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TEMA: OPTIMIZATION OF THE PROCESS OF PRODUCTION OF SHORT HALF LOGO IN THE "GARDENIA" FACTORY

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OPTIMIZATION OF THE PROCESS OF PRODUCTION OF SHORT HALF LOGO IN THE "GARDENIA" FACTORY

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Summary. *The present research was carried out in the Gardenia Factory and pursued as main objective, to detect possibilities of improvements in the production process of means from the design of a simulation model. This was made possible by the application of existing methodologies in the literature, both for the diagnosis of the production system and for the design of the model itself. For this purpose, the following tools were used: FlexSim, version 7.7.4, in conjunction with its ExperFit and Experimenter tools; SPSS, version 21.0 and Microsoft Excel, version 2013, which facilitated the design and statistical and mathematical processing of the information.*

FlexSim allowed us to obtain, in a simple and concrete way, data that the factory did not know and are of fundamental importance in the planning of its activities, such as: local and global production capacities, percentages of utilization of its resources, percentages of the incidence Have stoppages in the object and means of work, among others. On the other hand, the culmination of this work demonstrated the feasibility of applying the simulation, in order to facilitate the decision making regarding the optimization of resources and its favorable incidence in the current level of productivity.

Keywords

Operations Management, Diagnostics, Simulation of discrete events, FlexSim.

1. Introduction

Factory Gardenia, is a company that currently does not know the performance metrics in its production management, and we refer to "what is not measured is not improved", it could be said that this has caused the factory can not develop plans for improvement To measure and improve the efficiency and effectiveness with which they are working.

On the other hand, there are indications that the factory is considered one of the largest in the field of making socks, although the capacity of this has not been determined, the limiting point of the process is unknown and to the fundamental point of the It is for this reason that the proper allocation of personnel together with production planning have become a real challenge for the factory.

The application of the simulation in this topic of study is justified because the company evidences a problem of experimentation and with technological complexity. Thanks to the tools that FlexSim has, such as Experimenter, it is possible to design several scenarios, which can be evaluated through the Optimizer tool, also included in FlexSim, allowing the optimization of the process.

The results show reliability due to the randomness of the system that takes into account the software, which is analyzed with the tool Experfit, in addition to guarantee reliable results, it is necessary the run of several replicates that allow the stabilization of the variables analyzed.

2. Materials and Methods

2.1 Characterization and diagnosis of productive management

General characterization of the company

The general characterization of the factory was based on the description of internal factors: mission, vision, organizational structure, raw material and product portfolio and description of external factors such as: main customers and suppliers, as well as the position Of the organization with respect to competition. The system was classified as a batch production that shows a combination against demand and against warehouse. Finally, the production process is described for each of its operations.

Analysis of the technical and organizational requirements

Within this stage, requirements such as: reactivity, flexibility, reliability and stability were analyzed. Where it can be detected that it performs poorly in terms of reactivity and reliability, it is a 90% flexible system that is quite stable in cost of production and revenue.

Principles of production organization

In this analysis it was possible to detect that the Productivity Proportionality is affected by the batch production of the system, in addition to that the limiting point of the process is unknown. While the Continuity of Production was mainly affected by the interruptions that the machines have in the forming operation, for this reason a more in-depth analysis was performed on this principle.

Precision and enrichment of the problems that affect the management of the production

The precision and the enrichment of the diagnosis was made through interviews with the production and survey personnel to the operative and administrative personnel of the factory, handling a sample of 47 workers and a census to the administrative area.

Analysis of discontinuity in the forming operation

For the analysis of the discontinuity, the opinions of 8 experts were used, through which it possible to synthesize the causes of the stoppages in the machines was represented in a cause - effect diagram, using the Saaty AHP method. Chose the 5 main causes for the study.

2.2 Design of simulation model and optimization of the system

Definition of objectives, scope and requirements

The forming and sewing operations were considered as the scope of this work. In addition, objectives were defined for the simulation (general and specific) and objectives for the decision making which constitute the variables in the optimization process.

Collection and analysis of system data

The data were divided into two categories: structural and numerical The first intended to define the elements of the system and the second to the data collection and statistical analysis of the same.

Construction of the simulation model

For the construction of the model, the data collected was used, Fixed Resources and Task Executers were programmed along with other FlexSim functionalities that allowed the proper functioning of the model.

Validation of the model

The validation of the model was guaranteed in the first instance from the programming itself, by creating dashboards and analyzing the statistics obtained in these and finally through a hypothetical analysis of equal means between production data Current and the production obtained in the model for a test of 87% and 68% of machinery in operation.

Sensitivity analysis

A warmup time was determined for the 604800 second (one week) model by stabilizing the following response variables: Formed Performance, Total Output Formed, Sewing Input, Sewing Yield and WIP Forming - Sewing. A pilot run of ten replicates was performed through which it could be shown that the ten replicates were sufficient to obtain reliable statistics.

Optimization analysis

The design of the optimization process was done by taking as variables the number of enebradores and toners to work in each subsection of work. The Lower and Upper Bound were defined from the validation process of the model. Restrictions were added related to the percentage of vacuums in the tillers and tillers in such a way that this variable does not exceed 80% and 30%, respectively.

Finally, two objective functions were proposed: maximizing the value of production in the formation operation and minimizing expenses for salaries in the same operation. The option Pattern was marked to look for an approximate Pareto optimum that was stated as follows: 80% of the increase in Revenue is achieved with only a 20% increase in Expenditures, compared to the Current Scenario.

Analysis of performance results of the current scenario

The results of the performance of the Current Scenario were analyzed for each of the subsections, and analyzed as vital statistics the following: % of breakdown of machines,% of waiting for a resource of both machines and sleeves,% Processing, idle% of the toner, subsection performance expressed in dozens / minute and the defective quantity produced in the section.

Finally, the overall results of the forming operation were analyzed, resulting in a Total Output of 26163 dozen (3.55 dozen / min) and the stitching and remalling operation, which has an input of 3.52 dozen / min and a yield of 3.46 Dozen / min. The interaction between the two operations resulted in an average inventory in process of 1680 dozen.

Here, it was also possible to determine in addition to the capacity of the forming operation, the capacities by section and subsection of work and finally by type of average.

Results obtained in the optimization process

The optimization analysis yielded four possible solutions that allow the fulfillment of the proposed objectives, of which the solution nine was considered the most feasible due to the Pareto Optimal compliance, this solution consists of increasing a fertilizer and removing a toner in the section A and increase a fertilizer in section B. This allows the increase of the value of production by 73.23% with only an increase in expenses of 23.10%.

Proposed improvements

In summary it is proposed as an improvement:

• Analyze whether there is a possibility that two workers in the factory can be trained and occupy a new post as enebradores in Sections A and B, otherwise two new workers will be hired for this position.

• Assign the task of collaborating with the tacking activity in Subsection D1 to the worker named Control 1, instead of continuing to collaborate in the tacking activity in Section A.

• Assign the task of collaborating with the tacking activity in Section C to the worker named Control 2.

• Maintain the number of workers currently in the remaining subsections of work.

3. Results

TABLA DE RESULTADOS				
SECCIÓN	VARIABLE	MEDIA (Escenario Actual)	MEDIA (Solución 9)	Diferencia
SA	Breakdown (%)	2,72	2,45	-0,27
	Processing (%)	71,33	89,2	17,87
	WOM (%)	25,95	8,3	-17,65
	IE (%)	30,3	52,2	21,9
	WOC (%)	8,79	94,4	85,61
	WTC (%)	0,21	0,26	0,06
	WTCC (%)	0,31	1,07	0,76
	IVs promedio (%)	40,1	0	-40,1
	Rendimiento (doc/min)	1,0312	1,2466	0,2154
	Defectuosidad (u)	5883	7324	1441
SB	Breakdown (%)	2,79	1,75	-1,04
	Processing (%)	69,99	93,6	23,61
	WOM (%)	27,21	3,9	-23,31
	IE (%)	33,7	75,9	42,2
	WOC (%)	21,7	47,8	26,1
	WTC (%)	0,22	0,27	0,05
	WTCC (%)	0,58	0,95	0,37
	IV1 (%)	24,98	1,2	-23,78
	IV2 (%)	42,64	24,8	-17,84
	Rendimiento (doc/min)	0,5988	0,7947	0,1959
	Defectuosidad (u)	5791	7872	2081
Operación de Formado	Rendimiento Formado (doc/min)	3,5451	3,928	0,3829
	Total Output (docena)	26163	28986	2823
Operación de Cosido	Input Cosido (doc/min)	3,519	3,751	0,232
	Rendimiento Cosido (doc/min)	3,4564	3,523	0,0666
Formado y Cosido	WIP Formado-Cosido (docena)	1680	2320	640
Resultados finales	Valor de la producción ($/semana)	250.879,00	269.399,00	18.520,00
	Gasto sueldos ($/semana)	4.946,22	5.280,00	333,78

Figure 1. Comparison table of results between the current and proposed scenario.

In figure 1, it is observed how the processing percentages of the machines increase and the waiting time that they have by the enebrador for the arrangement of the stoppages decreases. The idle of the toners decreases and the waiting percentage of the covers increases, this increase does not represent a problem since the use of resources is better utilized and the final result is favorable.

In general, it can be observed how the forming operation shows an increase in its yield of 0.3829 dozen / min (2823 dozen / week), this also has a favorable influence on the sewing operation because it allows the increase of its yield in 0.0666 dozen / min.

These results are the result of an economic improvement, bringing the production value of $ 250,879.00 / week to $ 269399.00 / week with only the increase in expenses of $ 333.78 / week (23.10%).

4. Conclusions

1. The study carried out for the preparation of the Theoretical Framework confirmed the existence of the wide possibilities of the application of the simulation of discrete events in the decision making within the production processes, in order to achieve the optimum use of the available resources and A better performance of the main performance metrics of these processes.

2. The tool used for the diagnosis of the production system allowed to characterize and classify it properly, in addition to detecting the main problems that affect the management from a systemic perspective. The formation operation, the poor performance of the system against deadlines, the high flexibility of the system, as well as other problems related to production scheduling were identified as a fundamental point.

3. The multi-criteria tools used in the diagnosis made it possible to detect the main causes that affect the continuous work of the machinery in the forming operation. Maintenance planning, material quality, mechanical failures, electronic errors and raw material shortages were highlighted in order of priority.

4. By means of the simulation model constructed, it was possible to determine the current production capacities of the factory, for the total of the forming operation, by section and sub-section of work and by type of media. In addition, it allowed identifying the sections and subsections that constitute the best opportunities for improvement for the Training Operation.

5. The optimization process developed in the Experimenter enabled decision making in favor of Solution 9, with which the value of production was increased by 73.57% (18520 $ / week), with only an increase in The cats by concept of salary in a 23.11% (333.78 $ / week). This solution raises the performance in the Forming Operation up to 3,766 dozen / minute, and in turn, improves the continuity of work in the operation.

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