

# Value Chain Map Implemented Production Process Equipment Cables Nopal Industrialization in a Company of Mexico City

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**ABSTRACT**— *The objective of this study is to implement the methodology based on the Value Stream Mapping (VSM) in its current state AGRONOPAL Company in the area of cable production machinery for industrialization of the nopal. The VSM helped to diagnose the current situation of the company and identify problems and waste related to the process to finally lean production techniques. The VSM analysis ends with the proposal sketch map of the future situation where the supply chain is the application of the world class companies.*

**Keywords**— VSM, Value Stream Mapping, lean manufacturing, continuous improvement.

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## 1. INTRODUCTION

Unfortunately chronic problems are loss of quality or productivity or both and are difficult to disappear [Hopp, WJ and Spearman, M. L. (2000) *Factory Physics: Foundations of Manufacturing Management*, New York, USA, McGraw Hill].

By identifying problems and waste processes linked to finally select lean production techniques to remove such waste [Rother, M. and Shook, J. (1998) *Learning to See: Value Stream Mapping to Add Value and Eliminate dumb*, Brookline, Massachusetts, USA, Lean Enterprise Institute].

## 2. OBJECTIVE

The objective of this study is to implement lean manufacturing via Value Stream Mapping due to current opportunities detected. This study will be focused on AGRONOPAL cable production machinery used on cactus industrialization.

This will be achieved by applying a proposed methodology that is based on the use of mapping the value chain. Then presenting a comparative analysis between AGRONOPAL actual map against future map proposed as Value Chain changes.

## 3. LITERATURE REVIEW

This method (Value Stream Mapping) is a visualization tool orientated to the Toyota Production System, helps to understand and streamline work processes using the tools and techniques of lean manufacturing.

The chief engineer of Toyota Taiichi Ohno and the sensei Shigeo Shingo, and oriented primarily towards productivity rather than quality. The reason that productivity improves focuses on making the methodology helps expose future problems of organization and quality in the system. Thus the systematic attack on waste or dumb is also a solution to the poor quality factors as well as key management problems. The 7 wastes, garbage or dumb commonly accepted in the Toyota production system originally are:

- 1) Overproduction (more than necessary)
- 2) Waiting
- 3) Transportation
- 4) Inadequate processes.
- 5) Excess of inventory
- 6) Unnecessary movements
- 7) Defects (bug fixes)

Years later, Michael Porter proposed the concept of "value chain" to identify ways to generate more benefit to the consumer and thereby gain competitive advantage. The concept is to make every effort to achieve the fluidity of the core processes of the company, implying a functional relationship based on cooperation [Bernstein, R. (N / A). Improved Lean Flow: Collection Practices and Case].

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Among the core processes include:

- Implementation of new products.
- Inventory management (raw materials and finished products in the right places at the right time).
- Processing of orders and delivery.
- Customer service.

For Porter targets indicate which aims to achieve a business unit, the strategy responds to how to achieve them. The instrument used to perform an analysis to extract clear strategic implications for the improvement of activities with a focus on efficiency and effectiveness is the Value Chain.

#### 4. METHODOLOGY

The value stream mapping is a powerful tool used to create flow maps where information and material flow are registered. It is useful for manufacturing and administrative processes.

This tool allows companies mapping since the starting raw material and then it goes through different processes and finally become as a finished product. You learn to analyze the all process from start of a product until it has finished. This leads to start with a current state map that tells you where you are, and what you have. After finishing with your current state, then you propose the future state based on where you want to go, and it defines how you will achieve that journey. The gap between current state and future state, give an opportunity to calculate cost reduction.

##### 4.1 Procedure to prepare the Value Stream Map (VSM)

In this section, you will analyze the application of VSM to improve the production of cables for machinery in the packaging process of nopal; this project was carried out by the Department of Engineering applied to the production department.

Analysis of the information and material flow, as follows:

- 1) The information provided by the client initiates from right to left. This is flowing up the production control department and in turn this department is going to provide the supplier to take the raw material required for the production of products or product. Client information is placed on the sheet of mapping the value chain in the top sheet and as previously noted, flows from right to left.
- 2) The material process flows from left to right, and this starts from the time the company receives the raw material, applied all transformation processes, until the finished product is shipped to the customer.

The information flow is shown in Figure 1. Here we can see that the flow starts with the glider, and this continues to the supplier, and then to the production process. The planner release a work order to the production supervisor, and this, gives to three leaders different work orders for the shift. If production is slow the supervisor tells to the supplier about changes. Inefficiencies and failures affect the planned work.

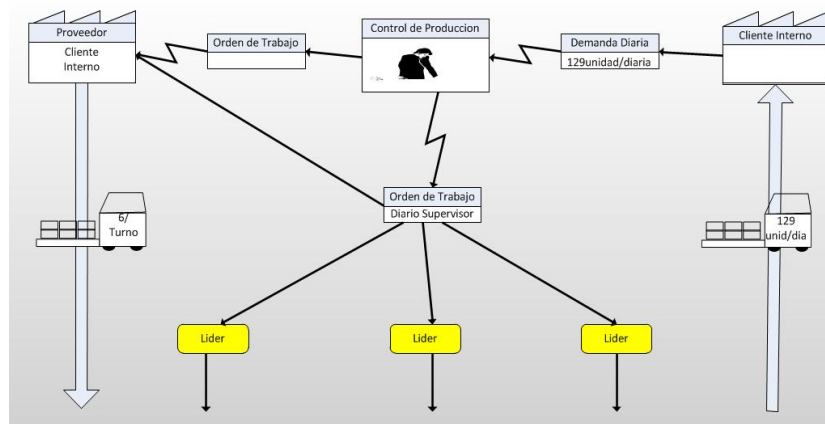


Figure 1. Flow of information

Once information flow is registered, then proceed to mapping the flow of material. As shown in Figure 2 the flow of material is recorded and written down the figure. It starts with the preparation workstation, then connecting operation follows cleaved station, polishing, assembly station 1, assembly 2, then testing, and finally packing station.

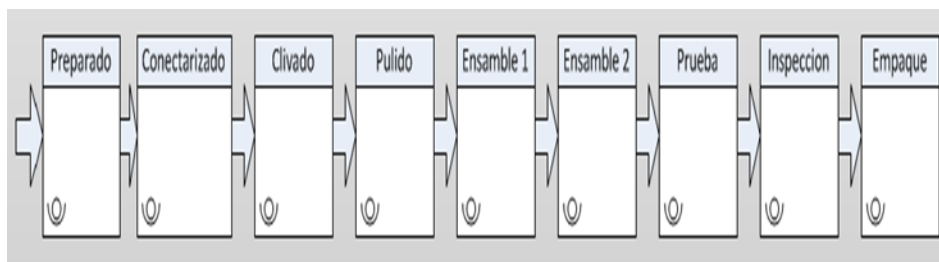


Figure 2. Material Flow

#### 4.2 Work area review

Applying the proposed methodology, we review the work area process, which consists of nine workstations, with 44 workers, which Table 1 shows how these workers are distributed.

Table 1. Number of employees per workstation

Workstation	Number of operators
Prepared	12 operators
Conectarizado	4 operators
Cleaved	4 operators
Polished	4 operators
Assembly 1	4 operators
Assembly 2	4 operators
Test	4 operators
Inspection	4 operators
Packaging	4 operators

### 4.3 Performing calculations

Once known the process, (information and materials flows). By using the proposed methodology, Table 2 outlines the content of calculations that included the Current State VSM case study. It includes cycle times taken in a time study in addition to all the necessary information of the process required by the technique of VSM [Womack, JP and Jones, D.T. (1996) Lean Thinking. Banish Waste and Create Wealth in your Corporation, London, UK, Touchstone book].

Table 2. Calculations included in the VSM

(1) Name of Workstation
(2) Numbers of operators
(3) Work in Process (WIP)
(4) Established standard time (STD T)
(5) Cycle Time (CT)
(6) Time Value Added (VCT)
(7) Percentage of value added (%VA)
(8) Time Available (AT)
(9) Distance Run (DIST)
(10) Down Time (DOWN T)
(11) Percentage of good parts (YIELD)

To conclude this section, we calculated the time takt time, this time synchronizes the production rate to match the rate of sales [Rother, M. and Shook, J. (1998) Learning to See: Value Stream Mapping to Add Value and Eliminate dumb, Brookline, Massachusetts, USA, Lean Enterprise Institute]. And serve for a study of line balancing is why they asked to be calculated, and then the calculation is shown:

$$takt\_time = \frac{\text{Net Available Time Production Journal}}{\text{Total Daily Demand}}$$

$$takt\_time = \frac{57960 \text{ seconds}}{260 \text{ units}} : 222.92 \text{ seconds} : 3.7153 \text{ minutes}$$

We perform the Map of Current State Value Stream, this is to see in graphical form the cable production process. Figure 3 shows the Current State VSM.

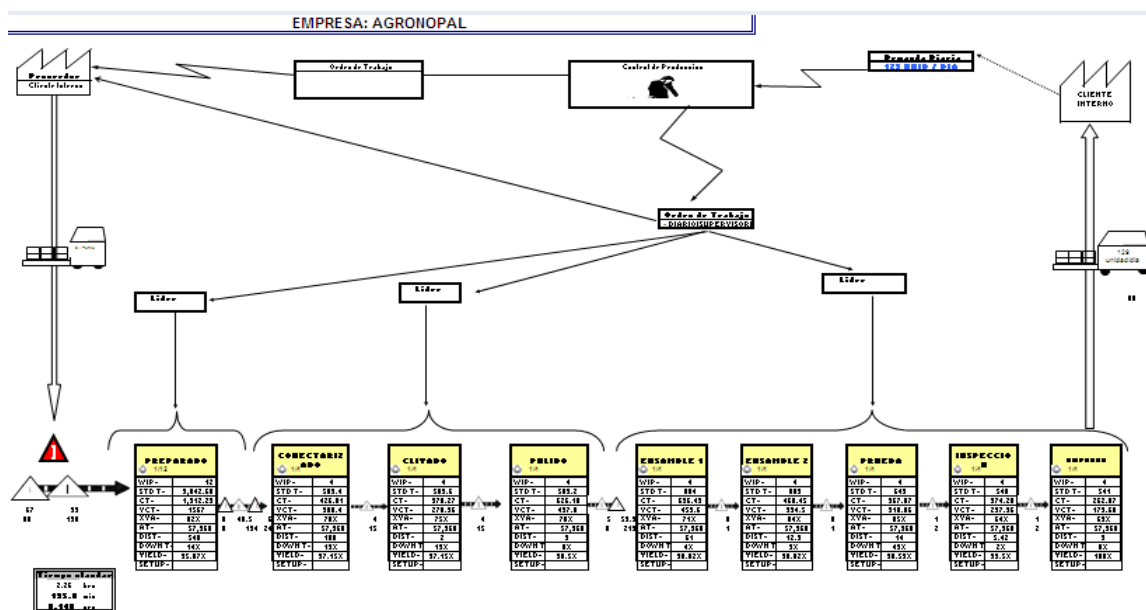


Figure 3. Value Chain Map

#### 4.4 Identification of improvements

With the mapping of the value chain of the current situation, follows to determine the problems in the supply chain and specific processes, such problems are assigned a symbol which is [Rother, M. and Shook, J. (1998) Learning to See: Value Stream Mapping to Add Value and Eliminate dumb, Brookline, Massachusetts, USA, Lean Enterprise Institute.]. Figure 4 shows the VSM with the opportunities for improvement.

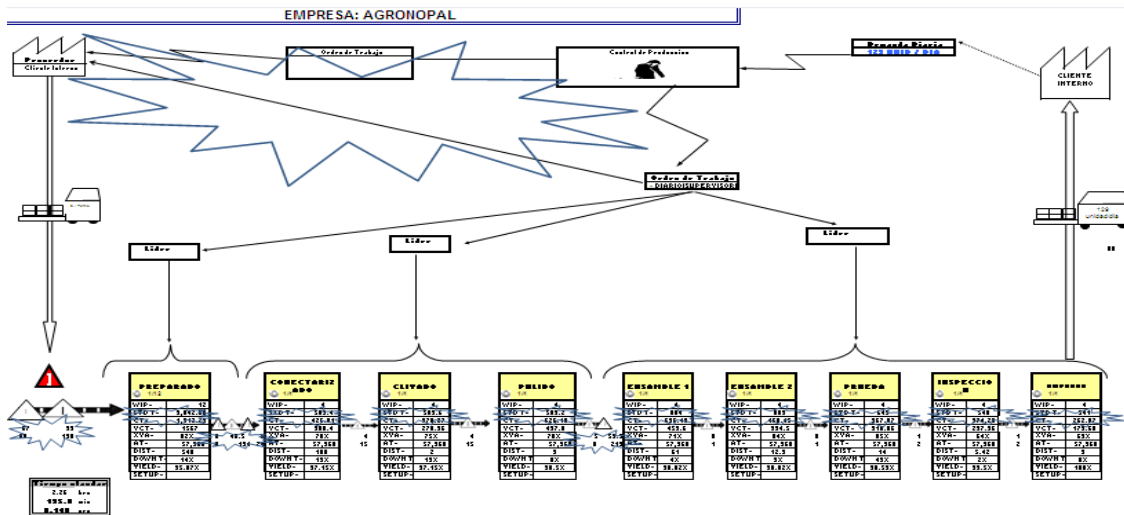


Figure 4. Value Chain Map with possible improvements

Once the VSM current state is prepared, it shows the possible improvements, a meeting with workers involved in the work area, held a brainstorming session. With an ideal state in mind, re part of the idea that the whole process is ideal (Blue Sky Thinking); question then is needed to reach the ideal process [Marchwinski, C. (2004). 2004 State of Lean report. (web document), www.lean.org].

Results are shown in table 3.

Table 3. Strategic activities

<b>Priority 1. Information</b>
<ul style="list-style-type: none"><li>• Improve the flow of information.</li><li>• Standardize a supply cable by Supplier.</li></ul>
<b>Priority 2. Focus on problems of each production line</b>
<ul style="list-style-type: none"><li>• To implement 5’s.</li><li>• To reduce inventory.</li></ul>
<b>Priority 3. Approach to Time</b>
<ol style="list-style-type: none"><li>1. Develop time study</li><li>2. Perform balancing by Workstation</li><li>3. Compare the swing by workstation standard time</li><li>4. Develop Study Activities that do not add value.</li><li>5. Layout Analysis.</li><li>6. Balancing the Production Line.</li></ol>

#### 4.5 Mapping the future state value chain

This section deals with the development of VSM applying the proposed improvement ideas. Figure 5 shows the proposed mapping the value chain of the future situation, namely, the chain will look like after they are implanted improvement proposals.

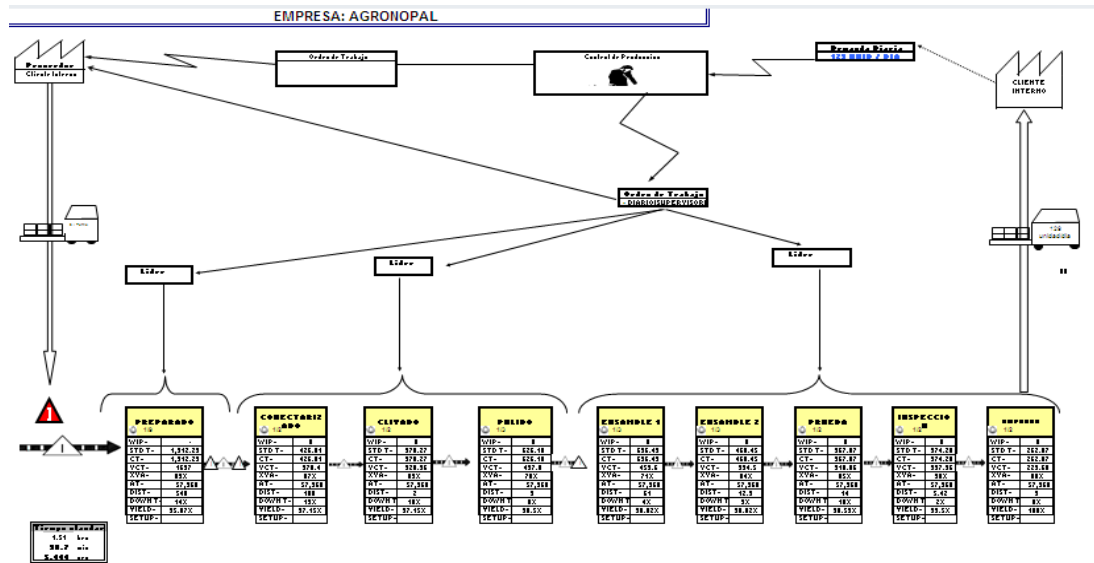


Figure 5. Map of Future State Value Chain

## 5. ANALYSIS

By implementing Value Stream Mapping (VSM), a current status map was developed, obtaining the following results:

- The parts of the process are clearly identified and the connections between operations are helpful to understand the process.
- It was confirmed that the information flow is inadequate, and needed to be fixed in order to flow properly, so the work can be completed on time.
- Using Line Balancing a project proposal was prepared. 28 workers may be sufficient instead of actual 44, meaning savings for \$ 40,000 dollars per year (every employee costs 2400 dollars annually).

## 6. CONCLUSION

In general, the business is looking for profits without much loss of capital or assets, so VSM is a good tool used to detect wastes and eliminate them. So the businesses will be profitable.

Today, anyone who wants to stay in business, will try to satisfy customers, offering good quality, low price and on time deliveries. It is possible if no waste caused.

When introducing Value Stream Map (VSM), is the primary responsibility of the manager, and cannot delegate it. Any employee may have a partial idea and do some to reduce waste, but only management has the global perspective of the business as a unit.

It is also recommended to carry out the proposed project study times and line balancing.

In reference to the time study, as it was noted, there are gaps in the predetermined times, causing down time. On the other hand, is recommended that once you have corrected the times of each workstation, perform line balancing. Then the quantity of workers can be reduced saving time and money.

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