

# **ADVANCED DECISION MAKING TOOLS IN THE PRODUCTION COMPANY**

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## **Abstract:**

*Today's companies collect a large amount of operational data relating to all kinds of activities. This data holds and hides the experience of company's history. The impact of "flood of data" perform unsafe situation. If management use these data and don't discover mutual relationship of these data it can lead to wrong decision. If right decision tools doesn't exist in the frame of companies very often is decision based on the past experience of managers. It can lead to wrong decision if situation on the decision area is changed. Properly analyse of data can have significant effect on a company's performance and profitability. This paper describe possibility of using advanced decision tools in day-to-day decision managers.*

**Key words:** *Simulation, data mining, ERP, BPR*

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## 1. Introduction

Information systems for production planning and control (PPC) were implemented already long ago in almost all industrial companies. They are using in day-to-day practise. Production Planning and Control Systems are focused to provide decision on operational and tactical level.

The economic evolution of industry is affected through the implementation of innovative information technology. Information systems for production planning and control already long ago implemented in almost all industrial companies are in their functionality limited. ERP systems offer a large amount of tasks that can help to managers making decision. Unfortunately there is no tools for discover mutual relationship data – knowledge inside ERP systems. There is fast development of data mining tools in the last five years. They are used together with ERP systems. This is together, with many others advantages, the reason why is increasing the usage of simulations tools, which could do nearly unlimited number of tests and experiments in wide scope. With all this software tools doesn't need to be only specialized but also they can be wide universal applicable and their usage need not only special knowledge and high education. The main aim of this connection is discover knowledge in a large amount of data. Decision support system based on knowledge systems is called business intelligent systems.

## 2. Predictive Tools

Decision Support Systems (DSS) use different kinds of techniques and models which help for right decision. General definition of decision support system doesn't exist. "Decision Support Systems are interactive computer systems that use data and models for solution nonstructured problems to help to decision subjects" Scott Morton (1971). Effective tool is "what-if" analysis. One of Decision Support Systems is

discrete event simulation. The principle of simulation is experiment with a computer model – an exact image of stochastic discrete system. There is allowed dynamic representation of material or customer flow, simulation experiment state, processes, machine using, etc. A user can monitor dynamic process. It means that he has necessary information for decision and system evaluation commensurate with chosen criterias. He receive answer of question: “What is the matter if I change (setup, invest, ...) ...?”. The system behaviour is monitored through reports and statistics. Prediction of system behaviour is efficient tool in project phases, reengineering of processes and on-line simulation nowadays. There is possible find an optimal setup of parameters for the best solution (minimum or maximum of objective function). On one hand it is possible to find optimal solution through simulation on the other hand there is not possible find out relationship between different parameters for a scope of the best solution for decision support. There is not possible to mine knowledge or models saved in data obtained during experiments with computer model.

The powerful tool of a large amount data analysis is data mining which help to discover relationship of data and hidden rules. There is not unified definition of data mining. It is possible to say that data mining permit discover hidden rules and relationship between data in wide databases. There is paradox: if we have more data there is difficult and time consuming analyse them with traditional methods. There is possible fast and fully isolate valuable and useful information through analytical technologies of data mining. It is state when models and experience can be received from data.

### **Simulation tools**

Historically, simulations are developed off-line using custom software packages/languages with limited direct connections to the actual data generated by the production system (Drake and Smith 1996) [4] This traditional simulation generally examines long-term system performance, mostly for planning and design purposes. These models are usually “one-shot models” because they are seldom used after the project is finalized (if - then mostly only for checking the system ability under new project conditions). Primary reasons for this inflexibility are that the input data of the simulation are collected and analyzed outside the simulation model and simulation environment and that the simulation system cannot communicate automatically with the information system - Enterprise Resource System (ERP) that is

responsible for collecting, administration and distribution of status information. On-line simulation integrates the information system with the simulation model. On-line simulation for process scheduling, real-time “intelligent” control, performance forecasting, process capability estimation, real-time control systems emulation, real-time displays of system status, and short term decision making is nowadays active area of software development. By using the most current information system, accurate predictions about the system and future control alternatives cannot be developed. The reason for using simulation is that simulation can better capture and describe the complex interactions where analytical methods fail. Current simulation software tools are already able to communicate with databases – but the full integration is more or less still future to see probably only in automotive industry by using the concept of digital factory. In this way stays the combination of simulation, information system and real-time control very promising framework for optimization of dynamic characteristic in flexible production systems.

Generally the simulation models can be built by general programming language as C++. But this way needs “special” programming knowledge. People able to build simulation model in this way are specialized and haven’t unfortunately on the other hand often practise experiences with the real system. This fact leads to building of bigger teams dealing with simulation or to buying simulation software tool.

Currently there are several software tools available. With the first already mentioned group these tools can be divided into tree basic classes:

- *General purpose simulation language* – weakness of this group is that the user has to be professional programmer and competent simulationist in one.
- *Simulation front-end* – essentially programs between user and simulation language.
- *Simulators* – software packages utilize construct and terminology common to the businesses community (manufacturing, services...) and offer graphical presentation and animation.

Last group, in case of discrete simulations, is very well usable for simulation of production systems. Building the model is relatively easy and needs net very specific knowledge of programming. Simulation experts can reduce the time needed for

building the simulation model. Currently is possible to buy many of these packages with following common characteristic (needed to be successful on market):

- Relatively good execution speed.
- Interfaces for data input/output (from external databases).
- Easy syntax.
- Random variable generators for often-used distributions.
- Graphical entities (elements) representing function of real system object:
  - Production machines.
  - Assembly machines.
  - Multiple machines.
  - Conveyers.
  - Storages.
  - Parts.
  - etc.
- Interface with general used language – possibility to add own programmes
- Possibility to import graphical objects (for layouts or elements design)
- On-line animation and status indication
- Optimisation
- Good building help and documentation.

These are the main features characterising present software packages. But not each of present software tools has all of these. You can find really good tools but specified on only one type of production as for example on flow shop production. One of this specialised software is Simpro. This is used in automotive industry and its elements could be really good used for this kind of production. So it is easy to simulate special kinds of conveyers. Disadvantage is but the difficulty of information flow by models that should simulate other kinds of production as for example mass production. In this case you have to use more fictive elements and so have problems with statistic documentation by interpretation.

### 3. The relationship of simulation and data mining

Data mining methods are used on the frame of real data stored in databases of Enterprise Resource Planning (ERP) systems, CRM systems and warehouses. There are implemented analytical methods from the classical statistical methods, neural networks, decision tree, etc. Except these systems the special software products of data mining are used for data mining projects.

Appropriate solution of using hidden knowledge from experimental modelling data is connection of discrete event simulation and data mining. The output of simulation (see Fig.1) are parameters' setup of the optimized system and consequential mining of knowledge hidden in experimental data. It allows define appropriate managerial system model .

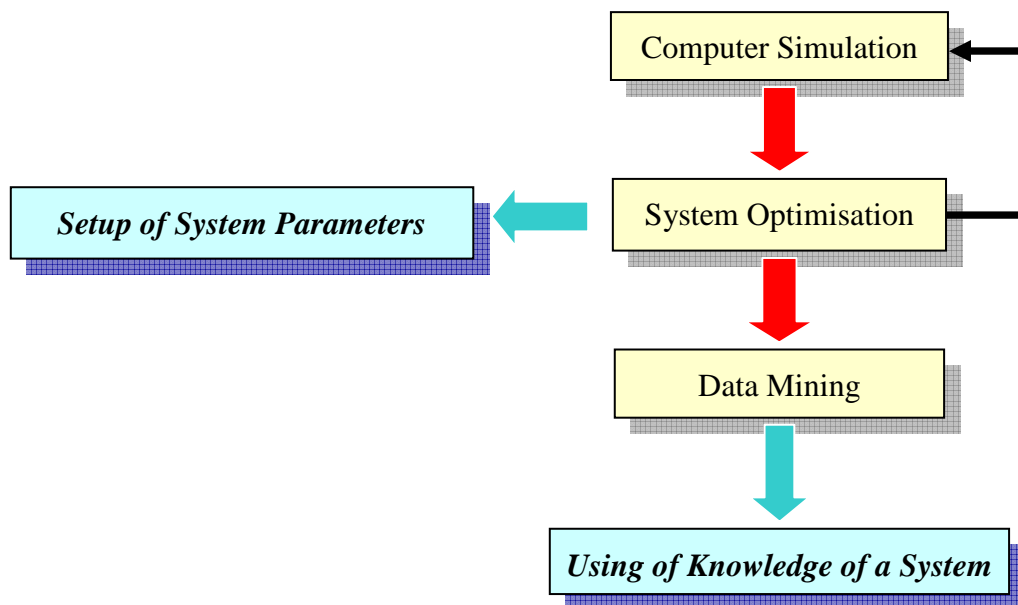


Figure1: Relationship of discrete event simulation and data mining

### 4. Case study of data mining using in practise

Case study is focused to using of discrete event simulation and model optimising of manufacturing process. The result of optimisation is file of experimental data. The data are used in data mining project. The aim is knowledge that are necessary for increasing productivity of manufacturing process.

Scenary is simulated through computer simulation. The process start with customer requirements, manufacturing include building and testing of computers.

## Simulation model

The input of model are customers' requirements. The specification is clarified through phone communication. The computers are assembled, tested and distributed (see fig.2). They are two skills labors (A and B).

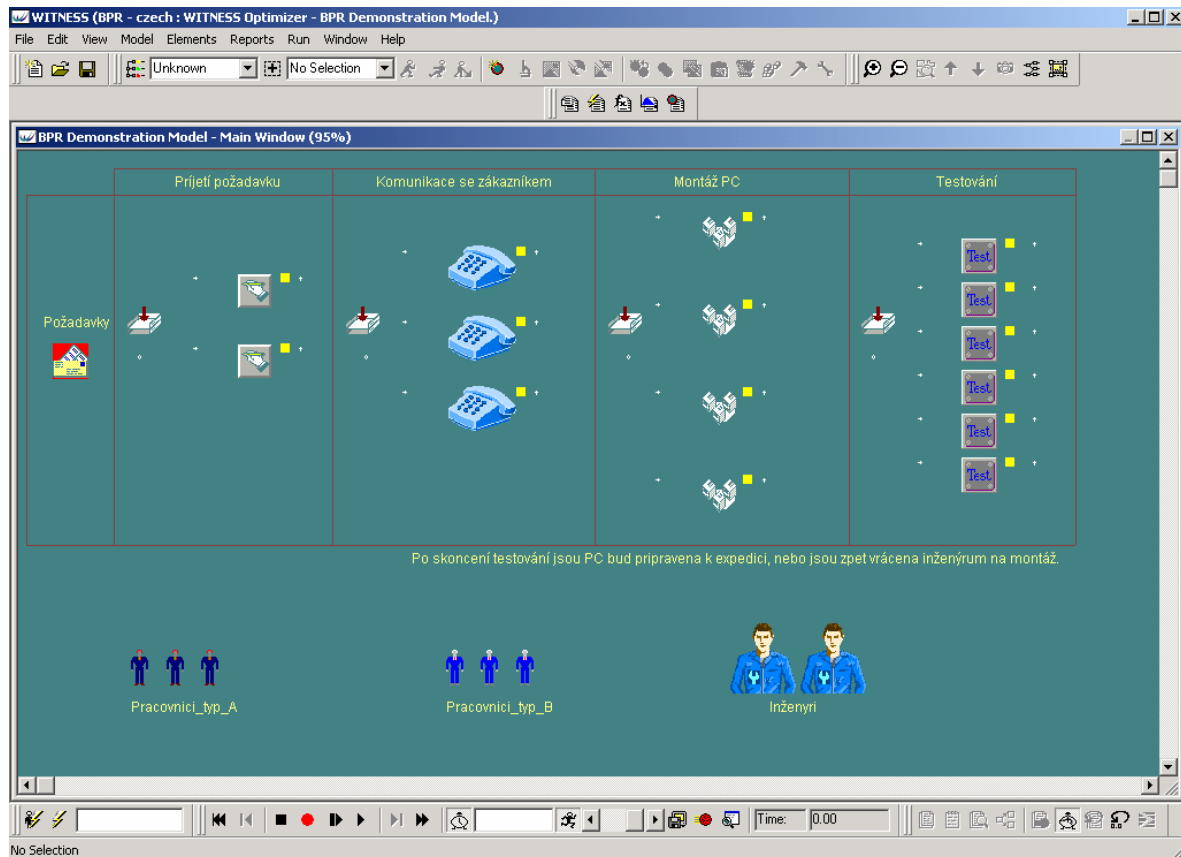


Figure 2: The model of manufacturing system

The optimisation is aimed to maximize of profit. The parameters for experiment are number of A skill labors, B skills labors, number of assembly and testing workplace. The best results were reached using Adaptive Thermostatistical SA method. The optimal result is 11 758 money units. It was found after 65 experimental runs.

Experimental data were exported to Microsoft Excel. File of experimental data is source file of data mining project (see fig. 3).



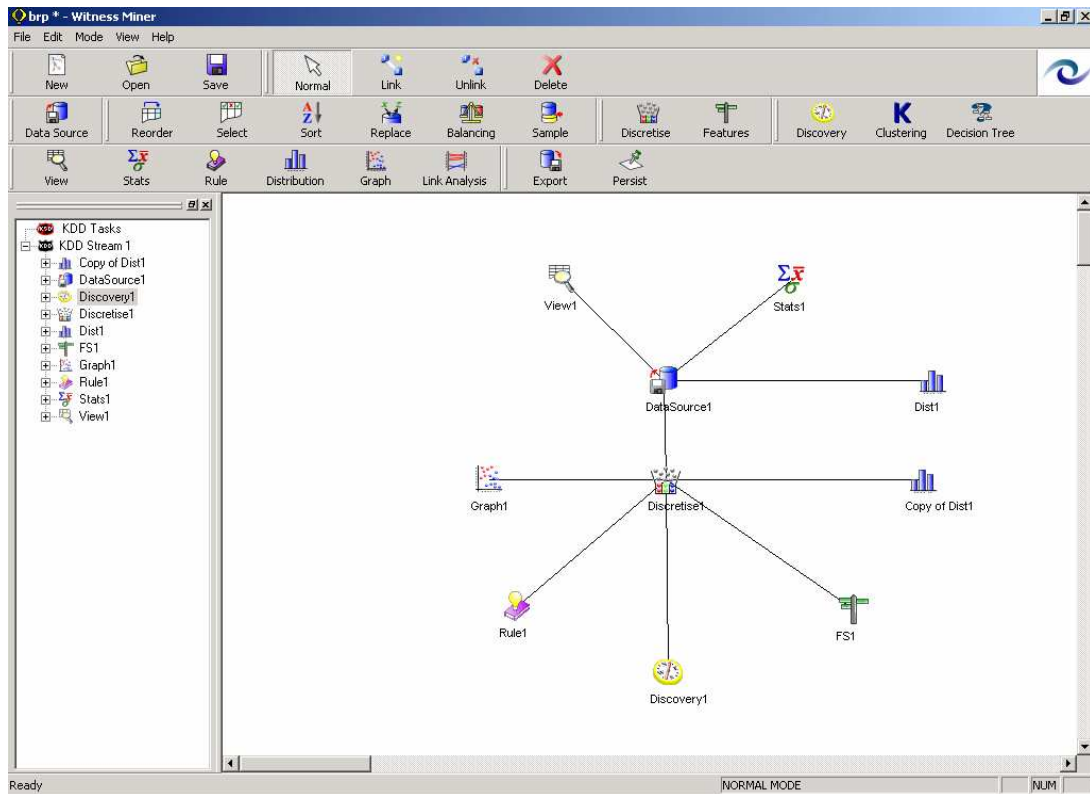


Figure3: Structure of project in Witness Miner

The result of data mining project (see fig.4) is decision support for maximum of profit and recommendation for parameters' setup. It means number of engineers higher than 2, number of testing workplaces higher than 4 and numbers of B skilled labors higher than 4. This solution correspond to aim of case study – elimination of labor costs and the other sources to maximize profit of computer building.

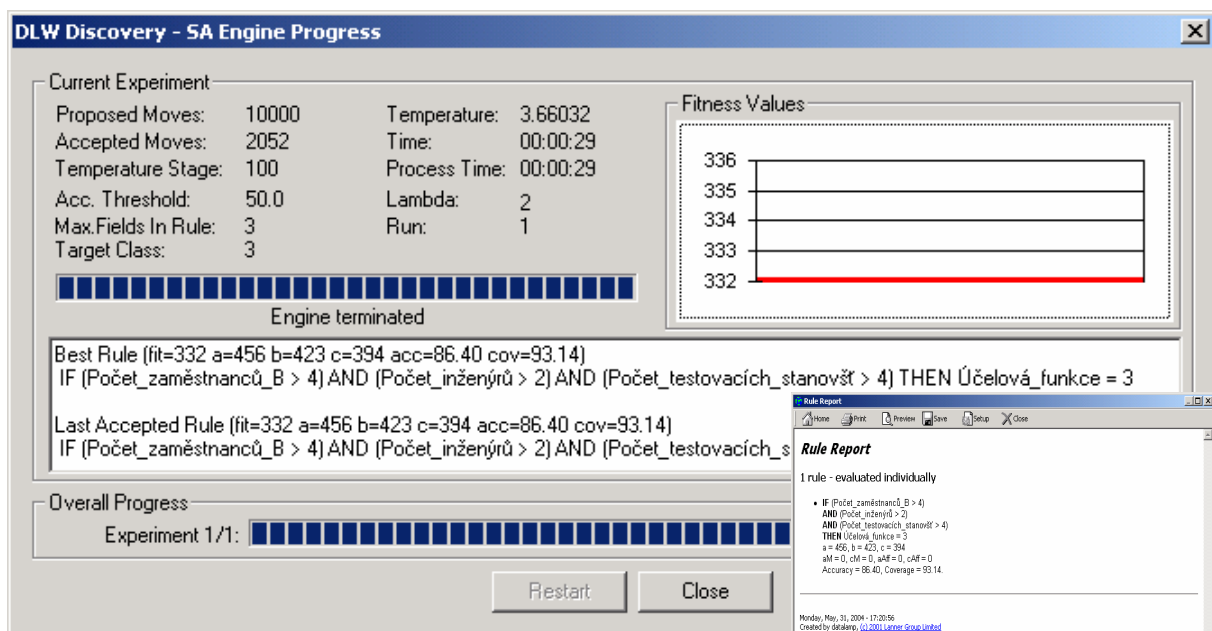


Figure 5: Knowledge discovery and data mining result

## 5. Conclusion

Business Intelligence systems work with real data that are obtained by long-term monitoring of systems. They discover knowledge stored in large databases. Computer simulation work with image of future system. It search the optimized solution by changing of system parameters. It means it search minimum or maximum of an objective function. A lot of experimental data is possible maximal use in data mining project to discover knowledge and find data relationship. Discover knowledge can management use for setup management rules of new building system..

## 6. Literature

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