

Original Research Article

Discrete Event Simulation Business Process of Trading Companies

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Abstract: The medium discrete event simulation of business processes of the enterprise warehouse shopping package Any Logic was selected which provides the best tool for making management decisions. To create a simulation model of the warehouse made the following list of activities: description of the warehouse, the definition of roles, the description of the main business processes, define key indicators and parameters, model creation, experimentation and optimization, analysis and interpretation of research results. According to the results of simulation warehouse we found the best solution to take the appropriate management decisions to improve the efficiency of business processes, consideration of commercial enterprise.

Keywords: Simulation; Discrete event simulation, Business processes of trading companies, Optimization, Efficiency of business processes.

INTRODUCTION

Today, more and more commercial enterprises are faced with the necessity of a complete restructuring or re-engineering of business processes to improve the sustainability and competitiveness in a globalizing world economy and the complexity of the nature of economic activity in terms of electronic sales. Obviously, re-engineering requires thorough research and methodological foundations and applications of formal methods for its development in order to reduce the negative consequences of wrong management decisions [1-4].

The need to search, rank and accounting for large amounts of data in the analysis of business processes of modern commercial enterprise requires the information technology application based on hardware-software decision support systems (DSS) [5-7].

On the problem of determining the market risks and opportunities are directed specialized monitoring systems, including functions by the statistical analysis and procedures results of quantitative trade indicators. The results which obtained by this methods are not sufficient for understanding the place in the commercial enterprise business process that

requires decision-makers search and iterative processes that in a large array of data and the high speed of change involves time-consuming and generally are not effective due to the necessity of constant updating information [8,9].

The aim is to increase business processes management efficiency of modern commercial enterprise on the information technologies basis with the use of models and methods of discrete event simulation.

The form of discrete event simulation has been selected due to the analysis [5-9]. It is perfectly suited for developed model, since it will be possible to take into consideration parameters such as time, utilization of individual zones, and it is possible to change the objects and their capacity.

AnyLogic (The AnyLogic Company) has been selected as a graphical modeling environment simulation package. AnyLogic provides a tool for management decision-making. [10] It is necessary to have an information about the interactions, dynamics and random business events. We need actuals to develop data for the analysis of "what - if". AnyLogic is

riskily possible to optimize the control strategy in a virtual environment. Decision support in supply chain management which based on simulations allows increasing the efficiency and business agility.

TASK DESCRIPTION

Company "Maria" LLP was chosen for practical research. The company is a franchise of the popular site for online purchase building materials, tools and accessories in Kazakhstan. The project was formed in March 2012 in Kazakhstan, becoming one of the first online market retailers.

At the moment, "Maria" is Kazakhstan's largest online store, representing more than 80,000 products and 70 brands of authentic building materials, tools and accessories. Nowadays the site was visited more than 150,000 times, 35% of them were the first to see it. Permanent audience of project is 7500 people. The largest numbers of visitors are from Almaty and Astana area which consist of about 40% of all consumers.

The aim of the research is to develop a simulation model of the company's own warehouse.

DISCRETE EVENT IMITATIVE SIMULATION OF BUSINESS PROCESSES OF TRADING COMPANIES

To create a simulation model of the warehouse company "Maria" is required to perform the following list of [11] requirement:

- 1) Warehouse description;
- 2) Determination of roles;
- 3) Description of key business processes;
- 4) Definition of key indicators and parameters;
- 5) Creating a model;
- 6) Conducting experiments;
- 7) Analysis and interpretation of research results.

DESCRIPTION WAREHOUSE

Warehouse company "Maria" is a core construction that meet the highest standards, designed to ensure the best conditions for storage of all types of cargo.

Self storage 2 has a gate for receiving goods and 2 for his feedback shipment. The area is divided into 6 areas:

1. The discharge zone;
2. Waiting area;
3. The temporary storage area;
4. Control Area;
5. The shipment zone;
6. Storage room.

Company Warehouse accepts 2 types of trucks: truck suppliers (12tn, red) and the delivery truck (5tn, blue), In stock it is equipped with about 100 vacancies, including the WMS space operators, hand-held and stationary terminals barcode reader and transfer tasks for forklift trucks and order pickers drivers.

The favorable location of the warehouse logistics company makes extremely effective for followings:

- distance to the railway siding station Almaty 1 - 5 km.
- distance to the ring road (Ryskulov st.) - 10 km.

ROLE DEFINITION

There are 6 groups of workers at the building:

- loaders;
- carriers;
- controllers;
- unloaders;
- receivers;
- loader.

Their role in the process of the warehouse is equal and interconnected.

Warehouse uses 2 types of technology:

- conveyor;
- loader.

Appropriate workers are having deal with each type of machinery in zones.

Main business processes description

3 main processes are involved in the warehouse of the company:

- 1) Delivery of goods to the warehouse (Fig. 1)
- 2) Admission to the warehouse
- 3) Shipping from warehouses

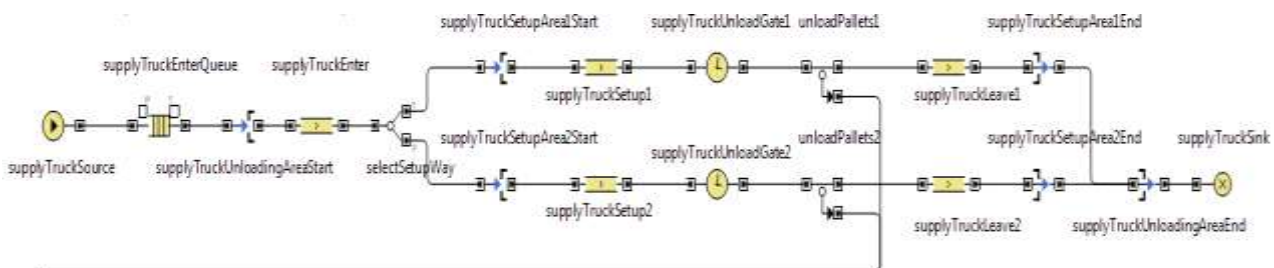


Fig-1: Business process "delivery of goods to the warehouse"

DEFINITION OF MAIN INDICATORS AND PARAMETERS

The models of the warehouse of the company consist of 26 basic parameters were defined and divided into 2 groups:

1) Parameters related to the capacity of the respective zones of 6 warehouse (waiting area, discharge zone, loading zone, control zone, a temporary storage area, warehouse area). Suitable indicators for each parameter are given in the model set.

2) The parameters for the operating personnel and distribution equipment are presented for each of the groups (a waiting area, discharge zone, loading zone,

control zone, the temporary storage area, the warehouse area) as well as trucks and unloaders.

CREATING A MODEL

The simulation model of the warehouse was built based on the data obtained in the description of the warehouse, description of roles, business processes, models and parameters.

The different software tools of AnyLogic were used to build a model [12]. First of all warehouse area, the ways and the main elements were outlined using the graphical interface of the software. Graphical model was lined turn by turn (Fig. 2).

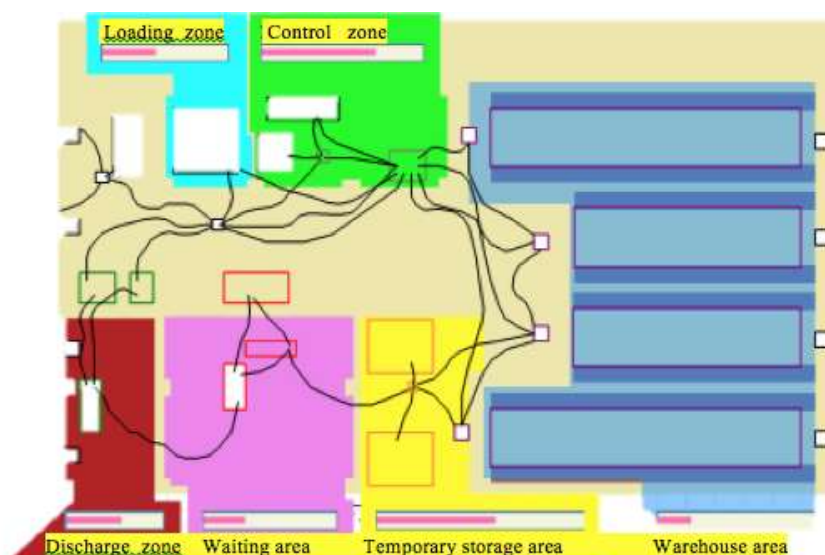


Fig-2: Graphic model of warehouse

In the next stage, each element of the warehouse has been described, they were added to the variables collection, and attached functions.

Model elements were added describing utilization of resources and time slots at the end of the work. Data can be adjusted depending on the conducted experiment during the simulation.

Functions and parameters are written in the Java programming language that describes the way in terms of sending and gates of each participant for this model, the script is usually given by random developments.

CONDUCTING EXPERIMENTS

The concept of discrete-event simulation is the possibility of statistical analysis of the model over time and the various parameters. Therefore, the object also has the ability to monitor the activity and statistics for each of the agents and for each of the areas of the model. If you enter different data, you can see changing

the participant's behavior. Timeline was used as a tool on the statistics.

In the model, the following parameters have been introduced, which is suitable to the real data storage at the beginning of the experiment with the model:

- 1) The number of loaders is 3;
- 2) the amount equal to 3 unloaders;
- 3) equal to the number of controllers 3;
- 4) the number of carriers is equal to 5;
- 5) the number of the receivers is equal to 3;
- 6) the number of trucks is 7;
- 7) the number of delivery trucks is 5, the loading time interval of 3 to 8 minutes, the delivery time takes 20 to 60 minutes;
- 8) Delivery trucks range is from 20 to 40 minutes, and unloading time of 5 to 10 minutes;
- 9) The maximum number of orders in the queues is 20, and the arrival time interval of 8 to 24 minutes.

As shown by simulation and the real state of the warehouse, under such terms resource use is not

optimal, a warehouse filled quickly (Fig. 3)

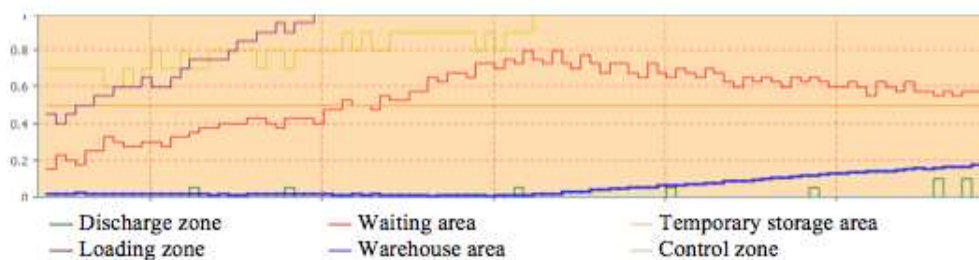


Fig-3: Loading graphic of warehouse zones

4. different experimental researches were carried out to understand the logic of the functioning of the model and its optimization and study simulation models. 4 experiments are necessary to obtain an optimal variant.

Experiment 1. Warehouse is loaded, the model is not optimal, experiments continue. Indicators satisfying the conditions, transferred to a new experiment and unsatisfied are changing.

Experiment 2. Warehouse is loaded, the model is not optimal, experiments continue. Indicators satisfying the conditions, transferred to a new experiment and unsatisfied are changing.

Experiment 3. Warehouse is loaded, the model is not optimal, experiments continue. Indicators satisfying the conditions, transferred to a new experiment and unsatisfied are changing.

Experiment 4. Warehouse is not full, the resources are used optimally, and the zone is not overloaded. It is possible to complete and summarize the experiments.

ANALYSIS AND INTERPRETATION OF RESEARCH RESULTS

The following optimal parameters for management decision-making have been identified on the results of the experiments:

- number of loaders is 6;
- number of unloaders is equal to 6;
- number of controllers is equal to 3; - number of carriers is equal to 9;
- number of decision is equal to 6;
- number of trucks is 12;
- delivery truck number is 7, the loading time interval of 10 to 15 minutes, the delivery time takes from 40 to 70 minutes;
- delivery trucks range is from 40 to 70 minutes, and unloading time by 20 to 30 minutes

- maximum number of orders in the queue is 40, and the time interval is from 2 to 20 minutes.

Warehouse operates optimally based on the data: human resources do not reach their limit, but their workload is mainly more than 75%. Thus "Maria" is a large company which increase the number of orders, the capacity of the queue, as well as the order of intervals. Stages of loading and unloading trucks are adjusted. The warehouse is downloaded just in half.

The model related to congestion warehouse identified a key during experiments. We need to build a logistics network to avoid overloading so that the minimum interval of arrival of new truck vendors shall exceed the maximum time of discharge of the previous truck.

The company plans to lease the part of free storage facilities in order to use space optimally. But in time the workload warehouse will increase due to the growth of the market.

CONCLUSIONS

- (1) AnyLogic was selected in a medium discrete event simulation of business processes stock trading enterprise LLP "Maria" which provides the best tool for making management decisions. Everything you need for a successful simulation is available at this object: an information about the interactions, dynamics and random business events. We need actual to develop data for the analysis of "what - if".
- (2) The following list of activities was made to create a simulation model of the warehouse: warehouse description, the definition of roles, and the description of the main business processes, define key indicators and parameters, model creation, experimentation, analysis and interpretation of research results.
- (3) Warehouse found the optimum solutions according to the results of simulation human resources do not reach their limit, but their

workload is mainly more than 75%. Thus "Maria" is a large company, which increases the number of orders, the capacity of the queue, as well as the order of intervals. Stages of loading and unloading trucks are adjusted. The warehouse is downloaded just in half. This analysis allowed us to adopt the best management decisions to improve the efficiency of business processes, consideration of commercial enterprise.

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