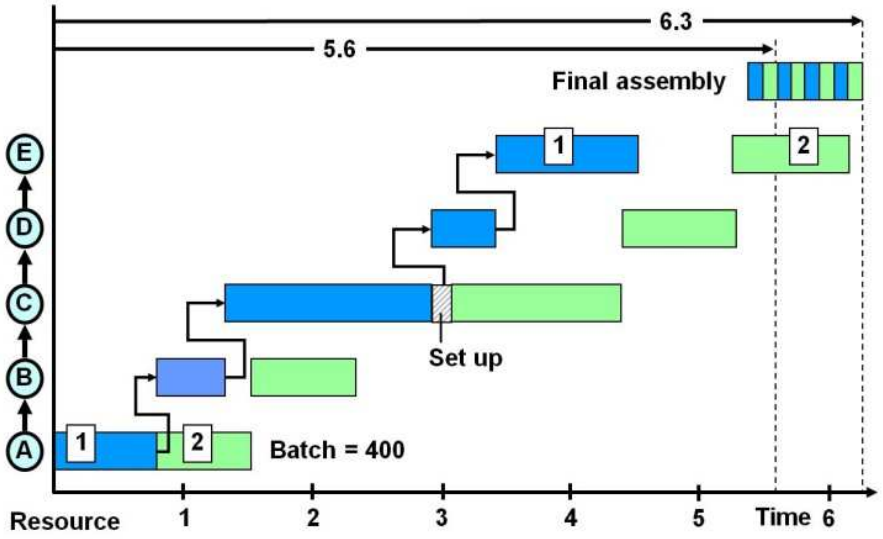

Figure 9: Production with "optimal" batch size

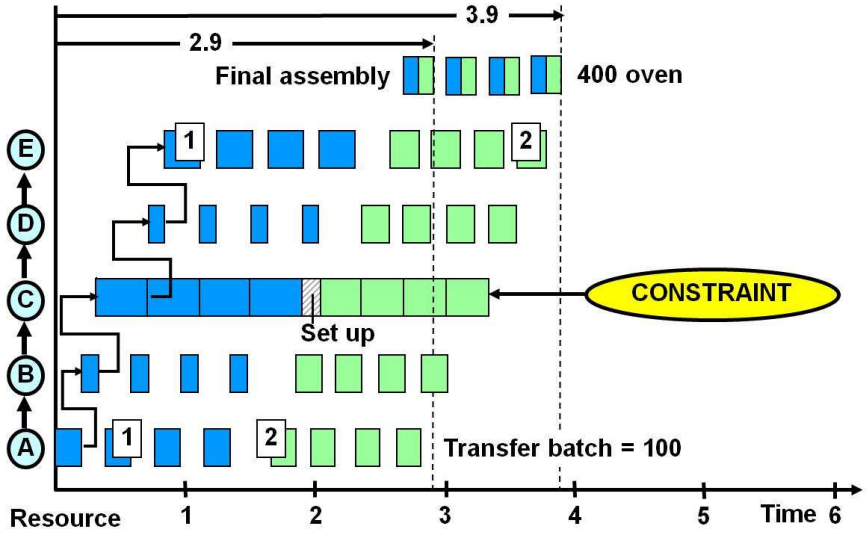

Figure 10: Production with improved flow

Once the much smaller transfer batches were used, the deep-drawing press turned out to be the new physical constraint of the production system. In accordance with the TOC methodology, the next step was to improve the flow of material through the press by implementing a quick change-over of moulds. In order to speed up the adjusting and calibrating procedures, a guiding system was designed and implemented, requiring a minor investment of approx. $ 3,500. The quick change over measures enabled the company to reduce the batches at the press and thus gain more production flexibility (see figure 12).

While looking for more opportunities to improve the constraint's performance, the possibility of using another press was analyzed in order to offload some of the work of the 40 tons. press. As it turned out, the 100 tons press had been shut down for its higher electricity consumption and therefore higher operating costs, as the following calculation shows:

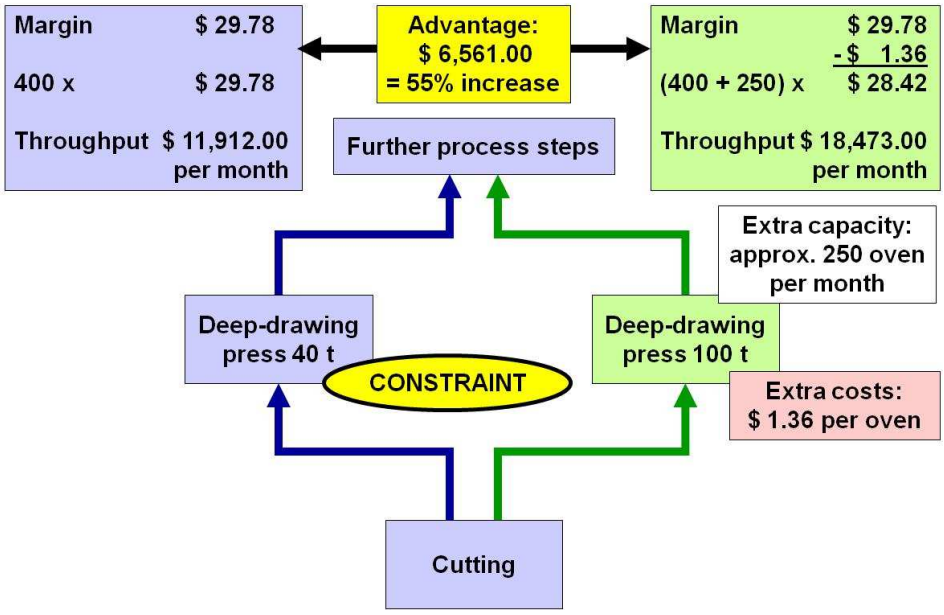

Figure 11: Cost vs. throughput calculations

Due to the fact that the company's management was desperately trying to cut costs, the decision not to use the 100 ton press for its more expensive operation of $ 1.36 per oven, was dramatically limiting the company's throughput. Just by changing the focus from a cost bias to throughput thinking, the company could gain an extra capacity of approx. 250 ovens per month and increase its throughput by 55%.

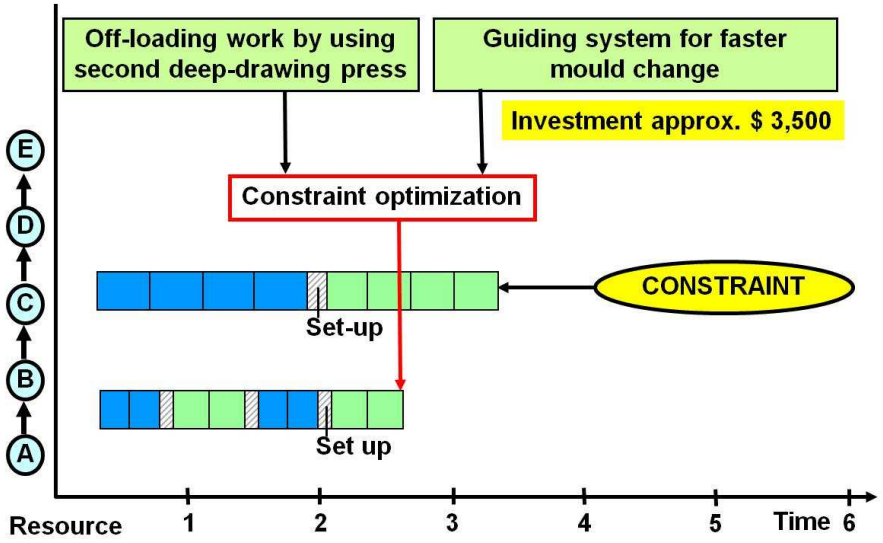

Figure 12: Effect of constraint optimization measures

As the company could gain additional processing capacity at the real constraint through the above optimization measures, the production capacity for the oven model 860 could almost be duplicated as shown in the following figure.

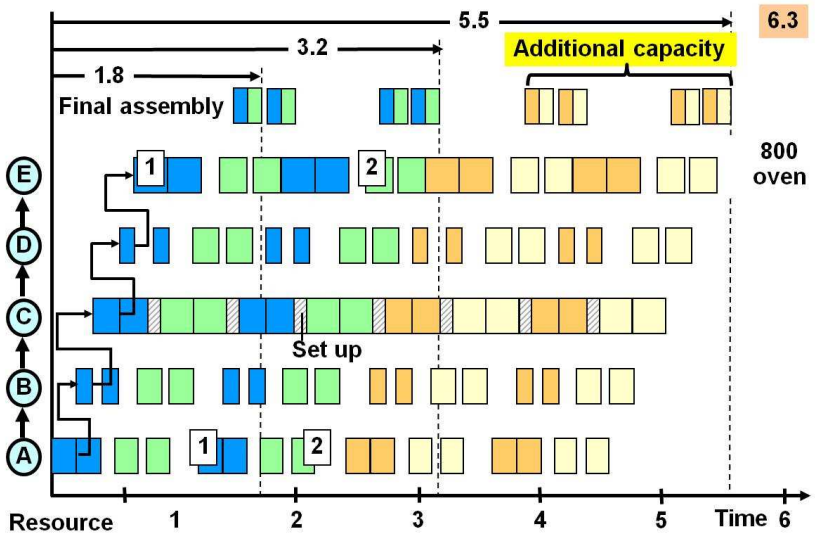

Figure 13: Additional capacity

In order to exploit this gain in production capacity and higher flexibility at a minimal cost, the company had to change its mindset at all levels in order to understand the importance of prioritizing throughput over cost cutting.

In the past, the company only started production of an oven model if they had enough orders to match the pre-established economic batch size. In the case of oven model 860, a production run for 400 units would start when there were orders from stores for a minimum of 300 units. In such a case, the company would produce the missing 100 units to stock, thus jeopardizing its financial liquidity. Even worse, the company did not realize the fact that as long as the stores were lacking stoves, the final customers had to wait or most probably would buy an alternative oven from a competitor while the company would lose that sale forever.

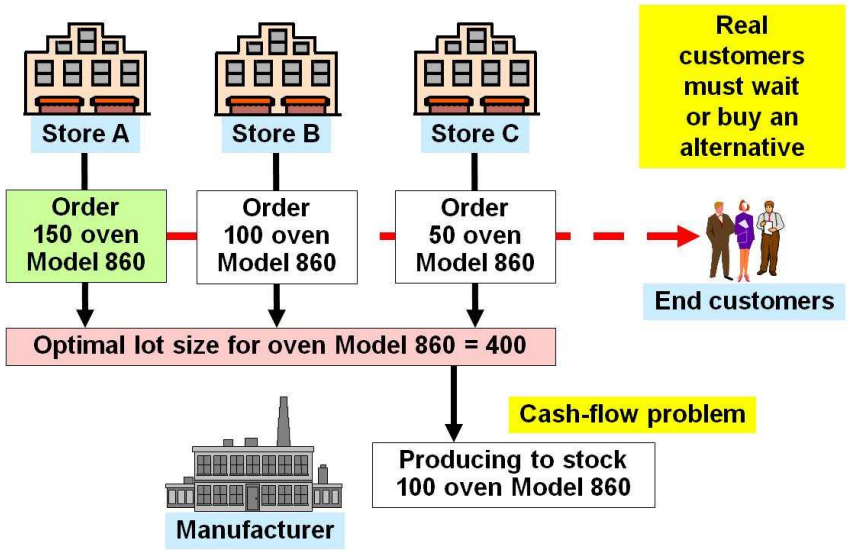

Figure 14: Negative effects of waiting for orders to produce large batches

By simply reducing the size of the production runs, the company would be able to match the real demand of final customers and thus increase the sales opportunities for the whole product range.

However, another problem had to be tackled in order to be able to reduce the size of production runs: the outsourced labor contractor. Since he was paid by parts delivered, he obviously chose to produce the higher value parts first, thus imposing his production priorities on the company. He, of course, was the biggest obstacle in changing from large batches to smaller transfer batches.

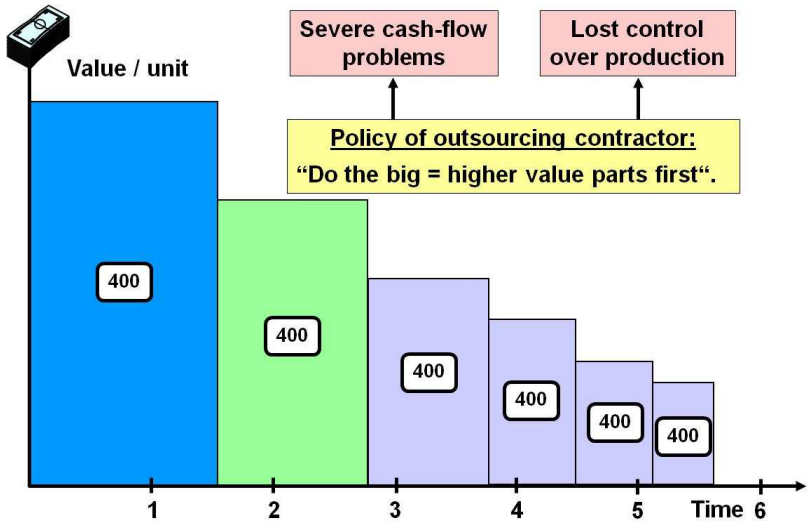

Figure 15: Negative effects of the behavior of outsourced contractor

In order to solve the problem, the company had to change the remuneration system to the complete kit concept. This meant that the contractor would only be paid for each kit delivered to assemble an oven. In this way he was forced in his own interest to accept the production of smaller batches.

Last but not least, the management was convinced to once again buy higher quality materials and the thicker steel plates, thus reducing quality problems and rework expenses.

The results

- Within two months after implementing the TOC policies, the company had increased its sales by 32%.
- Expenses for overtime and rework could be reduced to a large extent.
- Thanks to shorter lead times and more timely deliveries, one of the big chain stores placed a large order for an exclusive model.
- After improving the bottom line results, banks were eager to increase the credit lines.
- After a few months, most of the outsourced workforce was hired back. It was worth to the company to pay the social insurance contributions and taxes in exchange for regaining control over production.

The conclusions

The above example shows how misleading the indiscriminate application of conventional management strategies and tools focused on cost reduction can be – even to the extent of jeopardizing a company's existence and the well-being of its employees and workers.

What the example also shows, is how TOC concepts and tools can definitely help to turn around a company from a dire to a prosperous situation in a short time and without the need of huge investments, or investments at all. The solutions and their application are relatively simple and straightforward and based on sound common sense logic. TOC is therefore a highly effective way for managing SMEs also in developing countries. In this case, the work with the enterprise was part of the practical application of a TOC training for Alumni from RADES – Red de Alumni para la Economía Sostenible (Alumni network for sustainable economy).

Since TOC focuses on throughput improvement and not on cost-cutting, workers and employees will be protected from lay-offs as workplaces are not at stake. TOC, as a human centered management philosophy, is very keen on protecting and creating jobs and opposed to lay-offs. Consequently, the company, its employees and workers, as well as its customers and society will all gain from the application of TOC concepts and tools.

Another important lesson can be drawn with regard to improvements in the field of resource and energy efficiency: The company had bought a continuous drying furnace powered by cheaper gas to replace the more expensive to operate electrical batch type one with limited capacity. In addition to that, the 100 tons press had been shut down for its higher electricity consumption and therefore higher operating costs. Both "solutions" might have been suggested by somebody looking only for possible improvements in energy efficiency.

Having not understood properly the entire system, the investment into the second hand drying furnace powered by gas absorbed scarce liquidity of about 40.000 US-$. The shutdown of the 100 tons press caused essential losses in sales. Both measures together aggravated the economic situation of the company that will be having even more problems to improve their performance in terms of energy and resource efficiency.

The problems would have been avoided following a different approach:

1. Achieving the understanding of the system (material input, production flow and components, market demand)
2. Increasing throughput by elimination of bottlenecks, using available resources most effectively (throughput = profit made from products that have been sold)
3. Closer look at material flow, energy consumption, non product output in order to identify relevant potentials for improvements in resource and energy efficiency
4. Capturing of "low hanging fruits" that improve the environmental performance and reinforce profitability
5. Ongoing improvements on bottlenecks that require investments but can be implemented more easily due to increased cash flow
6. Mayor investments for improving the environmental performance that only pay back in financial terms in a mid-term of long-term perspective