ANALYSIS OF THE MANUFACTURING LEAD TIME IN A GRAPHIC ARTS COMPANY

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ABSTRACT

The study was made in a specialized printing folding pharmaceutical and cosmetic packaging company. This study was carried out to identify and propose solutions to the problems that afflict the organization, because, due to the inefficiencies in the delivery time of the work to the customers, they stopped making orders to the company with a direct impact on the revenues of the same. Previously the company had a total of 186 customers, the company has now lost 77% of them, now working only for 62 customers, reducing production demand by 50.2% compared to the same period, but 3 years ago. Therefore, the simulation of the process was carried out to identify the points susceptible to changes and be able to counteract delays and avoid the loss of more customers.

Keywords: Production times, methods, simulation, just in time.

INTRODUCTION

The company has been dedicated to offset printing for 46 years, has more than 307 m2 divided into 3 floors, which 154 m2 are for production and the 153 m2 remaining are used for administrative purposes. In addition, two more terrains are annexed which is one block away and a 5 blocks respectively which is rent and has an area of approximately 59.89m2 and 520m2.

Due to the inefficiencies of the deliveries, there has been a loss of customers, which has caused a decrease in the production orders that these generated.

In the following graph shows decrease in work orders respecting to the other semesters, where it can be seen that from the second half of 2016 there was a steep decline in the work orders sent to the production area for its realization. Likewise, it can be observed that the period between the end and the beginning of the year is where most production orders are lost, reflecting the loss of customers, with an average of 117 lost orders.

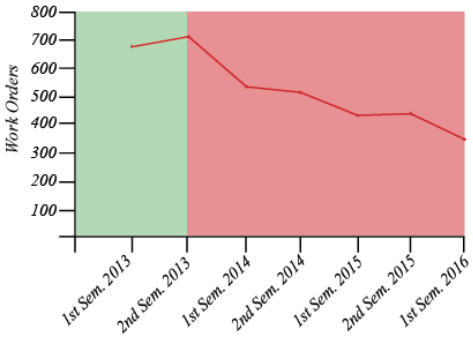

Image 1. Comparison of Work Orders by Semester. Own elaboration.

Due to this abrupt decrease in the orders that were generated towards the production department, it was decided to carry out an analysis of production times within the manufacturing process within the company.

DEVELOPMENT

A case to consider in the company and they are not given the necessary interest are the times of production and consequent the times of completion and delivery of the manufactured product, where the total orders of work per month that are issued a production of 80% presents the status of delay in the completion of the process, in the latter the average production is 2-5 days and sometimes the delay is usually more than 5 days.

It should be seen that sometimes the work orders at the delivery time of production and denote a certain range of delay, counting only 2 to 5 days for its conclusion, being that in some products the process is long and detailed.

An analysis made to the last 10 Work Orders registered from June 19 to July 30, showed the following results:

Product	Printing process	Start date	Scheduled end date	Actual end date	Percent finished	Status
40 Binnacles	Offset Printing	19th Jun.	26th Jun.	In process	90.80%	Delayed
30 Labels	Silk-screen printing	23th Jun.	10th Jun.	21th Jul.	100%	Delayed
250 Labels	Offset Printing	8th Jul.	7th Jul.	In process	0%	Delayed
35 Binnacles	Offset Printing	25th Jun.	2nd Jul.	In process	33.33%	Delayed
4,000 Labels	Offset Printing	15th Jul.	20th Jul.	In process	33.33%	Delayed
1,000 Order Sheets	Offset Printing	20th Jul.	21th Jul.	In process	33.33%	Delayed
50 Arrows	Silk-screen printing	15th Jun.	21th Jul.	23th Jul.	100%	Delayed
100 Labels	Silk-screen printing	15th Jun.	22th Jul.	23th Jul.	100%	Delayed
10 Rulers	Silk-screen printing	without date	23th Jul.	22th Jul.	100%	On Time
41 Binnacles	Offset Printing	23th Jun.	30th Jul.	In process	33.33%	On Time

On time production. Unfinished and delayed production. Delayed production.

Table 1. Status analysis of work orders. Own elaboration.

From Table 1 it can be seen that the last 10 orders sent to production, 30% were delivered to customers at wrong time, 50% of them have a delay in the process, between 30 and 90 percent of its culmination, the remaining 20% are orders completed in time and form.

This type of production delays have a direct repercussion on the company, showing a non-serious organization in the market, with customer losses due to non-compliance on the established delivery dates.

The workload that falls on the production department is very strong and therefore the pressure that this causes has a consequence in a decrease in the quality of the product that is manufactured, causing possible errors in the final product.

PRELIMINARY METHOD

To carry out the study of the process of transformation of the product will take 3 stages within a single product, this involves:

Image 2. Sequence of the elaboration process. Own elaboration.

Each of these stages was monitored, collecting data such as: times, distances, operations, inspections and adding notes to perceived events that are directly involved in the process, whether predicted or not.

Subsequently the data obtained will be plotted, interpreted and analyzed, evaluating the possible solutions to speed production times avoiding and predicting dead and/or unproductive times that affect the flow of the manufacturing process of the product.

DATA COLLECTION

As background:

Previously the product "tint box" was performed, which presented problems of variation in the register at the time of printing, of the total of the required printing, approximately 40% had this variation of registration in the yellow color. The problem is awarded to the supplier of CTP boards.

On August 19th, the printing was realized for the customer NX, printed work with 6 inks (CMYK + Pantone 1795C + Pantone 877C + Primer), the work contemplates two other processes for its completion: wiping and linear gluing. For the accomplishment of this work an analysis is made to the times of production and movements, using tools like chronometers, process diagrams and the observation of the processes.

First is showed the General Diagram of Operations Process which shows the complete process of the product. (See Attached A)

Subsequently it continued with the data collection of the processes that make up the general path to finalize the product. In order to locate the improvement points in the product manufacturing process, a time and motion study was carried out to determine unnecessary dead times and movements, which were recorded in process diagrams, see attached B (two processes were sequenced Which compose the development of the product in each of the diagrams; Prepress-Print and Die-Cut.)

Once collected the data of the process of impression of the packaging the analysis of them was realized, these data were summarized in a graph to make easier their understanding (Image 3), this graphic was divided basically in three sections: Pre-press, printing and downtime.

In this process the module, so to speak to each section of the process, that had the longest processing time was the pre-press which has 53.1% (2161 min); Here what most absorbed was not the work, if you do not wait for the approval and the lapse in time that the supplier of the CTP plates delayed in delivering them, since this type of plates are not made in the company.

Something that stands out above the print time is dead time, which with 34% is second in terms of time, which worries since more than 1/3 of the total time of the process is dead time or wasted time . The downtimes recorded in this process were due largely to carelessness and poor communication between departments

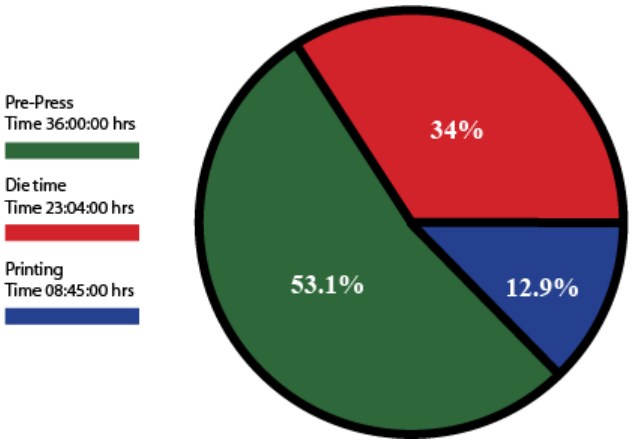

Image 3. Circular Diagram of Summary of Times of the Printing Process. Own elaboration.

As in the printing process, the analysis and graphing of the data collected during the punching and gluing process of the N.X. (Image 4), a very significant difference to be highlighted in this part of the process are the distances traveled by the product in only these two modules of the process, the total distance traveled is 708 m, just under one kilometer.

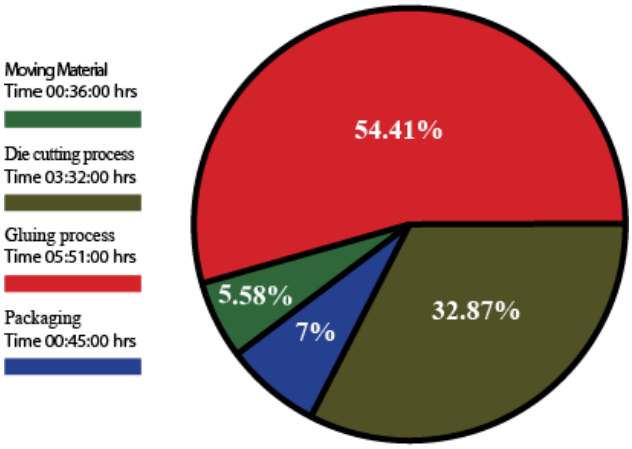

Image 4. Circular Diagram of Summary of the Die and Paste Process. Own elaboration.

This is because the three places where the product ultimately passes are not located in the home alone.

Integral Process Analysis

The data collected and analyzed above were concentrated to carry out a study of all the time and the movements that were used in the manufacture of the product, involving the 4 base modules for the completion of the work; Prepress, Print, Die Cut and Paste.

This general study of the manufacturing process involves all parts of the process and is summarized in a single main graphic to facilitate the analysis that takes place at the flow of the process.

First, the current flow diagram is presented, which is used in any work that is done within the company.

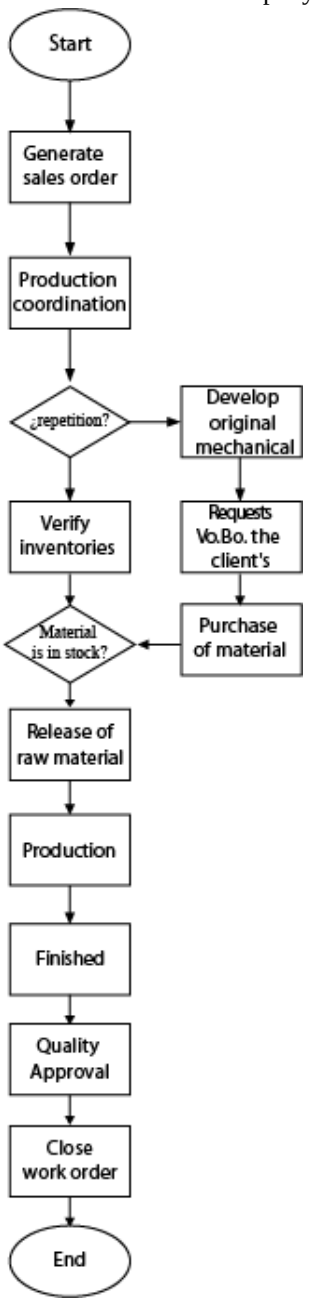

Image 5.General Process Diagram For Printing Of Folding Packaging. Own elaboration.

However, once the data were grouped for their general analysis, they were interpreted and a circular graph was obtained (Figure 6), where each of the modules by which

the manufactured product was transformed to be broken off, contains the time in each module were obtained and later analyzed separately.

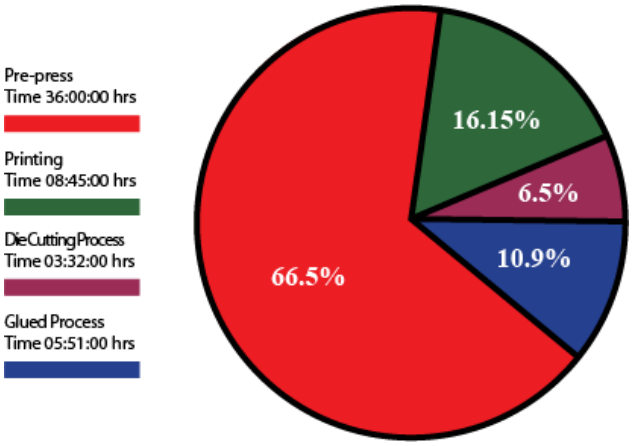

Image 6. General Time Graph in the 4 Process Base Modules. Own elaboration.

This general study showed that unproductive times span more than a quarter of the total time required to complete the process, a figure that is accurately reflected in Picture 7.

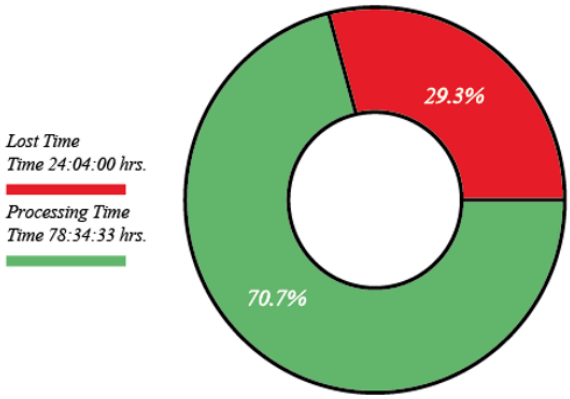

Image 7. Processing times and loss times. Own elaboration.

Modeling

The simulation of the system was used to experiment in the method commonly used to carry out production within the company. In the first instance, the current model was simulated to have a comparison reference for the future system, from which the data already mentioned and presented within the document were obtained. Here we can see the three addresses that the company has to carry out the production process of the folding packages. With this we observed the long movements that the material undergoes to take it from one processing site to another; As it happens to go from the place where the punching is carried out to where it will be glued and packed, for which you walk about 1.1 km occupying 26 minutes on average in moving from one home to another.

In the future modeling it was contemplated in the first instance to reduce the movements that were generated in the process, since after the transfer of the finished material in a process to its subsequent one that was in one of the other two areas with which the company counts The transfer times were very remarkable and did not generate any value within the system.

Image 8. Simulation model. Own elaboration.

Because in the printing process these movements represent 3.2% of the total time that was occupied for this process, along with pre-press. Similarly, in the gluing and die-cutting process, these movements amount to 5.6% of the total.

This is how it was supported by the simulation of the process to observe the behavior of the same, and then make an analysis of the obtained and with it generate alternatives for the best operation of the system.

Recommendations

In order to carry out this reduction of time it is suggested to transfer the machinery to the largest address with which it is counted, so that the process has a more fluid transit to the different areas through which it passes, thus at the end of a process Such as printing, the finished material can be moved to the next step, which would be sequentially to this and so on without having to transport large distances for its next process. Thus, in the proposed model, the mentioned option is modeled where an optimal plant distribution is implemented for the process flow.

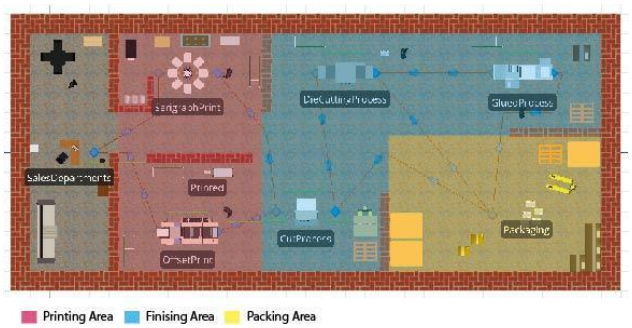

Image 9. Proposed plant distribution by sequential process. Own elaboration.

With this distribution it was sought that the process has a sequence as linear as possible, so that the material does not have to travel great distances which are unnecessary and do not contribute any value to the system, for this reason were formulated 3 zones or general stages of the process; Printing, finishing and packaging, these are the general steps that every product has to pass to its completion. That is why in the distribution these stages have sequence one after another, as seen in Image 9, where the process of printing (offset and screen) is as a pillar of the process, followed by the area of finishes; Comprised of cut or refined which is an average process through which all product passes, that is why it is in the middle of the route. From here you can transfer the product directly to the final packaging or if another process is required (punching or punching) these would be on the side having direct flow to the packaging area of the process for storage or shipment to be delivered to the client.

Thus, with this approach in the reduction of material transfers, the suggested plant distribution would reduce approximately one and a half hours of the general process, taking as comparison the data obtained in the first simulation that was carried out. This represents a reduction of 2.9% of the total time used for the overall process of the monitored product.

Thus, with the saving of 1.5 hrs for each product and based on the study that was performed to the 10 orders mentioned above (Table 1), there would be a saving in times of 15 hours, which is equal to almost two 8-hour shifts, so that orders that are in the process of being delayed could be terminated in a timely manner to meet customer demand.

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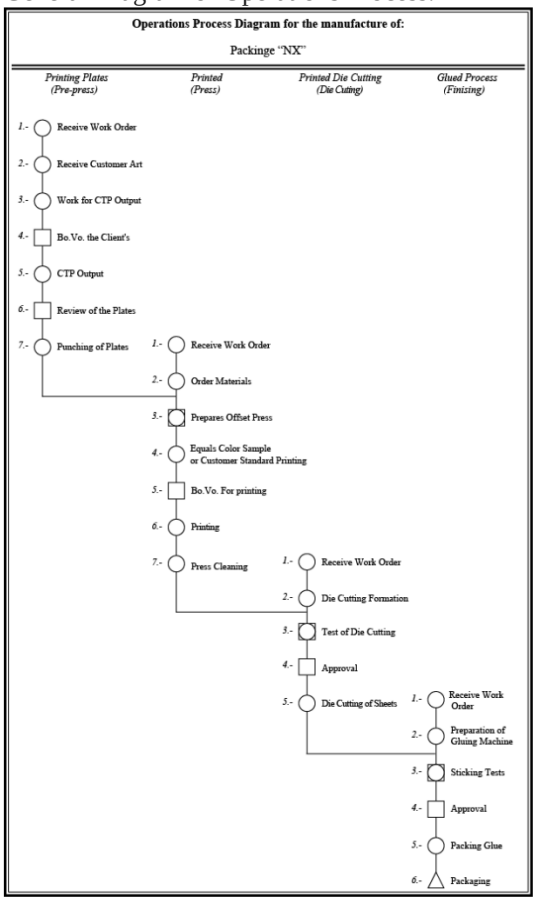
Attached A

General Diagram of Operations Process.



Attached B

Process Diagrams For Making A Package.

1) Pre Press-Print Process Diagram.

PROCESS DIAGRAM OF: NX Print Packing											
DIAGRAM : 3	METHOD: Current	Page 1 of 1	DATE: AUGUST 18th								
PRODUCT: 10,000 Packings NX											
OPERATOR: Javier	PRESS: XL	FTE	VTA								
PRODUCT SPECIFICATIONS: 6-ink plus primer; CMYK + Pantone 1795C + Pantone 877C+ Primer		TOTAL TIME: 67 :49:53 hrs	TOTAL DISTANCE: 694 m								
	DESCRIPTION	DIST. [m]	TIME [hrs]	SIMBOL							
1.-	Pre-Press		24	●	⇨	D	□	△			
2.-	CTP ouput		12	●	⇨	D	□	△			
3.-	Punching plates		0.01.34	●	⇨	D	□	△			
4.-	Transfer material to plant	336	0.23.13	○	➡	D	□	△			
5.-	Deliver material (warehouse)		0.15.48	●	⇨	D	□	△			
6.-	Accommodate printing material		0.06.17	●	⇨	D	□	△			
7.-	Prepares Offset Press		1.33.21	●	⇨	D	□	△			
8.-	Equals color sample		0.35.11	●	⇨	D	□	△			
9.-	Black plate change		4.41.09	○	⇨	●	□	△			
10.-	Insert plaque		0.01.13	●	⇨	D	□	△			
11.-	Equals color sample		1.03.21	●	⇨	D	□	△			
12.-	Change of mantilla		0.13.41	○	⇨	●	□	△			
13.-	Printing (CMYK and first pantone)		1.25.12	●	⇨	D	□	△			
14.-	Machine cleaning		0.26.31	●	⇨	D	□	△			
15.-	Prepares Offset Press		0.33.12	●	⇨	D	□	△			
16.-	Change the Pantone 877c plate		18.10.0	○	⇨	●	□	△			
17.-	Printing (second pantote and primer)		1.22.54	●	⇨	D	□	△			
18.-	Machine cleaning		0.18.21	●	⇨	D	□	△			
19.-	Move printouts to Die Cutting	358	0.38.55	○	➡	D	□	△			
			TOTAL	14	2	3	0	0			

1) Die Cutting-Glued Process Diagram.

PROCESS DIAGRAM OF: NX Die Cuntin Process and Glued Process Packing											
DIAGRAM : 2	METHOD: Current	Page 1 of 1	DATE: AUGUST 24th								
PRODUCT: 10,000 Packings NX											
OPERATOR: Margarito	M/C: Gluing machine	FTE	VTA								
OPERATOR: Barush	M/C: Die cutter	TOTAL TIME: 10:44:40 hrs									
		TOTAL DISTANCE: 708 m									
	DESCRIPTION	DIST. [m]	TIME [hrs]	SIMBOL							
1.-	Move print to court	336	0:11:54	○	➡	D	□	△			
2.-	Cutting of printed matter		0:22:18	●	⇨	D	□	△			
3.-	Transfer of cut-to-die print	18	0:05:57	○	➡	D	□	△			
4.-	Prepare die cutting machine		0:36:44	●	⇨	D	□	△			
5.-	Die Cutting Testing		0:01:37	●	⇨	D	□	△			
6.-	Authorization of die cutting			○	⇨	D	■	△			
7.-	Die cutting of sheets		2:31:29	●	⇨	D	□	△			
8.-	Moving material to glue	354	0:18:41	○	➡	D	□	△			
9.-	Deburring of die-cut material		1:04:31	●	⇨	D	□	△			
10.-	Prepare the gluing machine		1:24:53	●	⇨	D	□	△			
11.-	Authorization of gluing			○	⇨	D	■	△			
12.-	Gluing process		3:21:22	●	⇨	D	□	△			
13.-	Packaging		0:45:14	○	⇨	D	□	▲			
			TOTAL	7	3	0	2	1			

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