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Application of the Discrete-Event Simulation When Optimizing of Business Processes in Trading Companies

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***Abstract*—**Optimization of business processes in trading companies is reviewed in the report. There is the presentation of the "Wholesale Customer Order Handling Process" business process model applicable for small and medium businesses. It is proposed to apply the algorithm for automation of the customer order processing which will significantly reduce labor costs and time expenditures and increase the profitability of companies. An optimized business process is an element of the information system of accounting of spare parts trading network activity. The considered algorithm may find application in the trading industry as well.

***Keywords*—**Business processes, discrete-event simulation.

I. Introduction

THE growth of GDP in developing countries observed in recent years [7] has led to improvement of social conditions, in particular, is evidenced in increase of purchasing power of the population. Positive macroeconomic trends are reflected also in the automotive market: Increased sales, both of the vehicles and spare parts to them. As a consequence of an increasing number of customers and goods turnovers raise highly important issue of business process automation for commercial companies.

Effectiveness of business processes automation in commercial companies is covered by scientific approach, namely, application of models and methods by one of the areas of discrete-event simulation. It assumes that labor cost and time expenditure are optimized in business processes: "Waiting", "Customer order receiving and handling", "Transportation of cargo", "Goods acceptance at warehouse" etc. This paper considers application of discrete event simulation on "Customer order handling" business process for example, the accounting information system (AIS) of spare parts trading industry.

II. Proposed Model

"Customer order handling" business process before optimization looks as follows: customers learn about company from television advertising, newspapers, radio, recommendations of familiar people, after that customers come to the store, get some advice on spare parts and start sale registration. For sale registration user of the AIS, i.e. sales manager shall create "Document: Order", which displays information about the requested spare parts: Title of spare parts, price, quantity availability on the local stock, the price and quantity at a remote warehouse, etc. Shape of the AIS object is "Document: Application" that presented in Fig. 1 below:

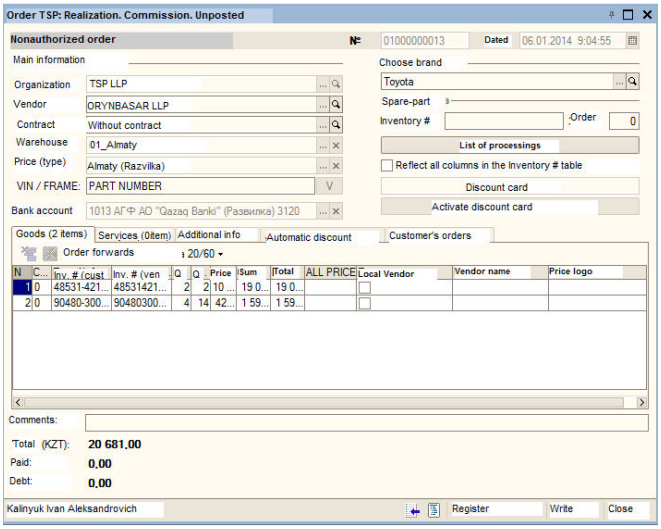

Fig. 1 Shape of the object "Order"

After the object "Document: Order" was created sales manager creates "Document: Customer order" that selects information from earlier created "Document: Order". Shape of the object is shown in Fig. 2.

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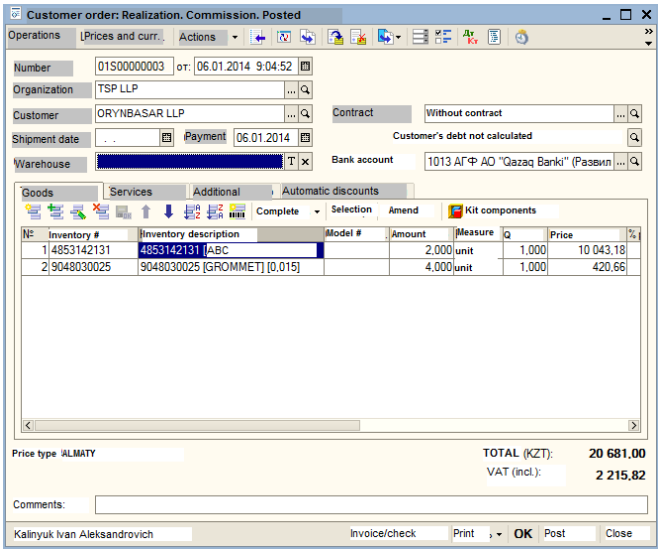

Fig. 2 Shape of the form "Document: Customer order"

In case customer confirms intentions on purchase the next step of sales manager was to print out "Invoice / Pay slip" from the object "Document: Customer order" and sends to pay on cashier.

As per of the conditions of internal policy established by the trading company: If the customer wants to buy goods possessed in stock, customer shall pay 100 % of invoiced spare parts, if spare parts possessed on outbound stock (remote storage), customer should pay 50 % of the invoice. After 50% of invoice was paid by customer and the abovementioned AIS objects were created by sales manager cashier stamps "Prepayment is done" on the "Invoice / Pay slip", which is issued to the customer. At the end of the day the store manager runs a special algorithm "Handling: Formation of Customer Order", previously developed in the accounting system, which consolidated application for the entire day and forms "Document: Purchase Order", which automatically downloaded from the so-called "invoice" and sent to provider via e-mail. Shape of the object "Document: Purchase Order" is shown in Fig. 3:

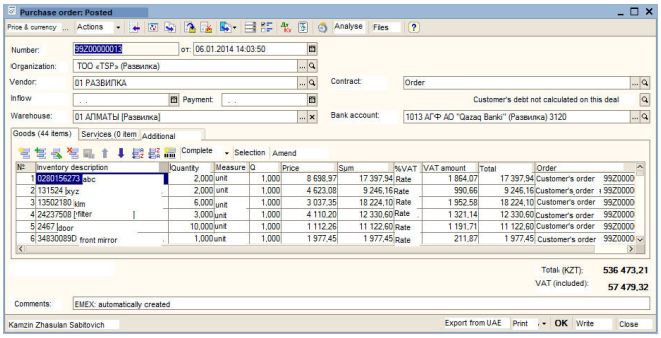

Fig. 3 Object form "Document: Purchase order"

On the next day after receiving "Purchase order" supplier starts packaging and delivery of ordered spare parts. The supplier regulated delivery time in 7 days. Along with this, vendor sends an invoice containing the information on sent spare parts to trading company via e-mail. Upon arrival of the shipment 4 employees of trading company within 5 days were carried out its receipt and acceptance at warehouse, and then customers were informed by phone on availability of the goods they ordered. The client came back to the store and pays remaining 50 % of "invoice / pay slip" to cashier after that cashier stamps "Vacation of goods allowed" on " Invoice / Pay slip". At the end of the business process 2 employees transfer spare parts to customers within 3 days. "Processing of customer's orders" business process before optimization shown schematically in Fig. 4.

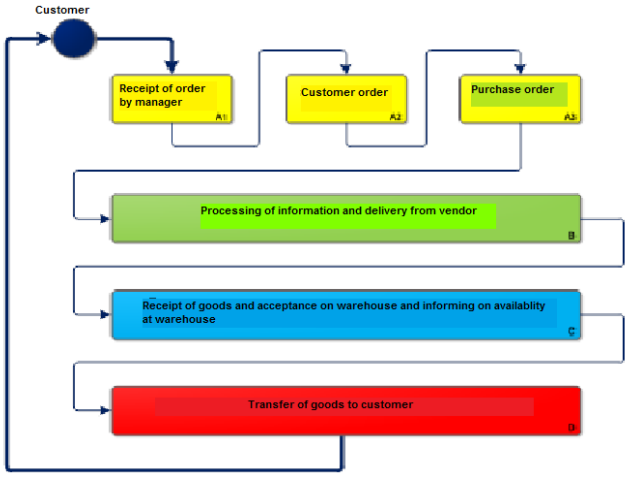

Fig. 4 Business process "Processing of client's order" before optimization of the business process

In formalizing this model the main criterion for commercial company was the time spent by the customer order fulfillment, which must be minimized [1]-[6]

$$t_j^r = t_j^o + t_j^v + t_j^d + t_j^w + t_j^t \rightarrow \min \quad (1)$$

whereas:

t_j^o - time consumed by manager for creation of Client order

t_j^v - time consumed by manager for creation on Purchase order for vendor

t_j^d - estimated time on freight transportation of goods (maximum estimate time on accomplishment of delivery is 7 days)

t_j^w - time consumed on receipt and acceptance of goods by warehouse

t_j^t - time consumed on transfer of goods to client (maximum 3 days on transfer)

j - number of the order

Business Process Optimization Model Using Accounting Information System

After analysis of the business process optimization was done, Figs. 5 and 6 graphically present the advantages appeared after optimizing business process "Processing of customer's orders".

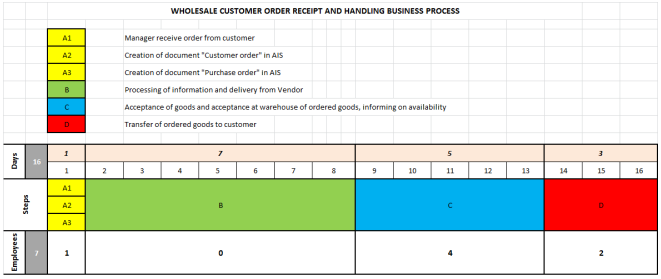

Fig. 5 Receipt and processing of wholesale clients' order business process – before optimization of labor time costs

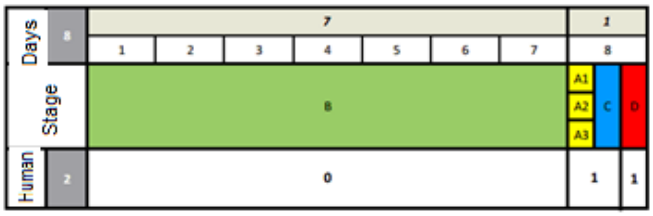

Fig. 6 Receipt and processing of wholesale clients' order business process – after optimization of labor time costs

Optimization consists of two main moments:

1) The customer through web-application orders goods directly from the supplier, but price includes margin of trading company
2) An automated mechanism in the accounting information system (AIS), entitled "Processing of goods ordered."

Once the customers themselves ordered goods on the site of the provider also complements and organizes the delivery of goods by truck to the warehouse of trading company in 7 days (Phase "B" in Fig. 5). In step "C" - the adoption of custom goods are loaded in the AIS vendor invoice using "Processing: Upload of ordered goods" (Fig. 7).

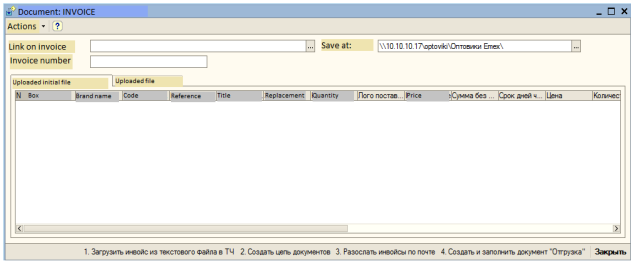

Fig. 7 Shape of the form "Processing: Upload of ordered goods"

During execution of automated mechanism by warehouse employee in the AIS reception is registered to the account at the warehouse received the ordered spare parts. At this point, due to the existing AIS contact information about customers, pre-filled sales managers to client e-mail addresses to send letters that their ordered spare parts will be available and customers can get them. Lists of goods in the accompanying documents attached to e-mails. Also, through the mechanism of "Processing: Upload of goods ordered" a chain of backdating documents, according to those shown in Fig. 5 stages: "A1", "A2", "A3". At the end of an optimized business process, step «D»:

1) using the above mechanism in the AIS creates a "Document: Shipment," locking outflow of goods from a warehouse and transfer them to the client
2) Perform a physical loading of goods arrived in freight customer and transfer printed accompanying documents to order the product.

Business process model after optimization is presented in Fig. 8 below:

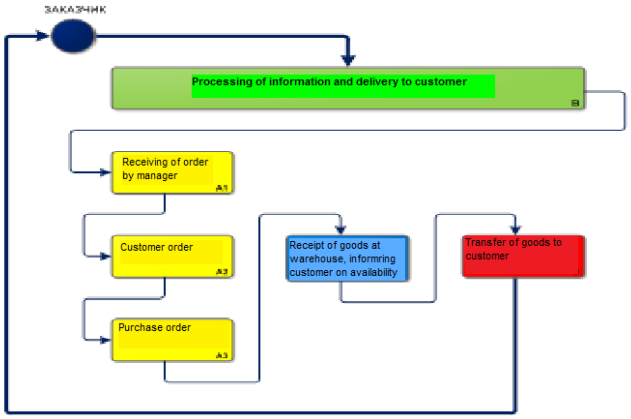

Fig. 8 Business process "Handling of customer order" after optimization

III. Conclusion

The optimization of the original model (1), the time spent by the customer order fulfillment, is greatly reduced due to [1]-[6]:

$$t_j^r = t_j^v + t_j^d + t_j^t \quad (2)$$

whereas:

t_j^v - time consumed by managed on creation of purchase order for vendor, significantly decreases due to client's order formed by clients themselves

t_j^d - time consumed on freight transportation of goods (maximum days on accomplishment of delivery is 7 days)

t_j^t - time spent on the formation of the documents accompanying the goods, warehousing and delivery of goods to customers with three days reduced to one day;

j - number of the order

Obviously, at steps "A1", "A2", "A3", "C", "D" optimization performed substantially. The implementation process takes just one day, you have to use just 2 employees: sales manager and employee stock. In general, the optimization of business process time was 8 days, compared to

16 days. Employees involved throughout the process -2 to 7. Temporary costs reduced by 50 % and labor reduced by more than 71%. This example model can be used by trading companies' generalist practitioners wholesale goods to order.

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