Simulating and Improvement a Warehouse Flow Using FlexSim Application

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Abstract: *In recent years, the increasingly pressing problem for any commercial company is that of being flexible in order to respond to market demands. One of the places where continuous adaptation to market requirements is needed are warehouses. Depending on the needs, the warehouse must be able to redefine its routes for storing and delivering products. FlexSim software can be used for modelling, simulation, and improvement systems such as manufacturing, warehousing, health, material handling, logistics, etc. The aim of this paper is to improve the existing flow in a warehouse. For this, in the first stage, the warehouse is simulated in its existing state in order to be able to see the reception times, the storage mode, the package preparation times as well as the transport times. Based on the data obtained, in the second part, a simulation will be carried out in which the flow in the warehouse will be improved, starting from the different aspects identified in the initial simulation. FlexSim software is used to define the model, simulate and improve the warehouse.*

Keywords: *FlexSim, simulation, warehouse.*

1 INTRODUCTION

In recent years, the increasingly pressing problem for any commercial company is that of being flexible to respond to market demands. One of the places where continuous adaptation to market requirements is needed are warehouses. Depending on the needs, the warehouse must be able to redefine its routes for storing and delivering products.

Different types of articles present different simulations used FlexSim software.

In paper [1] was present a study on the simulation of industry 4.0 factories based on the ontology on flexibility using FlexSim.

In paper [2] „Simulation and Optimization of Automated Warehouse Based on Flexsim", was used FlexSim to reduce the logistics and commodity storage costs in the operation of e-commerce enterprises.

An introduction in FlexSim is made in paper [3] where the working methodology in the FlexSim software is presented.

In paper [4] was used FlexSim to be modelling and simulate a technological flow and was presented the working methodology, benefits and results that can be obtained.

If we have a technological flow simulated in FlexSim, we can make different changes to the logic of the flow. The results obtained after the changes can be viewed in FlexSim.

Basically, FlexSim is a software that helps to modify and optimize a system before implementing the system in a factory.

2 WAREHOUSE SIMULATION

The warehouse is based on the activity of three essential logistics departments: the receiving department, the delivery department and the stock control department. They work in close collaboration, forming a functional network that ensures the efficiency of the entire logistics system.

The purpose of the simulation is to identify and improve the existing operational flow, in the two most important departments that operate within the warehouse, namely, the reception department and the delivery department.

2.1 Initial data

The reception department is responsible for receiving and checking the goods arriving in the warehouse. Employees in this department have a key role in ensuring that the products received are in accordance with the delivery documents and their registration in the inventory system. In figure 1 is presented the process map of the reception department.

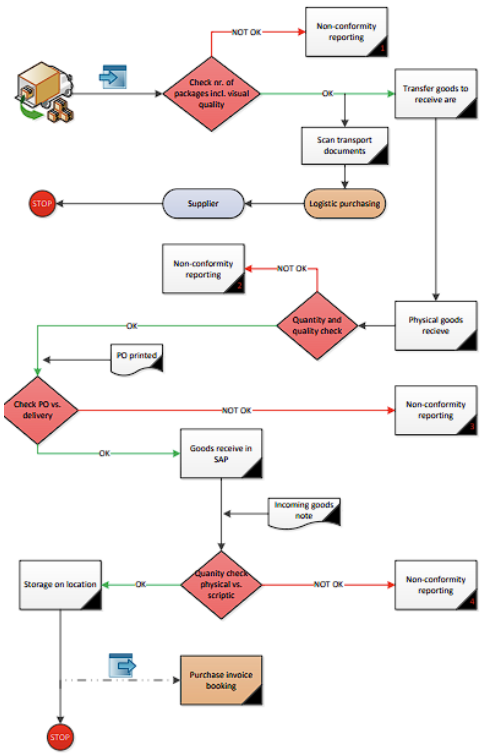

Fig. 1. Process map of the reception department

The second department, the delivery department, deals with the preparation and dispatch of goods to customers. It involves processing orders, selecting the necessary products from stock, packaging and preparing them for delivery. The delivery team has a crucial role in ensuring that the products reach the recipient in the shortest possible time. In figure 2 is presented the process map of the delivery department.

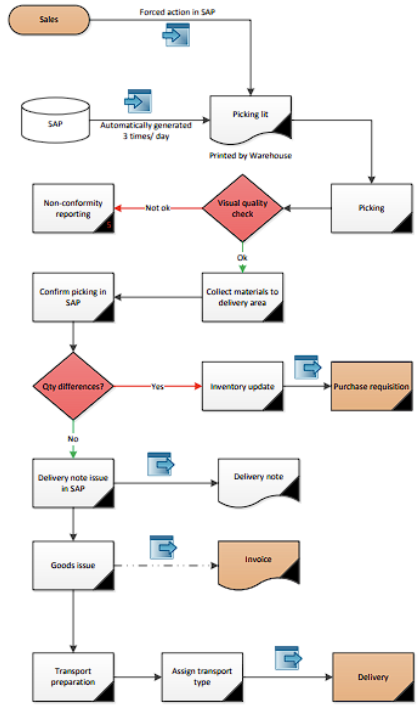

Fig. 2. Process map of the delivery department

In order to be able to improve the flow of goods from the warehouse, the following is considered:

1) Detailed process analysis - we want to have a clear and accurate picture of the processes that take place in the warehouse, what are the stages, how are they connected and where improvements can be made,

2) Identifying bottlenecks and delays – we want to determine exactly where the current process is experiencing difficulties or becoming slower, we want to understand the causes and find solutions to eliminate them.

3) Simulation and evaluation of different improvement scenarios - in the first phase, we simulate the warehouse in the initial situation, and then we try a scenario to improve the total efficiency of the warehouse.

Resources are an essential aspect in any process. Detailed knowledge of available resources allows us to build an accurate simulated model and identify possible areas for improvement.

The following types of resources are considered:

- Employees: In the warehouse, the number of employees is 5, 2 employees are part of the reception department (operators 1 and 2), 2 employees are part of the delivery department (pickers 1 and 2) and 1 employee is in charge of stock control and forklift handling

- Equipment and machinery: The warehouse is equipped with a forklift and 5 carts for transporting goods.

- Storage space: Storage space 880 m^2

2.2 Simulation of the initial data

In accordance with the previously presented data, the warehouse model was created using FlexSim software [5], which is presented in figure 3.

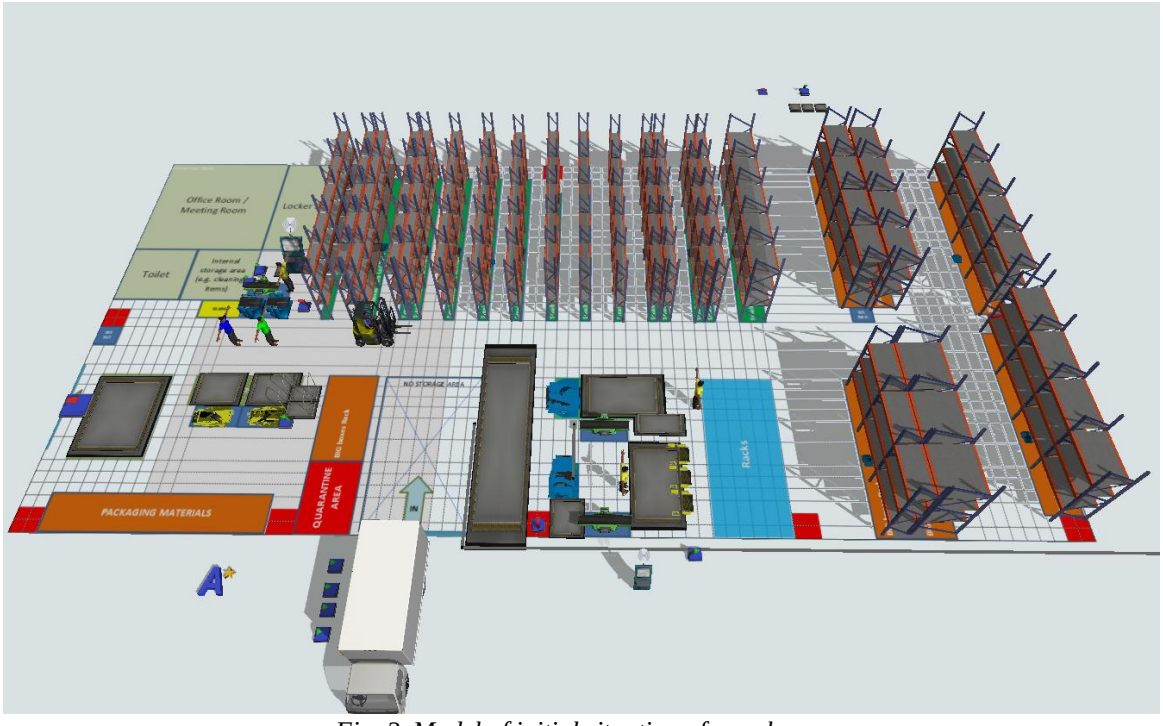

Fig. 3. Model of initial situation of warehouse

2.2.1 Results of initial simulation

We want to see a series of data. The average time of the reception process, number of packages prepared. The simulation takes place over a period of 8 hours.

In figure 4 is presented the average time of reception process for package.

Reception Process Time

Avg Staytime	Min Staytime	Max Staytime
2028.00	135.00	4570.00

Fig. 4. Reception process time

In figure 5 is presented the number o packages delivered in 8 hours.

Number of Piking Made

Input
73.00

Fig. 5. Number of packages delivered.

In figure 6 are presented the occupancy rate for the 5 operators.

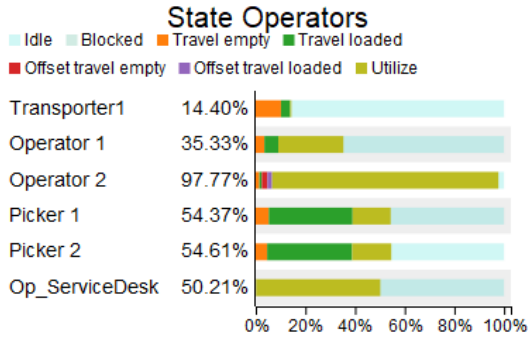

Fig. 6. Occupancy rate operators.

2.2.2 Conclusions of initial simulation

After simulating the initial situation in the warehouse, a series of problems can be found:

- the average time between reception and storage of a relatively large product, approximately 34 minutes,
- the number of packages delivered in 8 hours is 73. We want to increase the number of packages delivered.
- the degree of occupation of the operators is quite low for transport operator and operator 1 and also unbalanced.

2.3 Simulation of the new model

Changes made to the model following the analysis of the initial simulation:

- The shelves were rearranged so that the length of the routes for the large boxes is shorter.
- The rearrangement of the shelves canceled the intersection of the reception and goods preparation operators with the forklift. This new arrangement helped to improve the process flow of both the reception department and the cargo preparation department.
- As far as the reception department is concerned, the final desired result is the reduction of the reception time of the products. For this, certain steps performed in the goods reception system (software) have been eliminated, as well as a greater degree of automation.

In figure 7 is prezented the new model simulation.

Fig. 7. Model of new situation of warehouse

2.3.1 Results of final simulation

In figure 8 is presented the average time of reception process for package.

Fig. 8. Reception process time

In figure 9 is presented the number o packages delivered in 8 hours.

Fig. 9. Number of packages delivered.

In figure 10 are presented the occupancy rate for the 5 operators.

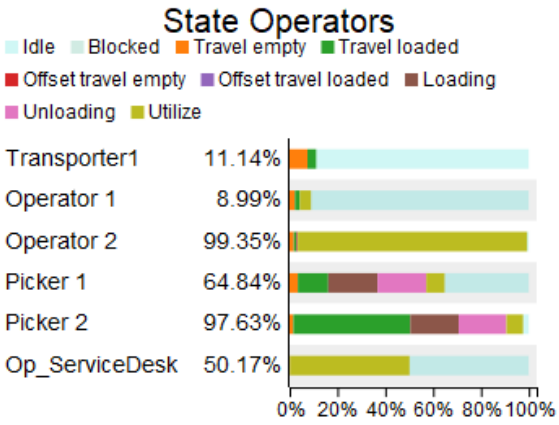

Fig. 10. Occupancy rate operators

2.2.3 Conclusions of initial simulation

After performing the simulation after changing the layout of the warehouse, it can be seen that:

- the average time between reception and storage of a relatively large product, approximately 28 minutes,

- the number of packages delivered in 8 hours is 105. We want to increase the number of packages delivered.

2 CONCLUSIONS

FlexSim software can be used to stimulate the flow of a warehouse. Based on the data obtained, measures can be taken to improve the flow in different areas of the warehouse.

In the first stage, based on the existing data, the warehouse was modeled and simulated. After the simulation, over a period of 8 hours, it was possible to establish the following data:

- the reception time of the packages entering the warehouse;

- how to store received packages;

- how to prepare the packages to be delivered;

- the number of packages delivered from the warehouse;

- the degree of occupation of the operators in the different areas of the warehouse (reception, storage, delivery).

Based on the data obtained after the first simulation, it was possible to establish the necessary measures to improve the flow from the warehouse, in the sense of increasing the number of parcels delivered through:

- redefining the work procedure for the reception of packages in the warehouse, in the sense of decreasing the reception time;

- the repositioning of the racks in the warehouse, which led to the improvement of the routes of received and delivered packages.

All the measures taken led to an increase in the number of packages delivered from the warehouse.

Following the simulations carried out, starting from the existing configuration and using the new improved configuration of the warehouse, it is found that:

- the average package reception time decreased by 18%, from 34 minutes to 28 minutes.

- the number of delivered packages increased by 30%, from 73 to 105.

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