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AUTOMATION PROPOSAL FOR A PRODUCTION FACTORY

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ABSTRACT

In a productive process, the implementation of automation systems is not always justified, but there are certain indicators that justify and make necessary the implementation of these systems.
As manufacturing systems, grow in complexity, certain processes become obsolete and difficult to manage manually, hindering compliance and expansion of production standards. Automation emerges as a solution to these problems, and when applied correctly, it can minimize time, increase quality and perform other tasks that are impossible for the worker, among other benefits.
When a process is automated, it is because after performing various analyzes it is known that said automation would positively and significantly affect at least one of the company's indicators.
This article describes the characterization of a company manufacturing cooling products, as well as the analysis to detect a process that can be improved through automation. This process turned out to be the cutting and punching of the metal sheets that make up the main structure of the chillers, which are the processes with which the entire production cycle begins. The present proposal will allow the company to generate an economic impact that encompasses the improvement of a process in time and quality, in addition to promoting the reduction of labor and energy expenditure, which leads to substantial economic savings.

KEYWORDS: automation, production, indicators, improve, manufacturing.

1. INTRODUCTION

The manufacturing industry plays a strategic role within the Mexican economy, since it is responsible for the production of intermediate goods and for final consumption, thereby generating a vast amount of jobs and thus contributing greatly to the generation of gross domestic product.
Therefore, it is important to keep competitive the production industries through the improvements and optimization of their processes; this can be achieved through an analysis of their processes and thus determine the best short, medium and long-term technological strategy to implement.
Among the products offered by the factory analyzed are chillers, air curtains, freezers, ice preservers and water suppliers, each with a certain level of personalization. It has two own production lines and a staff of 480 employees. This company has presence in different countries of America. The plant has 58,519 m2 in total; It has office area, production, quality, finished product, sales and warehouse.
The objective is to generate an automation proposal that results in an improvement in the indicators of the chiller factory through the analysis of a problematic or inefficient process of the manufacturing system.

2. MATERIALS AND METHODS

Identification of competitive strategies

In addition to the continuous growth and international recognition, the main corporate objectives of the company are three:

- Profit growth before taxes of 9% per year.
- An annual production increase of 11.5%
- The reduction of its workforce from 480 employees to 435.

Its market analysis reflects 17 developed clients, a high level of production and the following types of demand: through annualized bidding, distributors and subsidiaries.

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Its success factors in the market are based on the competitive price, the quality and variety of its products, and its fast and reliable delivery times. Likewise, they offer a level of personalization for companies that gives them an important added value.

Production strategies

Due to its characteristics, the type of company has been identified as durable goods. This produces about 3,800 chillers per month, which results in some 45,600 units annually, which represent a high level of production.

The type of distribution of the company is online; the manufacturing delivery time is longer than the delivery time expected by the customer, there are different product models to choose from and there is an inventory of sub-assemblies, which represent a high cost.

These sub-assemblies, such as thermostats, compressors, condensers, etc., are purchased as raw material; it is the client's order that determines the order of the final assembly. As the finished product comes out, it enters a warehouse, and an inventory of these products is available.

The product has a standardized level of customization, where you can vary the image or stamp on the coolers depending on the brand, as well as introduce some changes depending on the customer's need.

For all the above characteristics, the production strategy has been identified as Assembled to Order (ATO), so some of the stages of production planning are done in advance and others are executed when the client make an order. The storage is in bulk, since it deals with large loads, which allows a greater density but also implies less accessibility; some loads are placed on pallets on top of others, and there are some racks and mezzanines.

The strategy used for storage is random storage; the articles are stored in any available place in the system, although efforts are made, as far as possible, to keep the orders that have a closer date of departure in places of easy access, and the units that have the furthest delivery dates are they try to place in the upper levels, or in the more difficult sections. However, this is done without any kind of control and rather relying on the common sense of the workers.

Flow chart of the complete manufacturing process of a cooler

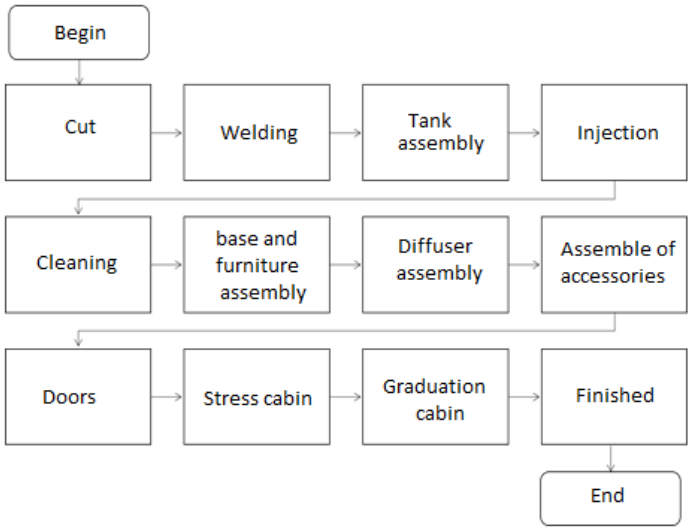

Figure 1: Diagram of the complete process

Model As-Is

The current process takes place in a relatively linear manner, and has a large number of steps and verifications as shown in Figure 2.

Start with the production order by the planning and production headquarters; the tracing, cutting and bending (TCD) area requests material to store so that it begins to process and can supply the other areas. With this order the planes of the model to be produced are obtained, according to which the sheet is cut. Subsequently, the cut sheet is unloaded and stored temporarily in order to have a certain stock with which the demand of the rest of the line can be handled.

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Later the sheets are loaded individually for the punching process, which is done with a CNC machine, using the database drawing plans, containing the information of each model. Each punched piece must be validated with a flexometer, a goniometer or square according to the model of the piece. The verified parts are placed in another temporary warehouse.

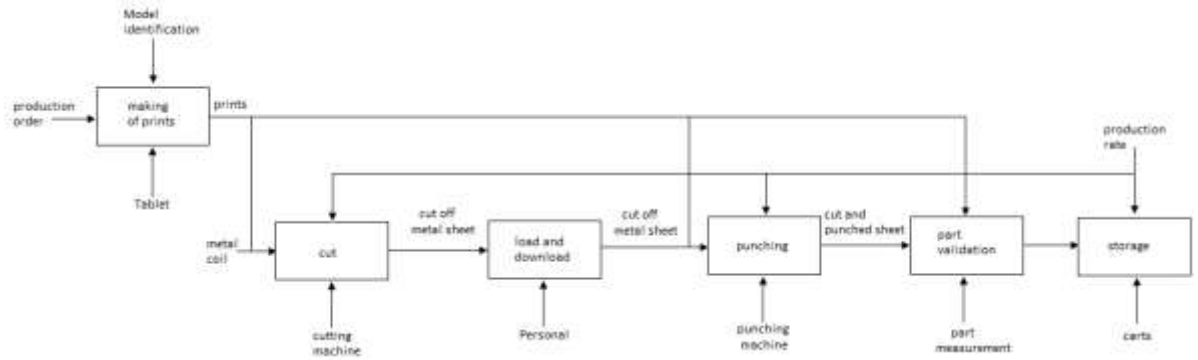

Figure 2: AS-IS model of the technology used

Technology impact indicators

The indicators used in the company are:

- Line efficiency.
- Percentage of extra hours.
- Total efficiency of the equipment.
- Percentage of compliance to the production program.
- Use.
- Quality (number of reworks).

These indicators are obtained through the information collected on a daily basis at the plant, and reports obtained from the area of quality and administration.

3. RESULTS AND DISCUSSION

Problematic

The bottleneck of the production is in the cutting and punching section; currently there is a cutter and three punching machines, which work 365 days a year, 24 hours a day, completing three shifts per day. The rest of the plant works only from Monday to Saturday, with two shifts a day.

The machines cannot cope with the level of production that is being handled. Added to this, the machines have flaws typical of the years of use; although normally one operator is required per punch press, and two for the cutter, currently a quality manager in charge of verifying the correct dimensions according to the drawings is required for each piece machined, due to frequent problems of decalibration. With this, there are 6 workers who are responsible for cutting and punching the metal plates that will become the main structure of the cooler.

Model To-Be

The fastest and most economical way to automate the process is with the acquisition and implementation of an automatic cutting and punching machine.

Only one operator would be required to establish the initial set-up of the machine; with this we would reduce the 6 operators from start to 1. The IDEF0 diagram of the TO-BE model is described as shown in the following Figure 3.

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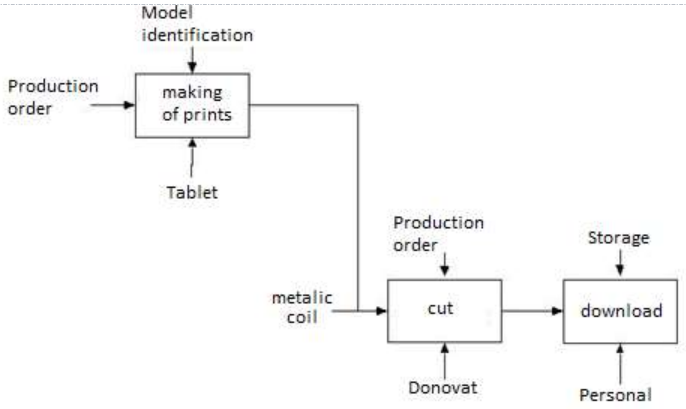

Figure 3: IDEF0 diagram of the TO-BE model

The technology to be applied will drastically reduce the use of labor for the processes of cutting and punching, as well as considerably reducing the time (it currently takes around 2 minutes to cut and punch a piece) and make better use of the raw material.
Being a relatively standard process for all parts, where the only thing that varies is the configuration or geometry of the cuts, its automation does not compromise flexibility in any way.
The proposal consists in the replacement of the cutter and a punching machine by an automated system that integrates both processes. By implementing automation, improvement can be achieved in at least one of the technology impact indicators described above.

Requirements of the process and characterization of the technology
The requirements of the process to solve the problem without compromising the other processes are the following:

- It must allow a change of Set-Up in a low time.
- Compatibility with the CNC drawings, present.
- Have storage of raw material and processed product.
- Carry out the cutting and punching process.
- Use of electric motors.
- Have distributors in Mexico.

Also, the selected machine must be able to improve the production rate of the previous technology and have:

- Raw material storage area
- Shearing machine
- Conveyor for transporting shear to punching
- Punching machine
- Processed product storage area

And allow connection via ethernet for monitoring and updating of plans, as well as a saving in consumption of 60% compared to a current hydraulic system.
It is expected that the implementation of the automated system of cutting and punching free work force to be used in other areas, since to use 6 operators is reduced to 1 only. Also, a reduction in the times of said process is expected, since the verification of each individual piece with respect to the plans will no longer be necessary; only the random inspection of a piece every so often will be necessary.
The dead times of the machine that caused the loading and unloading of parts in the system will be eliminated, increasing the efficiency and use of the machines. The solution to the aforementioned problems has been achieved (excessive use of the machines, calibration problems, excess of labor) as well as eliminating repetitive and meticulous tasks for the operators.

4. CONCLUSION

Every automation proposal requires an analysis of the manufacturing structure, strategies and production procedures of the manufacturing company, because if there is any inconsistency, the proposed solution will not have the expected impact on the company's indicators. In general, it can be concluded that the analysis achieved:

- Obtain more detailed knowledge of the production process, through the collection of information and statistical data.
- Identify the main bottleneck of the productive system and generate a proposal for improvement that affects the company's indicators.

In addition, with the implementation of the automation proposal:

- An improvement in the quality of the operator's work and in the development of the process is ensured.
- The productivity of the system is increased, achieving more product in less time.
- A reduction of costs is obtained, since the work is rationalized reducing the time and money dedicated to maintenance.
- The number of employees dedicated to a single area of the process is reduced.

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