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SIMULATION MODEL OF A STOP PRODUCTION LINE: THE RELATIONSHIP BETWEEN FINANCIAL RETURN AND PRODUCTIVITY

Bruno Miranda Santos
Universidade Federal dos Rio Grande do Sul (UFRGS), Brazil
E-mail: brmiranda10@gmail.com

Taís Bisognin Garlet
Universidade Federal dos Rio Grande do Sul (UFRGS), Brazil
E-mail: tais_garlet@hotmail.com

Luciano Klein
Universidade Federal dos Rio Grande do Sul (UFRGS), Brazil
E-mail: klein.lu@gmail.com

Franco da Silveira
Universidade Federal dos Rio Grande do Sul (UFRGS), Brazil
E-mail: franco.da.silveira@hotmail.com

Paulo Cesar Chagas Rodrigues
Instituto Federal de Educação, Ciência e Tecnologia de São Paulo (IFSP), Brazil
E-mail: paulo.rodrigues@ifsp.edu.br

Wagner Bueno
Universidade Federal dos Rio Grande do Sul (UFRGS),Brazil
E-mail: wagner.bueno@ufrgs.br

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ABSTRACT

Making innovations to become competitive is not always an easy task, and in the industrial sphere, this thinking becomes even more complex. In this sense, proper use in raw material transformation processes becomes very challenging for managers, since improving processes is a condition where more can be done with less. Thus, many organizations seek to develop improvements through existing activities using a variety of techniques that are addressed in the literature, such as value flow mapping, lean production, simulations, among others. Therefore, this article aims to study and apply the computational simulation, through the use of Tecnomatix Plant Simulation © software, to obtain the best relation between financial return and productivity of a upholstery production line. In the methodology of this work was carried out the structural proposition of five scenarios. For the construction of these, a current scenario of the production line was carried out and for each new scenario, operators were added with new tasks to be performed. Although the final results show a better financial return for scenario three, the results obtained in scenario five are significant in terms of productivity indicators, although the cost with extra operators is much higher than in the other scenarios. Thus, it was clear the relevance of applying simulation in the production line, since the model assisted the managers in the decision making.

Keywords: Simulation; financial return; productivity; decision-making

1. INTRODUCTION

A supply chain can be defined as a process that integrates several entities, such as suppliers, distributors, manufacturers and retailers who work together to acquire the necessary inputs and turn them into different end products that will be distributed to customers (MIRANDA et al., 2018). The traditional supply chain presents sequential production, storage and distribution activities so that the planning and optimization of each individual activity is a reflection of decisions made based on simulations and projections of a future state that the organization wants to achieve (ADULYASAK et al., 2015).

To reduce production, inventory and configuration costs, production planning must consider specifications for capacity, raw material availability, processing time, storage limitations, etc. After production planning decisions are used as input for managers to make decisions about the logistics of delivering products to customers (CHEN, 2004). In this context, this article aims to study and apply the computational simulation, through the use of the software Tecnomatix Plant Simulation ©, to obtain the best relation between financial return and productivity of a production line of the Belgian company Estofados, located in the Region South of Brazil.

Specifically, the objectives are to perform the production process mapping, analyze the current scenario of the upholstery production line, simulate the relationship between financial return and productivity for different scenarios of staff increase in the production system, and finally identify the scenario that guarantees the best relationship for the company.

Due to the high competitiveness among companies, as a result of the globalization of supply chains, rational use of resources must be made to strengthen customer service levels and reduce lead times and total costs. Considering these factors, considering production simulation as an instrument to support decisions may reflect an increase in efficiency and cost savings (DÍAZ-MADROÑERO et al., 2015).

Traditionally, when considering the question of analyzing new investments and their resources, some points that are fundamental must be considered, such as the modification of the layout, the need for labor and alternatives of movement and storage of materials, with the purpose of achieving greater productivity and flexibility of the production system (SOUZA, 2010).

There is a need for a greater understanding of the dynamics of production processes, with a view to continuous improvement. In this case, some tools are fundamental, such as: lean production techniques, value stream mapping, and computational simulation (CASSEL, 1996).

The utility in many segments, from services to manufacturing processes, reinforces the reason why organizations adopt simulation software as a means of uncomplicating the understanding of more complex systems, which have several variables influencing the production process (SOUZA, 2010).

Siemens' Tecnomatix Plant Simulation © software presents tools developed for: analysis of models with stochastic processes, calculation of distributions in samples, management of experiments in simulation, and optimization of system parameters, in order to simplify the needs of advanced programming work (SOARES, 2013).

Recent studies have demonstrated several applications of this simulation tool. Duranik et al. (2013) proposed the use of Tecnomatix Plant Simulation © software as a way to analyze the process of a thermoset molding industry and create scenarios to increase productivity.

Hovanec et al. (2015) used the software to simulate the entire flow of materials, including all relevant divisions of manufacturing, storage and transportation activities in a digital factory. Malega et al. (2017) developed a simulation model of a tapered roller bearing production process using the simulation tool to improve process efficiency.

This paper is structured as follows. In section 1, the introduction addresses the context of process optimization and use of Tecnomatix Plant Simulation © software. In section 2 a contextualization on the furniture industry and the use of the simulation is presented. Section 3 presents the study scenario, the description of the upholstery production line and the methodological procedures adopted in the development of this study. In section 4 the results are presented and discussed. Section 5 presents the study conclusions and suggestions for future research.

2. THEORICAL REFERENCE

Due to the increasing demand for planning that integrates production and distribution, several optimization models and solution techniques have been proposed to assist in the decision making process at the different hierarchical levels (for example, strategic, tactical and operational). Studies of solution models and methods are available in the literature, e.g., the work by Mula et al. (2010) considering strategic and tactical levels; Chen (2010) and Moons et al. (2017) at the operational level and Adulyasak et al. (2015) at the tactical-operational level.

As for the strategic level, it is essential to highlight the design of the production-distribution system, which mainly involves deciding on the quantity and location of production facilities, modes of transportation, capacity planning, among others (SARMIENTO; NAGI, 1999; GOETSCHALCKX, 1997). At the tactical level, production and distribution planning uses joint data to determine production lot sizes, stock levels, and delivery quantities, in view of production and distribution capacity (DIAYAS-MADROÑERO et al., 2015).

The operational level, the main focus of production planning is the problems of scheduling machines and vehicles, so that it aims to optimize detailed production and delivery operations, taking into account individual customer requests. In this sense, the key decisions are to assign customer orders to features, determine the start and end times of each customer order, assign customer orders to delivery vehicles, and define delivery routes and delivery times for each customer order. Therefore, the result is a detailed production and distribution schedule with the exact moment each customer order is executed (MOONS et al., 2017).

In a scenario where competitiveness among firms is increasing, industries are forced to invest in process improvements to survive and remain profitable (SILVA et al., 2017). In view of this, companies are inclined to rethink their products, invest in innovation, processes, machines, labor requirements, as well as in the final quality of the process in order to offer a product that meets the needs of the market. Being able to provide high quality product and add value to customers has been considered as a key element in the furniture industry market (TOIVONEN, 2012).

In order to be more competitive, this sector must adopt good market strategies and invest in management, which means developing studies that consider, e.g., layout analysis (FIEDLER et al., 2010), line balancing (ANTONIO et al., 2009), inventory management (BAYOU; KORVIN, 2008), that is, there are ample opportunities through the simulation of creating and testing strategies for the productive process.

Discrete event modeling and modeling techniques allow you to use computers to create scenarios that mirror the behavior of any production system. These scenarios can be modified and tested without interfering with the actual performance of the system (SILVA et al., 2017).

In this way, the simulation is used as an instrument to support decision making, as it provides reliable results, e.g., the quantity of production, lead time, takt time, productivity, etc., in a few minutes of computational processing. In addition to a problem analysis tool, simulation can be seen as a means of facilitating the understanding of systems, serving as a form of communication between analysts, managers and people connected to the operation (CHWIF; MEDINA, 2007).

Therefore, modeling and simulation are tools that contribute to analyze and predict the behavior of production systems before implementation, and if applied according to an appropriate methodology, will allow to obtain statistically reliable results and guide the managers to identify the best paths during the process of decision-making.

3. METHODOLOGY

This chapter describes the scenario and production line used as a case study, as well as the development of the model and the respective control logic that constitute the computational application for the case study. The present application was intended to simulate a production line of a upholstery factory through the use of the Tecnomatix Plant Simulation © tool, developed and marketed by Siemens.

3.1. Scenario

This study was carried out at the company Couch Belga, a fictitious name attributed to the company object of this study. The Belgian Couch is a small organization and family run organization. Currently, its staff has six direct employees, as well as two indirect ones in the administrative and commercial sectors. The company started operations in 2009 in the city of Restinga Seca, in order to serve the South region market with a line of popular couch. In the city, there was one of the largest furniture industries in Latin America.

This industry was already experiencing difficulties, and the installation of the Belgian couch in the region was seen as an opportunity to use the available skilled labor. Over the years, the skilled workforce in the Restinga Seca region eventually migrated to other regions of the state, such as Bento Gonçalves and Gramado. This migration, in 2013, made the Belgian Upholstery decided to move its headquarters to the region of the Rio Pardo Valley.

Due to the opportunities found in the couch market in the Santa Cruz do Sul region, Belgian couch focused on qualifying its labor to produce mid-range couch. The company developed the Amarok couch, its main entry product in the region's upholstery market, as shown in Figure 1. Afterwards, a consultancy was contracted to restructure the company's industrial processes to fit the needs in terms of cost and quality.

Figure 1: Amarok couch

With the restructuring in 2016, the company was given the opportunity to relocate to the city of Santa Cruz do Sul. The main objective of this important change was to open the doors to the general public for the production of high and adapted lines. Nevertheless, the company maintained in its portfolio its main product, to serve the retail market of the region.

3.2. Description of the upholstery production line

This topic describes the production line considered as a case study in this work, with the objective of assisting in understanding the process of manufacturing upholstered furniture. The description of the production line will be made for the Amarok model upholstery in detail, with the actual names of the stations and work processes.

The production line under study has a upholstery assembly line, comprising parallel sequences of workstations, which are automated or with the presence of operators. Figure 2 shows the layout of the production system under study, extracted from information provided by the company.

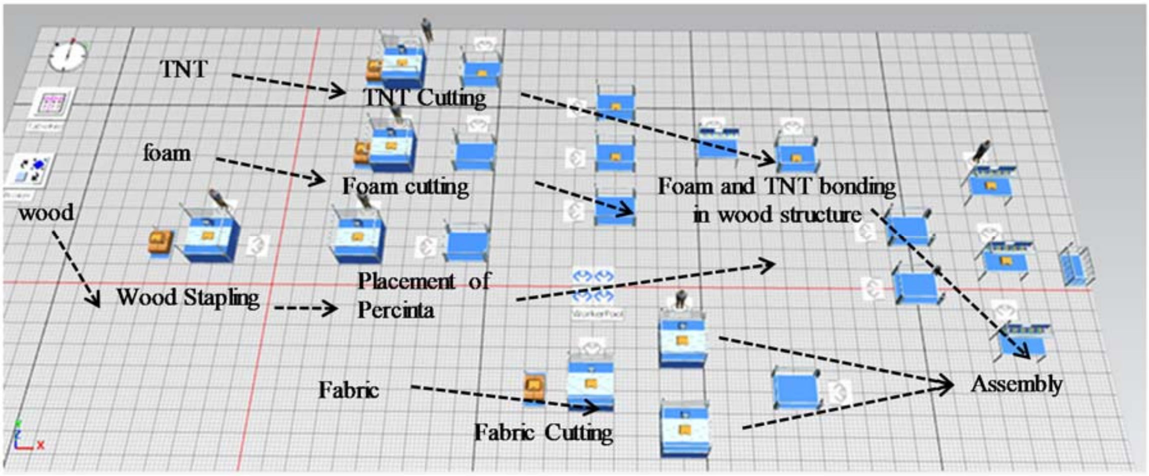


Figure 2: Layout of the production line of the Amarok model couch

Manufacturing is started by preparing the raw materials, concentrating on cutting them into smaller pieces, with a view not only to the assembly of the product, but also to the rational use of materials in order to avoid waste. The wood is received already cut by the factory, being ready to be used, while the foam arrives at the company in large blocks that are then cut and shaped according to the demand. Fabric and TNT are usually marketed in rolls and require specific attention to be cut in order to ensure the quality of the product's finish.

Following the production steps, the pieces of wood are then positioned so that they can be joined by a stapling process in order to form the structure on which the components necessary for the materialization of the couch will be assembled. The next step consists of placing percinta in the structure in order to allow the support with a certain cushioning to the couch set.

With the structure of the wood ready, the foams and the TNT can be fixed with the use of contact glue. Parallel to the preparation of the structure, the cutting of the fabric occurs obeying a previously established cutting plane for the model in production. The pieces of fabric are then sewn in such a way that the cover layer is obtained for the sofa and its components. From this point, the coating takes place on the main frame, where clips are usually used for fixing the fabric to the wooden frame. After this step, the upholstery is ready to be sent to the expedition.

3.3. Strategies of representation of the elements of the productive process

The simulation model was created from a series of basic objects of the Tecnomatix Plant Simulation © software. The following types of basic objectives were used:

a) Source: source that produces mobile units (MUs) in a single station. It produces the same or different types of MUs, one after another or in a mixed sequence. Represents the department of receipt of the factory that introduces the pieces produced in other places;

b) SingleProc: object for representation of processes or machines. It receives a portion of its predecessor, processes it and moves it to the successor;

c) Assembly Station: adds mounting parts to a main part;

d) Buffer: object for the storage of mobile units or for their displacement, preventing the production process from stopping;

e) Drain: object for collection of the mobile units, at the end of the process;

f) Entity: unit that circulates through the flow of materials, representing the products in a productive process;

g) Connector: establishes material flow connections between two objects and connects objects to an output or input;

h) Workplace: it is the place at the station where the operator carries out his work. It can be assigned to SingleProc and Assembly Station to demonstrate that operators are processing the product, or the Buffer to control the operators that carry mobile units;

i) Broker: it is the intermediary for necessary services, that is, it acts as manager of the various operators;

j) WorkerPool: represents the factory staff room; and

k) Worker: represents the operator who works in a Workplace.

l) From these basic objects, the different elements of the productive process were modeled as follows:

m) Entry of the entities in the process: the representation of the wood, foam, TNT and fabric inputs in the production line was done with Sources;

n) Wood, foam, TNT and fabric: were modeled as entities, that is, they constitute the basic units of movement in the model. In this way, different types of entities were created to represent the raw materials considered in the model;

o) Cutting, stapling, trimming and sewing: the representation of foam, TNT and fabric cut elements, stapling of the wood frame, fastening of the percinta and sewing of the fabric was done with SingleProcs;

p) Foam bonding and TNT in the wood structure and assembly: these elements were modeled from Assembly Stations;

q) Storage of mobile units and their displacement: the representation of the storage of process entities, as well as their displacement between workstations was done from Buffers;

r) Operators: the representation of the operators in the processing of the raw materials or in their transport was made from Workers;

s) Processing or transport locations: the representation of the stations in the stations where the works are carried out by the operators and the transport from one station to the other was made from Workplaces; and

t) End of the process: the representation of collection of the mobile units, indicating the end of the productive process, is made from Drain.

Figure 3 illustrates the types of objects used in the model.

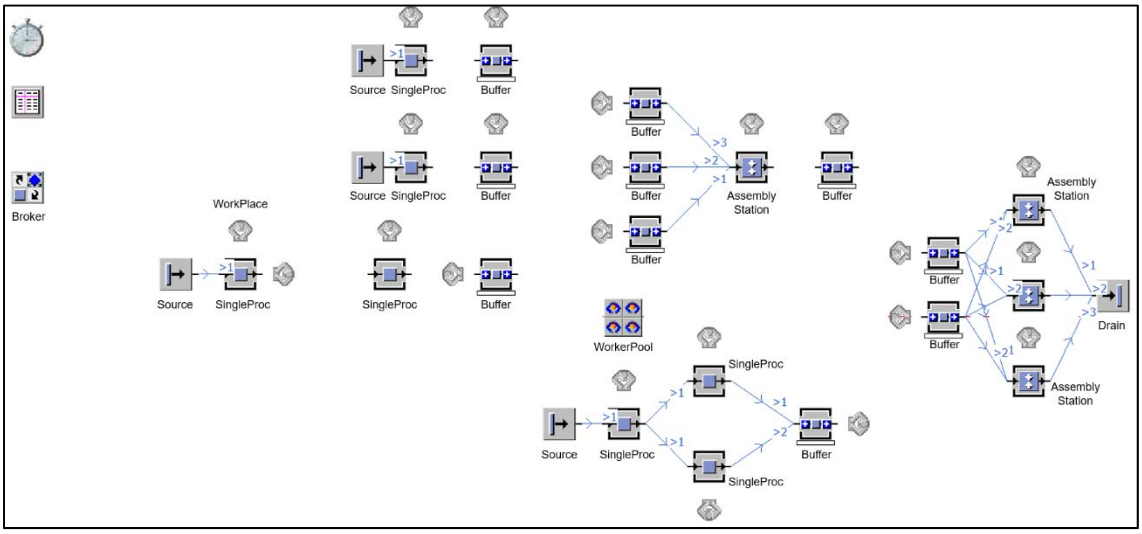


Figure 3: Objects used in the model

3.4. Materials Handling Strategies

The movement of the materials was done in an automated way through the use of connectors in the process and also through transport services of the operators. Most of the elements had a successor defined in the flow, either by means of connector or assignment of service to the operators, while the step of cutting fabric presented two possible successors, which correspond to the two existing sewing machines. The entire production flow followed the first in - first out production strategy, where the orders were served in the sequence where they were recorded in the tables (queueTables). To move the mobile units from the foam storage buffers, TNT, fabric and wood frame, to the Assembly Stations, it was considered that only five units can be moved at a time, as reported by company officials.

3.5. Strategies for working with operators

As reported by the company, there are currently six operators working on the production line studied, and they are divided as shown in Table 1.

Table 1: Operators and their functions

Number of operators	Tasks code	Functions
1 operator	#01	• TNT Cutting • Foam cutting • Cutting of fabric • Move TNT to Collage • Frothing Foam to Glue • Foam bonding and TNT in the wooden frame
1 operator	#02	• Staple of wood
1 operator	#03	• Move wood until you put the percinta • Placing the percinta

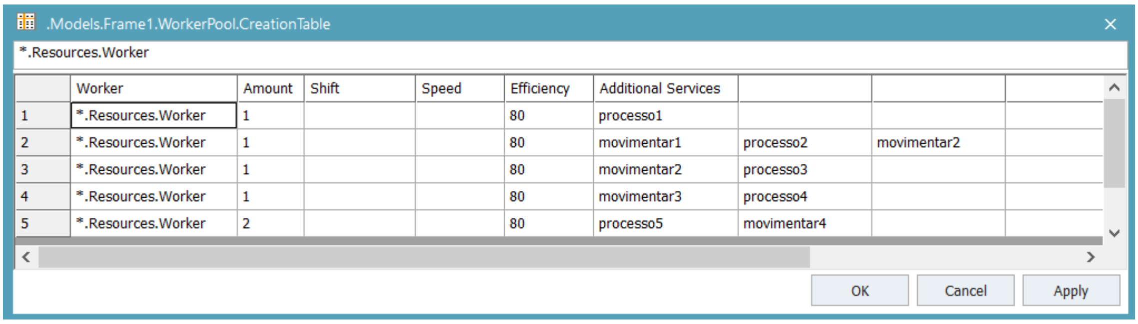
		• Moves wood frame up to Glue • Move TNT to Collage • Frothing Foam to Glue
2 operators	#04	• Sewing Machine 1 • Sewing Machine 2 • Move fabric sewn up to Assembly
1 operator	#05	• Moves structure glued to Mounting • Assembly

In the Tecnomatix Plant Simulation © software, Workplaces were created to represent the work places or places of movement of the operators. In addition, a Broker has been added, which corresponds to the manager responsible for the operators, and a WorkerPool, which refers to the employees' room in the company. After, the actual operators were inserted (Workers), for which they were assigned the services in accordance with Table 1. In the simulation of different scenarios, operators have been added to assist in the task codes # 01 and # 05, as shown in Table 2.

Table 2: Simulated scenarios

Scenarios	Operators
Scenario 1	6 Operators (Current scenario)
Scenario 2	7 Operators (addition of 1 operator to assist in tasks # 05)
Scenario 3	7 operators (adding 1 operator to assist in tasks # 01)
Scenario 4	8 operators (addition of 1 operator to assist in tasks # 01 and 1 operator in tasks # 05)
Scenario 5	9 operators (adding 2 operators to assist in tasks # 01 and 1 operator in tasks # 05)

In the SingleProcs and Assembly Stations, through the Importer tab, it was possible to specify those responsible for the processes, which were added in the Services table, as shown in Figure 4.


.Models.Frame1.WorkerPool.CreationTable

*.Resources.Worker

	Worker	Amount	Shift	Speed	Efficiency	Additional Services			
1	*.Resources.Worker	1			80	processo1			
2	*.Resources.Worker	1			80	movimentar1	processo2	movimentar2	
3	*.Resources.Worker	1			80	movimentar2	processo3		
4	*.Resources.Worker	1			80	movimentar3	processo4		
5	*.Resources.Worker	2			80	processo5	movimentar4		

Figure 4: Designation of services and movements to operators

For moving objects through operators, in the Exit tab of the buffers, SingleProcs and Assembly Stations, the option Carry Part Away was selected to assign a given operator to the desired location. It should be noted that all services and movements performed by each operator were specified in the WorkerPool Creation Table. In addition, 80% of the operators were attributed efficiency, according to information obtained from the company.

3.6. Processing Time Strategies

Simulation of processing times depends on the type of object. SingleProc and Assembly Station elements allow you to set process time. According to data collected with the company, the stages of cutting, stapling, percinta, foam bonding and TNT in the wood structure, sewing and upholstery assembly have fixed process times, as shown in Table 3. Thus, the specified times were entered in the Processing time of the Times tab of each of the steps.

Table 3: Processing Times

Process	Processing time
Foam cutting	60 minutes
TNT Cutting	30 minutes
Fabric Cutting	120 minutes
Stapling	120 minutes
Placing of percintas	30 minutes
Seam	240 minutes
Foam bonding and TNT on wood frame	60 minutes
Assembly	165 minutes

3.7. Strategies for using process buffers

The strategy used in the buffers model consisted of the destination of the raw materials to the buffers when the destination positions were occupied, serving then as a storage point of these mobile units so that they were then directed to the next step. Figure 6 shows the configuration of the company's production system.

In addition, buffers were placed together with Assembly Stations to allow operators to move mobile units from storage points to those locations in order to circumvent the limitation of the simulation tool used, which prevents operators from loading materials and leaving them Assembly Stations.

3.8. Indicators

A set of indicators was created to evaluate the results of the simulation model: warmup time, quantity of upholstery produced, average time to process an couch (average lead time), average exit time (in percentage), time relative to the transport of materials within the factory (in percentage) and time relative to the storage of mobile units (in percentage). Through the information obtained with these indicators, it was possible to calculate the profit margin for the number of upholstery produced and to evaluate the feasibility of hiring other employees to assist in the production line.

4. RESULTS

The proposed simulation model was initially used in the current scenario, in order to validate and verify if it represents, in a reliable way, the actual behavior of the productive process analyzed. For this, the established indicators were used to provide baselines at the moment of comparison, both with the current scenario and for the other potential scenarios. Initially, it was necessary to identify some information about the analyzed product, such as the sale price, the cost of production and the margin of return. Table 4 shows the financial figures for Amarok couch.

Table 4: Selling price, cost of production and margin of return

Amarok couch	
Selling price	R$ 1.077,00
Cost of production	R$ 799,00
Margin	R$ 278,00

These data were used in the construction of the proposed scenarios, as a basis to evaluate the best relation between financial return and productivity. In this way, the model was first run for the current scenario (scenario 1), in order to validate and verify if it would be compatible with the company's reality. Table 5 presents the results obtained by the simulation in Tecnomatix Plant Simulation ©.

Table 5: Productivity results for scenario 1

Units produced	Average Lead time	Average Takt time	Production rate	Transportation rate	Storage rate	Added value
32	54,85	5,64	45,13%	0,01%	54,86%	15,18%

The results obtained in the model indicate a very approximate representation of the reality of the current process of Belgian couch. It is observed that with the availability of 6 operators, 32 upholstered products are produced and the production rate is around 45%. Another point that can be emphasized is the average lead time, 54.85 hours, which showed compliance with the actual process.

In the simulation of scenario 2 (addition of 1 operator to assist in tasks # 05), it is noticed that the addition of 1 operator to assist in tasks # 5 did not have significant influence in the process, as shown in Table 6.

Table 6: Productivity results for scenario 2

Units produced	Extra output	Average Lead time	Average Takt time	Production rate	Transportation rate	Storage rate	Added value
32	0	54,85	5,64	48,06%	0,01%	51,93%	15,18%

It is observed that, although 1 operator was added, this did not have a reflection on the quantity of products produced, or a significant difference in the indicators measured. However, in financial terms, the total cost has increased due to the hiring of one more employee. We verified that this analyzed scenario was inefficient, from the point of view of productivity and from the financial point of view, since the hiring of one more operator only resulted in another cost for the company.

The results obtained in scenario 3 (addition of 1 operator to assist in tasks # 01) begin to demonstrate that there is a relationship between financial return and productivity. Table 7 presents the results obtained regarding productivity.

Table 7: Productivity results for scenario 3

Units produced	Extra output	Average Lead time	Average Takt time	Production rate	Transportation rate	Storage rate	Added value
32	21	45,07	3,44	42,03%	0,02%	57,96%	20,28%

It is observed that, compared to the quantity produced in the previous scenario, 21 more products were produced by hiring a multifunctional employee allocated to assist in tasks # 01. In addition, a reduction in lead time and takt time was obtained. In financial terms, the hiring of a multifunctional employee would be advantageous, as shown in Table 8.

Table 8: Result of the financial return for scenario 3

Financial Return	
Extra Operator	1
Cost Multifunction Operator	R$ 2.970,00
Upholstery Operator Cost	- R$ 2.970,00
Total (A)	21
Output Extra	R$ 278,00
Margin	R$ 5.838,00
Total (B)	R$ 2.868,00

It is noted that the contraction of an operator to perform the tasks suggested in scenario 3 would represent an additional expense for the company of R$ 2.970, however, would compensate due to the impact on productivity indicators. This change, as already mentioned, would result in 21 extra products, which corresponds, considering the margin of the product analyzed, to a positive balance of R$ 2.868.

In the simulation of scenario 4 (addition of 1 operator to assist in tasks # 01 and 1 operator in tasks # 05), it is noticed that, although a small improvement in productivity indicators was obtained, the option for this scenario does not represent the best decision for the company. Table 9 presents the results of scenario 4.

Table 9: Productivity results for scenario 4

Units produced	Extra output	Average Lead time	Average Takt time	Production rate	Transportation rate	Storage rate	Added value
57	25	43,17	3,19	49,91%	0,02%	50,07%	21,88%

In scenario 3, scenario 4 showed improvement in all productivity indicators, evidencing that the hiring of two more operators would reflect, albeit not so significantly, an increase in production and reduction of lead time and takt time. In financial terms, however, hiring two operators for this scenario would not be the best option for the company. Table 10 shows the results obtained.

Table 10: Financial return results for scenario 4

Financial Return	
Extra Operator	2
Cost Multifunction Operator	R$ 2.970,00
Upholstery Operator Cost	R$ 3.240,00
Total (A)	- R$ 6.210,00
Output Extra	25
Margin	R$ 278,00
Total (B)	R$ 6.950,00
Total (A+B)	R$ 740,00

It is observed that in this scenario an extra production of 25 products was obtained, which corresponds in terms of financial margin of R$ 6.950. Although the margin increased due to extra production, the hiring of 2 operators makes this scenario not reflect the best option because the resulting balance, although positive, is lower than that obtained in scenario 3 simulation.

Scenario 5 (addition of 2 operators to assist tasks # 01 and 1 operator in tasks # 05) presented optimal results in terms of productivity when compared to previous scenarios. There was a substantial improvement in all productivity indicators, as shown in Table 11.

Table 11: Productivity results for scenario 5

Units produced	Extra output	Average Lead time	Average Takt time	Production rate	Transportation rate	Storage rate	Added value
73	41	13,17	2,5	91,83%	0,04%	8,13%	49,83%

The results obtained in the simulation for this scenario represent a good alternative with respect to productivity indices. In this scenario, we obtained 41 extra products, a reduction in lead time and considerable takt time, a storage rate well below the other scenarios and a significant gain in value added to the process. As for the financial return, the results obtained were also satisfactory, since the resulting balance under this scenario was positive. Table 12 presents the results.

Table 12: Financial return results for scenario 5

Financial Return	
Extra Operator	3
Cost Multifunction Operator	R$ 3.240,00
Upholstery Operator Cost	R$ 5.940,00
Total (A)	- R$ 9.180,00
Output Extra	41
Margin	R$ 278,00
Total (B)	R$ 11.398,00
Total (A+B)	R$ 2.218,00

It should be noted that, although this scenario presented the best results in terms of productivity, it does not reflect the better economic performance, given that the balance obtained in scenario 3 is greater than the balance obtained in this scenario, which was R$ 2.218. Based on the simulated scenarios and according to the initially proposed objective, scenario 3 presented the best relationship between productivity and financial return. Table 13 presents the comparison between the scenarios analyzed.

Table 13: Comparison between the scenarios analyzed

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Extra Operator	0	0	21	25	41
Extra operator Quantity	0	1	1	2	3
Extra operator cost	R$ -	R$ 3.240,00	R$ 2.970,00	R$ 6.910,00	R$ 9.180,00
Final balance	R$ -	-R$ 3.240,00	R$ 2.868,00	R$ 740,00	R$ 2.218,00

Although Scenario 3 presented the best relationship between productivity, low cost with hiring of extra operators and satisfactory financial return, the results obtained in Scenario 5 are significant in terms of productivity indicators, although the cost with extra operators is much higher than in other scenarios.

5. CONCLUSION

Currently it has been an increasingly competitive market, with new technologies, optimized production processes, with companies seeking constant updates to stay ahead of your competitors. In this context, there is a growing search for methods and tools to increase business performance, contributing to competitive advantage, cost reduction, process improvement and customer satisfaction increase (BIAVA; DAVALOS, 2014).

The present study structured a methodology related to the use of computational simulation in the decision making and in the planning of modifications of a productive system of upholstered furniture. Through the use of the Tecnomatix Plant Simulation © software, it was possible to simulate different scenarios of staff in the production line to verify the one that allowed the greatest relation between financial return and productivity. Thus, it was identified that scenario 3, which represents the addition of an operator to assist in the tasks of cutting materials, moving and gluing of foam and TNT in the wood structure, proved to be the best solution to the problem.

The results of the simulations were presented to the company manager, who showed great interest in looking for a new operator to work in the factory, in order to increase the productivity of Belgian couch and maximize the financial return. Thus, this application proved to be relevant for the analysis of results and orientation for decision making about possible hiring of employees to assist in the production line.

The knowledge obtained during the development of this study can be considerably extended aiming at the elevation and improvement of the simulation model. In this way, the inclusion of all the company's upholstery production lines in the model is presented as a suggestion for future research. To do this, the total resources of the plant must be analyzed, as raw material and labor, as well as information about the efficiency of the operators, processing time, handling time, equipment downtime, stations in the plant and other data that are necessary to improve the model.

In addition, the application of the model in other companies of the furniture sector upholstered as perspective for future studies is identified. Thus, there is the possibility of standardizing performance indicators for factories in the industry and the opportunity to validate a model that can be deployed in companies with this configuration. This also allows the comparison of the overall performance of companies that use the simulation model developed with those who do not use it.

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