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Manufacturing cell implementation to improve knives packaging at a local maquiladora

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Abstract: Due to the increasingly competitive environment in the business world, improvements in processes have become an alternative to prevail in the market through the effective usage of resources. Such is the case of the organization under study, where the concept and/or idea has been deeply-rooted and become part of the everyday tasks of each of its areas. In this order of ideas, the company under study set the goal of implementing a manufacturing cell for the area of grinding knives, which is expected to significantly reduce the man-hours needed for production. To achieve this, the methodology proposed by Socconini (2013) and Villaseñor & Galindo (2007) was adapted. Firstly, it was necessary to use the load balancing technique for packaging activities, reducing timing by 645 seconds per packaging unit, which represents around 1067 hours annually. Secondly, the area's requirements were determined and the space and infrastructure limitations were identified; finally, a proposal was made for a useful manufacturing cell for each type of packaging. With the implementation of the cell a total monetary saving of 133,365.44 Mexican pesos per year is expected.

Keyword: Cell, Manufacturing, Packaging, Costs

INTRODUCTION

Productivity is defined as the relationship between the product and its raw materials in an operation system, pointing out that raw materials may be represented by that which generates a company expense (Carro & González Gómez, 2012). Seeking to increase such value, different methods have emerged, among which the Toyota production system is worth mentioning (Somos Toyota, 2017).

Headed by Eiji Toyoda and Taiichi Ohno, the Japanese were pioneers in adopting techniques focused on minimizing waste or MUDAS, as well as value creation within processes (Womack & Jones, 2005), being *Just in Time*, *KANBAN*, and *5's* the main ones. (Toledano, Mañes, & Garcia, 2009). Such techniques have currently proven to be applicable in offices, logistics networks, and enterprises.

The organization under study is characterized by its focus on client satisfaction, thus developing improvement projects that have led to its positioning as the best alternative in the market. One of these projects implies analyzing the knife assembly process (see figure 1).

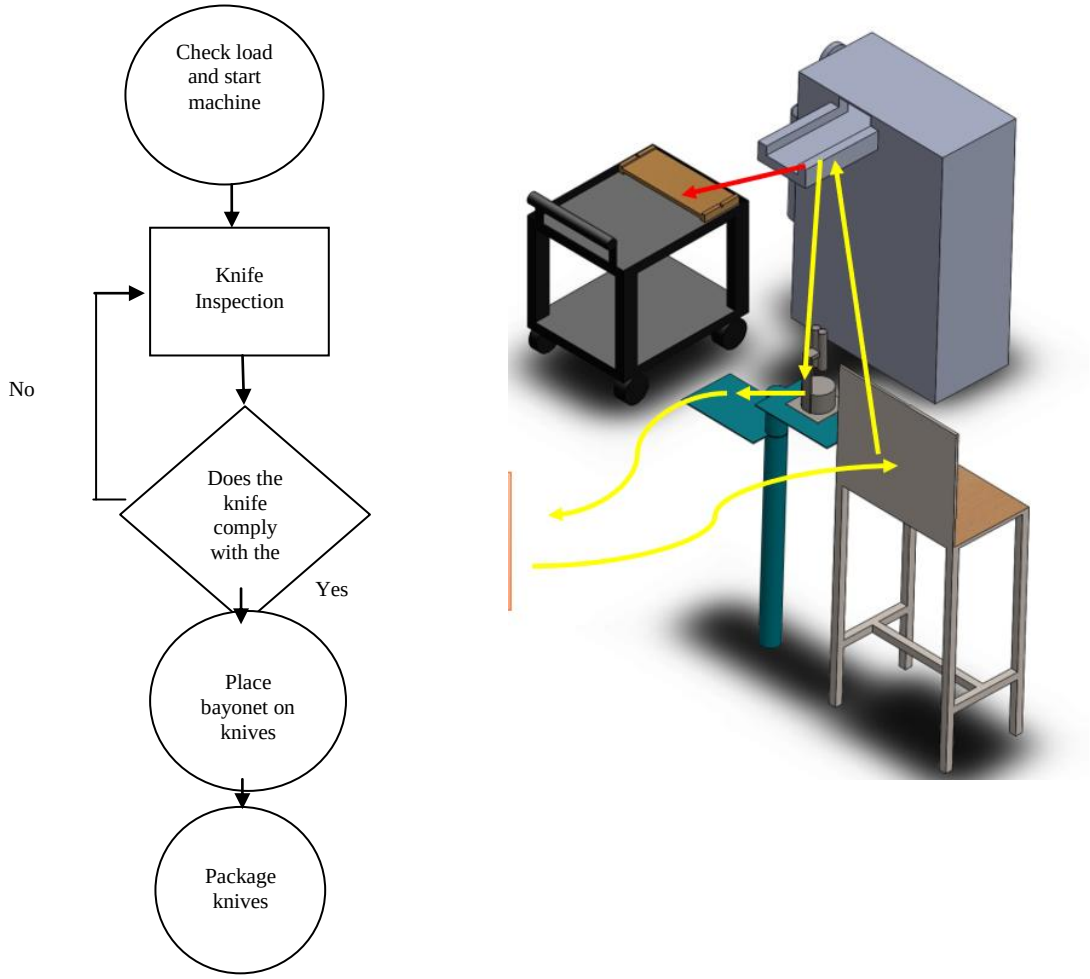


Figure 1. Knife Assembly Process

To initiate production, the operator makes sure that the machine has the steel reel; if not so, the operator must go the oven/furnace steel reel supermarket, take a new reel and install it in the back of the grinding machine. Once the reel is installed, the operator starts the machine and conducts the first knife inspection, and if it does not comply with the specifications, the knife should be placed in the scrap bin, and an adjustment should be made to the machine mechanism. Once the adjustment process has been carried out, the operator repeats the inspection activities by following the same procedure until the product complies with the standard.

When the machine is properly operating, the knives are placed on bayonets in batches of approximately 965 knives; then, the bayonet with knives are placed in a wooden bin on a cart with a capacity of 30 in each bin.

By observing the process during the operator's shift, the following was documented: 53% of the operator's time is invested in knife inspection activities and machine adjustments; 14% in preparation and cleaning activities, and 6% in product processing. Also, it was observed that 27% of the time, the operator remains with no activity. The total cycle time for each of the different knife displays takes from 3.3 to a maximum of 13.7 hours. In addition, there is a time-consuming packaging time which leads to the following research question:

How can packaging processing time and costs be reduced for each of the types of knives produced at a local *maquila* company?

Objective

To implement a standard cell work in the packaging process for each of the knife types in order to reduce waste-associated processing time and costs.

METHOD

In order to define the required procedure for conducting this project, references from work conducted by Meyers (2006) and Socconini (2013) were considered regarding Standard Work and Cellular Manufacturing, as well as the Line Balancing methodology suggested by Villaseñor (2007). Company information was gathered in order to identify the packaging number parts that would be considered for the project development. After that, a value chain mapping was created in which the following were pointed out in each process: main behavior indicators, inventories, demand, TAKT time, main clients and suppliers, and cycle timing.

The next step was to represent a future scenario through value chain mapping (VSM) where the manufacturing cell design was to be outlined along with the layout, visual aids, and packaging instructions.

RESULTS AND DISCUSSION

As part of the results obtained through the creation of a **current state value stream map**, it was possible to identify the value stream in which the process waiting time was that of 3.59 days, and the cycle time per unit was 24.8 hours, which resulted in the need to technically intervene through a proposal for improvement. With this information as a reference, a **future state value stream map** was created, in which the following was suggested: a manufacturing cell implementation in the assembly area, with which a great part of the production would be dealt with, therefore avoiding transporting waste; workload balancing, whose analysis is considered fundamental in the creation of a steady stream for what will become the manufacturing cell.

By analyzing activities and timing, the current production standard times was obtained in each of the packaging areas; for each of these, an the desired timing was suggested to comply with the goal set forth. These processes are repres Yamazumi diagrams, in which the activities are piled up and pointed out in different colors. In l timing for each of the methods and the differences among them are observed (see figures #)

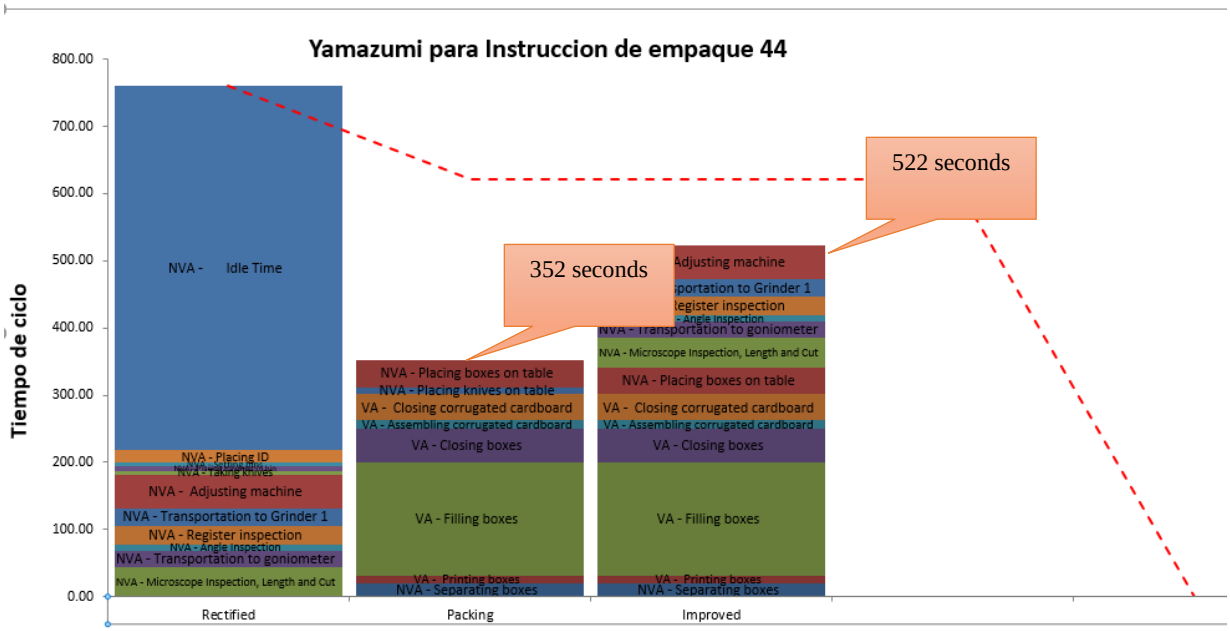
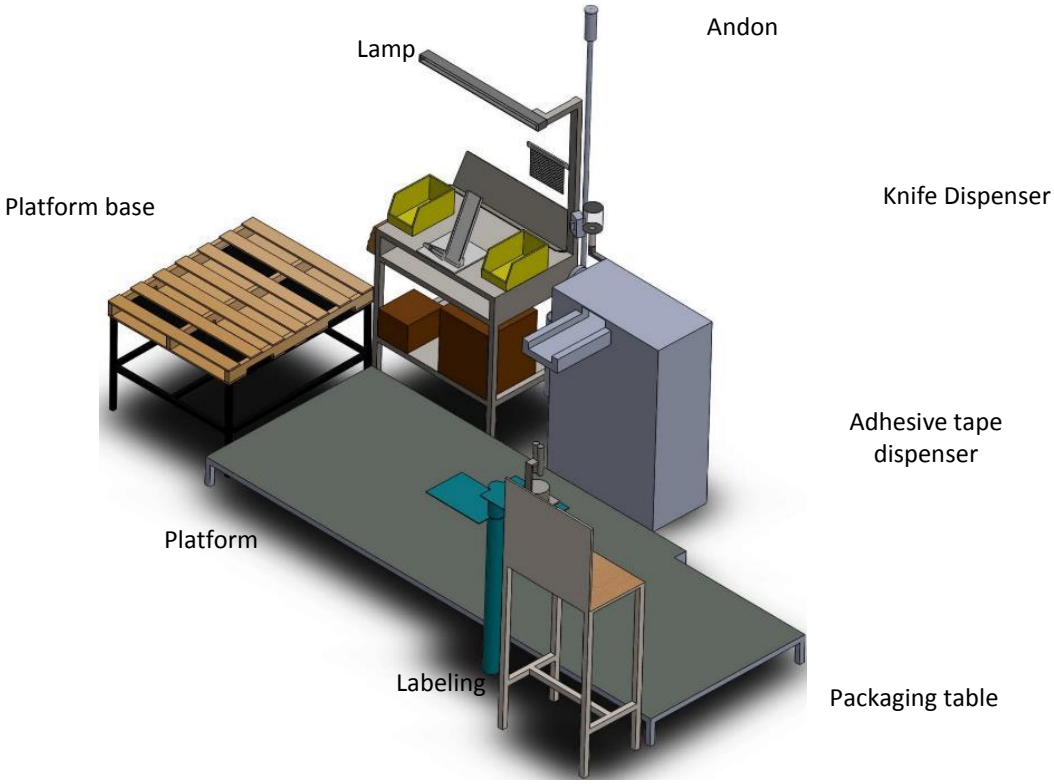


Figure #1. Yamazumi Packaging 44 Instructions

For packaging process 44, it was suggested that activities that do not add value to the process be eliminated by using the grinding machine operator's idle time, and thus, saving 589 seconds for each of the finished product corrugated cardboard.

Regarding the packaging process 62, both the packaging and grinding activities were balanced, which allowed a decrease in idle times and activities that do not add significant value, and a reduction of 645 seconds from the final packaging process.

With respect to the packaging process 62, both the packaging and grinding activities were balanced, leading to a reduction in idle times and activities that do not add significant value, and saving 484 seconds in the final packaging time. A second improvement detected from the future status VSM previously designed, the implementation of a manufacturing cell was suggested, as described below:



As it can be observed, the accessories designed in the previous section were added, according to each of the packaging instructions requirements. In addition, location of each of the packaging materials are represented, as well as the boxes in which they are contained. Finally, once the cell lay out designs were obtained, the estimated time saved was calculated in approximately 1067 hours per year, which represents $ 133,365.

CONCLUSION

In conclusion, a standard packaging process work cell was implemented for each of the types of knives from the grinding area, which led to a reduction in waste-related processing times and costs, savings well above $130,000 a year. Throughout the development of the project, an elevated operator idle time was identified, which contributed to an inaccurate usage of each cycle time.

TO GUARANTEE THE SUCCESS OF THE MANUFACTURING CELL, CHANGES IN THE DISTRIBUTION AREAS ARE REQUIRED IN THE ENTIRE PLANT AS TO FOSTER PRODUCTION FLOW, GENERATE VISUAL AIDS TO STORE MATERIAL IN EACH OF THE WORK STATIONS, AND ASSESS FEASIBILITY OF REDUCING THE NUMBER OF INSPECTORS.

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