DYNAMIC SIMULATION UTILIZATION IN STOCK MANAGEMENT

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ABSTRACT: At this time in economic environment there is the big trend of coming logistical chain, supply chain, supply chain management (SCM) and demand chain management (DCM). SCM deals with material and information flows control, inventory management, demand forecast, production plan optimization, distribution management etc. DCM presents the connection of supply chain management and customer’s relationship management. Nowadays for effective purchase, production and distribution plan and control in companies are utilized the simulation and simulation programmes. This paper deals with the simulation programme Witness and its utilization for finding of results real problems. This article is published as a part of research intention MSM 6046137306.

KEY WORDS: Supply Chain Management, Simulation Programme Witness, Stock Management, Automotive Industry, Cartons and Paper Boards

1 INTRODUCTION

Bringing changes in practice always involves inconsiderable risks, the dynamic simulation as a predictive method helps in minimizing the risks by modelling your work environment and simulating the results of different decisions. By the means of the running model it is possible to test the alternative behaviour of the observed object under different conditions and with an aim to defined scales of productivity we focus on optimizing its functions. Such modelled object or process can be e.g. running production, assembling line, machine, other sites and technological devices and their sequences, silo, operational stocks of store and manipulation, information flow, etc.

This way of work brings many advantages – it is possible to create models of yet not existing systems and suggest solutions that behave exactly according to the demand of the submitter. The simulation time passes faster than in real, so it is possible to promptly evaluate different variants of suggested solutions.

This article describes the simulation method, its utilization in stock management. First problem is targeted the storing of semi-finished products in company producing cartons and paper boards. Second problem is concerned stock solution in company where are produced semi finished products for final production of automobile.

2 DYNAMIC SIMULATION AND SIMULATION PROGRAMME WITNESS

One of characteristics of classic models is their static. On the basis of model’s result was accepted one – off decisions on the beforetime. In practice we need to catch the dynamic of control system. One of used method is dynamic programming. But by experiment of implementation of accidental influence to model of dynamic programming we get at next increase of numerical calculations.

Extraordinarily efficient tool, how overcome above problems, is computing simulation. The simulation is process of the production logical – mathematical model of real object, defined system of the model or decision process and realization of quantity experiments with the model. The target is[3]:

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• Describe of the system.
• Knowledge of its functions.
• Presumption of its behaviour in future.
• Finding the solution of problem.
• Suggestion and verification of functions in new structure.

The simulation model is considered for the system that copies the structure of system and its transaction by the help of the realisation of the simulation programme in computer. The system simulation is a specific form of realization process that is used as the tool and the method of real and suggested system investigation, support of decision-making process, the tool for formulation of pieces of knowledge, hypotheses and prognoses. The subject of simulation system is system defined as the objects realization and their transaction that is dynamic systems. The basic principle of system simulation is to understand opinions about the simulation system by the help of experimentations with the simulation model [4].

Shannon defined the simulation as it is process of creation model of real system and diversion of experiments with this model in order to achievement of better understanding of studied system behaviour or in order to appraisal of different variants of activity system [2].

Using the simulation has also many other positive side effects like a better understanding of the system functions, exact description of the processes, realising the links, relations and influences of the surrounding environment, the possibility to use the model for flexible designing, operative management and planning, staff training, speeding the changes implementation in evaluating the alternative procedures during the adaptation and other answers to the questions „what if”[1].

Nowadays there are available simulation programmes that enable the description and modelling of the real systems behaviour on the market. WITNESS has been used as the environment for my simulation. WITNESS, the world’s leading business simulation system, gives you the power and flexibility to model your working environment, simulate the implications of different business decisions and understand any process, however complex. As a result, you can always be confident that you have found the best business solution for organization — before making a financial commitment to change.

WITNESS is the most successful program for simulation of production, service and logistic system on the world. It is used to interactive creation of models, creation of modular structure, interactive experiments, partnership with CAD and CAM applications and informational systems, creation of centralized optimization modulus and 3D visualization – virtual reality [2].

This programme falls into the group of visual simulation programmes, when the model is seen on screen all the time. Each worker can observe the behaviour of each individual element every minute. WITNESS can be used for analysis of any process and all incidents are recorded for assessment of system performance according to selected criteria. In the programme the formulation of models that truly describe real environment is possible. At any time you can stop the simulation, change system parameters (for example capacity of buffer, number of labour on the shift, number of machines or buffers) and then you can continue with simulation. The incidences of these changes can be seen immediately.

3 MODEL FOR CAPACITY DETERMINATION

For requirement of the model I have started to define the production with the machine, which cut the paper board belt according to customer requirements. This semi finished product has to deposit in the warehouse. Minimal detention time is 6 hours. The semi finished product is specific for each product. There is important to write, the company is producing 20 types of carton and paper board. From the warehouse of semi finished product they are sent required
amount to the machines. There are five machines. Each of them produces specific type of carton or paper board.

Management of this company bought a new product line for finishing preparation according to customer requirements. But management didn’t know if the capacity of semi finished product warehouse is sufficient because detention time of semi finished product is different. The basic target of this work was the determination of maximum value of warehouse capacity, which the company needs.

Customer requirements from the last time are described in table in programme MS Excel. There are amount and the type of cartons and paper board there. This data are processed with the simulation model. Result of this model is the determination of maximum value of warehouse capacity of semi finished product (WIP). On the Figure Nr. 1 is the simulation model of cartons and board paper production. This figure shows the situation in production after a few steps of simulation. The maximum value of warehouse capacity is described to value “MAX” in the model.

**Figure 1 The simulation model of cartons and board paper production**

**Model of stock solution**

The model describes assembly line producing goods that are semi finished products for final assembly of automobile in other company. Assembly line consists of three station – riveting, preassembly and control. The operation of riveting represents two machines which work concurrently. Each machine operates one worker. The second of station is preassembly that is compacted of two operation positions that are concurred. Each position is operated
worker accordingly in the model; each position is created as machine. Semi finished products from riveting and preassembly are sent to worker that brings two semi finished products together. This worker is created as machine in the model. Next worker put the product to the machine – control. The final product is compiled from sixteen materials S1 – S16.

The model involves the material flows from material entries for production, their stocking and stocks of semi finished products from own production. The target of this model is to analyze the material flow front of input to the production and to verify the usefulness and effectiveness of current material ordering system for final product.

Materials S6, S11, S15 and S16 are produced in this company accordingly their delivery system is very simply. The other materials are imported from supplier. And this delivery system is problem for this model.

Each material has its small buffer at assembly line – in model this buffer is called H_buffer. If this buffer is full and material is delivered then worker puts material in buffer, in W_buffer. For this material flow is accepted system FIFO (first in, first out). That means if material is delivered, H_buffer is empty and in W_buffer is stock of this material, than in H_buffer is transported material from W_buffer and the new material is put into W_buffer.

The results of this model will be various combinations of delivery time providing cost minimization. In this model are used costs of material entry, costs of package transport, costs of material transport between H_buffer and W_buffer, costs of stocking material etc.

For this result it is possible to use the specific tool of programme Witness – optimiser. It finds the best result according to criteria function and defined conditions. Criteria function will be total costs connected with storage and gathering a stock.

On the Figure Nr.2 you can see the model of stock solution in automotive industry.

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**Figure 2 Model of stock solution in automotive industry**
This model is possible to use for the determination of bottleneck of this assembly line. For this establishment I have used one of the numbers of outputs – the chart of utilization of single machine in production. The highest value of state “Busy” has the machine “preassembly2”.

4 CONCLUSION

At the present time it is very important to effective control material and information flows in company and in all supply chain. For effective control are used dynamic simulations. On the market it is possible to buy various simulation programmes. On our Department of Economics and Management of Chemical and Food Industry is utilized programme Witness. This programme falls into the group of visual simulation programmes, when the model is seen on screen all the time. Each worker can observe the behaviour of each individual element every minute. The aim of this article was to obtain the information about simulation utilization for stock management.

The aim of first project was to obtain the information for producer of carton and paper board, how it needs the warehouse capacity for its semi finished product. Capacity of warehouse depends on the customer requirements, which have to be realized in required time. If the customer requirements change, manager has to change value in the table in MS Excel. This change is very simply and he sees with half an eye the results. It is one from advantages of the simulation programme Witness.

The aim of second project was to obtain the information about simulation utilization for assembly line in automotive industry. The built-up model serves for the determination of bottleneck and for effective material flow control on the start of production. The target of the model is established the optimum delivery time system for the individual materials providing cost minimization and satisfaction of all customer’s requirements in demanded time.
5 REFERENCES


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