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INFORMATION SYSTEMS AS DECISION SUPPORT ON RISKS

Abstract: *The importance of applying information technolgies-IT to support the decisions making process of the business process management is one of the ways to dispose the necessary information quickly and efficiently in order to make a proper decision. Having in mind the above, as well as the process complexity, the necessary knowledge to manage processes, many different types of information systems has been developed- IS that support this. The method of work relates to the process structure, possibility of automation and speed of management. There is a difference between on-line information systems for real-time decision making and those off-line when decisions are made in the stage of management after an activity has been completed. The responsibility for the process relates to all participants in the process, especially to the managers that have the major influence on the realization of processes, subprocesses, and other acitvities.*

Keywords: *Decision Support, Information Technology, Responsible for the process*

1. INTRODUCTION

The management of organizational changes in conditions of turbulent surroundings is one of the most important and most difficult tasks that managers meet these days. Modern decision making occurs in conditions of tight temporal terms, with insufficiently reliable data. These are the high risk circumstances. It is necessary to find ways for faster, easier and higher quality making business decisions. Qualification of managers for correct and timely reactions in solving complex problems and making important management decisions is an issue of knowledge, experience and training.

2. MAKING DECISIONS IN MANAGEMENT

2.1. Making decisions in management

A manager can be extraordinarily successful in generating the ideas or motivation of employees, but at the final instance he is evaluated by the quality of decisions he makes. At the company each manager makes decisions. The decisions are not unexpected, isolated events, but a part of the current and evolving process. In this way each business decision is an element of a dynamic process which is under influence of numerous factors. The decisions can be considered mechanisms which managers use to achieve a certain desired state. In spite of that, they present a

response of the manager to business problems. First of all, the manager must identify a need for decision, define a problem, collect facts and develop alternative solutions. In the next stage he evaluates the alternatives and chooses the best solution. In the end, the chosen alternative becomes a practice with adequate process of control. The image no.1 is one of possible reviews of the basic stages decisions making.

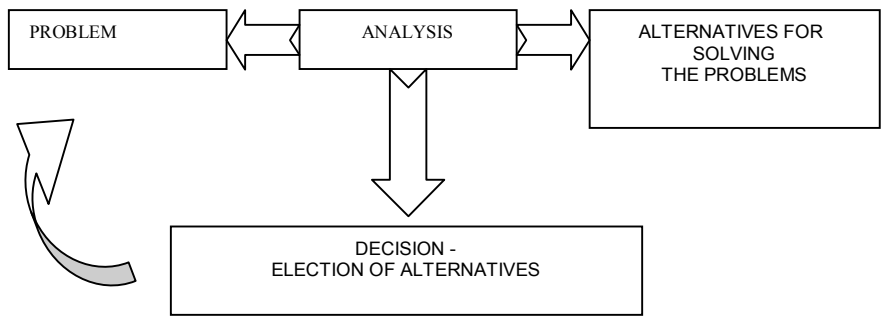

Image 1 – Process of making managers decisions

Consequently, if making decisions is selection of an alternative which leads to the realization of the set goal, then a quality making decisions is a selection of the best alternative, and efficient decision making – a prompt selection of the best available alternatives which will provide the goal achievement. It is important to have in mind the characteristic psychological reactions of each person (although he/she is not a manager) when he meets a problem. The first normal reaction is an attempt to avoid the problem: ``It is not a real problem, and if it is, someone else should solve it``. If this variant does not ``pass``, the person tries to solve the problem in a standard way, as he used to solve similar problems in his/her experience: ``Once I did the similar analysis, I will find and modify the old version``. ``Once when we had a similar damage, we fixed it by replacing a certain part``. On the basis of this psychological reaction a concept of modern education and training is established. Through training, the managers` experience is enriched and he passes through situations that he will meet in his future realistic practice. Trained for them, in practice he will act in the similar way and the problem will be solved by choosing the adequate alternative. (Clearly, this type of reaction hides a danger of wrong recognition of the situation as a similar one although it is not, which may lead to making an inadequate decision. With a quality and quantity of trainings, this danger is minimized.) Eventually, if the problem cannot be avoided nor solved in known ways, the manager explores and finds a new – original solution for the problem.

2.2. How to increase the efficiency of making decisions

Ways to increase the efficiency of making decisions are first of all in different forms of training: from so-called ``cold`` analysis, like ``WHAT – IF`` and ``IF – THEN``, which are carried out if the time is not a critical factor and present a direct preparation for ``hot`` situations, through studies of cases – analysis of similar problems from the practice, to simulations which can be totally simple, or presented by very complex models of realistic systems. United system of assisting in managers` making decisions is a system for decision making support.

3. DSS - DECISION SUPPORT SYSTEMS AND ITS APPLICATION

Decision support systems – DSS present the assistance in making strategic decisions in a company. The DSS are complex computer programs which on basis of entry data from the data basis, using various mathematical models, can predict acting of the realistic system in some future circumstances.

The DSS enable the management to test the systems acting in different conditions of changing the surroundings, as well as to test reactions of the surroundings to different changes in the system. The DSS enable to recognize quickly the effects of different strategic decisions.

3.1. Basic goals of the DSS are:

- to help performers in decision making process,
- to support but not replace decisions of management, and
- to improve the efficiency of logistic decisions.

The Decision Support Systems are based on various mathematical, simulation and analytic models, which are projected to help in the process of decision making. These systems use information from the data base and results of the automatic data processing (AOP). The DSS process the data, by application of various models and the result is an analytic data form. In fact, the DSS present the analysis and on basis of the analysis suggest the decision. It is necessary to emphasize that the DSS do not make decision, but have a role to assist the manager to make the decision faster and in a higher quality way than it would be possible otherwise.

3.2. Basic functions of the DSS are:

- Collection of all the necessary entry data
  DSS use data from the data base of the information system.
- Data processing and analysis
  Data processing and analysis are carried out by adequate mathematical models which describe a realistic system and relations that exist in it.
- Application of different models of decision making
  DSS includes various models of making decisions that enable making of variant solutions for different strategies of managing the realistic system.
- Presentation of various solutions
  Achieved variant solutions are presented in an adequate form, so that users can quickly and simply notice their advantages and defects.

In practice there are two types of the Decision Support Systems:

- Close type systems and
- Open type systems.

The Decision Support Systems of close type implicate the definition of complex mathematical model which describes the realistic system. All the entry values and operational limits are included in the model. On basis of system model and different models of decision making, the union of variant solutions of the problem to which the DSS is assigned, is obtained. The user of the union of offered solutions can choose the solution that he evaluates as the most efficient in practice.

The open type systems are interactive systems in which the communication between the users (manager, dispatcher) and the computer is possible. On the basis of the decision making model the DSS proposes different variant solutions and the user is in situation to be able to include certain corrections and changes the solutions. This is an iterative procedure which provides the integration of decision

making model and human knowledge, which is not always possible to mathematically present and formulate.
The DSS consists of various subsystems. In theory there are no strict regulations which subsystems each DSS must have, but practical experience and functions of the systems point out the basic union of the subsystems.
The basic subsystems are:

- Subsystem of entry data
- Realistic system model
- Models for decision making support
- Presentation of solution data.

3.3. Entry data

The subsystem of the entry data enables taking of all the necessary data from the data base. The entry data for the DSS are internal and external data. The internal data are the data about company and the external data are the data related to the external surroundings. All these data are in the data base. The special group of the entry data is the data that include parameters on which basis acting of the systems in different conditions of changing surroundings are simulated.

3.4.Realistic system model

Modeling can be defined as a process of development of the symbolic presentation of the total system, that is as a procedure of describing the realistic system by a mathematical model. In practice it is very difficult to describe acting of the realistic system with one model. The realistic system can be presented as a union of subsystems, so that in the procedure of modeling each subsystem is described by a particular model. The DSS often includes several models which describe the realistic system. With the adequate relations all these models are connected in a unique system, which presents a model of the realistic system.
For modeling of the realistic system different mathematical models and heuristic algorithms are used. The application of the mathematical models is relatively difficult, because it is very hard to describe the realistic state in the system by a finished mathematical model. The realistic system has many limits and it is difficult to present it with the finished mathematical model. In practice a modification of a mathematical model is often done according to the concrete conditions or a new model for the system is made, which is modeled. The widest application in modeling of the realistic state has the heuristic algorithms.

3.5. Models for decision making support

A particular part of the DSS is models for decision making support. Within one DSS there could be different models which support making of various decisions. Existing of various models for decision making support depends on the basic purpose and function of the DSS. Some models can be made for the following purposes:

- Production planning,
- Sales expectations,
- Vehicles distribution,
- Vehicles route projection,
- Determination of sales objects location, etc.

The subsystem for model management maintains the model library. A special advantage of the DSS is that they offer to a user a possibility to experiment with the model in order to examine the influence of various factors on the result of the analysis. The models can be at different levels, like strategic, tactical or operational. They can be based on statistics, simulation and management. Also, they can cover various domains like finances, marketing and transport.
The widest application in practice has heuristic algorithms. The heuristic

algorithms are series of procedures developed for solving the concrete problems. The heuristic algorithms can be developed so that in one their step they have an optimal method (i.e. dynamic programming). The heuristic algorithms can be applied for solving huge problems, they are carried out very quickly and have a possibility of including all the operational limitations from the realistic system. Solutions made by application of the heuristic algorithms are not optimal, but they are close to optimal.
Eventually it is possible for the user of the DSS to simplify the model that he uses to solve the problem, where it is necessary and possible, and to preserve its realistic complexity in the aspects which he analyzes in details.

3.6. Classification of the DSS system

The main classification of the DSS is made according to their purpose and type of model on which they were built. Consequently, the DSS systems can be made on the basis of the following systems:

- for data access
- for data analysis
- for prediction
- for simulation
- on basis of analytical models
- on basis of optimal models
- on basis of models for giving suggestions

3.7. Characteristics of the DSS systems

The essence of the DSS analysis originates from a model, where the model presents a simplified presentation of an object or phenomenon in the real world. Such abstraction, that is a generalization usually of very complex objects and appearances in the real world, enables the application of analytical methods when the analysis is carried out on the model. In the DSS systems two basic methods of analysis are applied:

1. Analysis ``what – if``, when it is possible to observe how changes of some basic variable values change solution values in a mathematical model of the realistic object. The decision is made on basis of the results of several alike experiments.
2. Analysis on basis of set goals which is reduced to successive changes of certain entry variables until the desired solution, that is a goal, is not achieved. An example of the ``what – if`` analysis is the analysis showing how increasing the expenses for advertising influences increasing of the company profit. The example of the analysis on basis of set goals is as follows: a manager can specify a 20 million dinars goal as a net profit after setting the fee aside. For the value of the desired profit he can analyze the situation and ways how to achieve the goal by combining possible values of income and expenses.

3.8. Presentation of solution data

The DSS process the data from the data base and applying various models give solutions which present the support for the decision bearer. The solutions of the DSS can be presented in different forms. The presentation of solution data can have the following forms:

- As a chart
- As a graph
- On a geographic foundation

Solution data can be presented in the chart form. A user (manager, dispatcher) can define the format and appearance of the chart, so that it is possible to review quickly and simply all the offered solutions.

The presentation of the solutions on geographic foundation is enabled by application of the GIS tools. The GIS tools provide presentation of all the data on any geographic territory (for example

schematic arrangement of all subsystems in company, location of sales objects on a territory, review of projected vehicles routes, etc.).

3.9. Examples of different DSS

- DSS for traffic managing in cities
- DSS for vehicles routes projecting
- DSS for timetable projecting
- DSS for flight schedule disorders
- DSS for transferring operations distribution
- DSS for production planning and managing
- DSS in accounting
- DSS for expenses evaluation
- DSS for risk evaluation

4. DSS INFORMATION SYSTEM APPLICATION IN RISK EVALUATION

Risk that occurs during the purchase can be divided in two basic categories:

1. Risk as a consequence of events inside the purchase chain – the internal risk
2. Risk as a consequence of events outside the purchase chain and a company in the chain does not have any influence on it. According to the previous, we can name this risk – the external risk.

The internal purchase risk occurs as a consequence of interaction, cooperation and communication between the companies that make the purchase chain. Risks from this group arise because of the following:

- Insufficient ``visibility`` (the possibility of a company to see the data about the planned and achieved results) along the chain.
- Lack of proprietor influence (a company does not have enough power to ``force`` the other to act in a certain way)
- ``Just in time`` practice which can differ among the companies, which can have as a consequence expectations of one company towards the other, without a real basis and wrong or al least different predictions in various parts of the purchase chain.

The external risk occurs in conditions of interactions of the companies from the purchase chain and its surroundings. Those interactions can relate to strikes, storms, natural disasters, war or terrorist assault. The companies cannot influence these risks in any way.

From the inner company purchase it is expected to:

- provide continuous flow of materials, supplies and services necessary for the work of an organization,
- minimize investments in demands and losses,
- maintain adequate quality standards,
- find or develop competent suppliers,
- standardize purchasing wherever and whenever it is possible,
- purchasing of necessary units and services at the lowest possible price,
- improve competitive position of the organization,
- work in accordance with the other organization `s parts and
- fulfill the purchasing goals with the lowest adiministrative costs.

With a better access to the information, employees and managers can better understand what is going on in the company and in that they way can improve the decision making process. A simple example is that the DSS system can point out reducing or increasing number of orders at the purchasing department. Its result is that all the received orders will be

satisfied in time or that the raw material costs will be reduced.

For significant improvement of the purchasing chain process, a software for purchasing chain is needed, but also, the DSS system can be applied in following and carrying out of the process.

Within the economic structure of Serbia there are mostly small and medium companies that because of the poor application of the efficient information solutions, create constant losses due to the lack of following the business processes. Dynamic business processes like purchase, request a constantly wide volume of information which is necessary to work out and present in a simple way in order to improve a better function of the business process.

For that reason and for the purpose of this work, the team of the authors carried out a small experiment of creating a simple information system of decision making support Meat-Supply.

To generate the information, a small export - import company ``Beos`` d.o.o. from Belgrade was chosen.

The company is occupied with the retail turnover of meat and manufactured meat products, and as such was chosen as an example that the information systems of decision making support are applicable in almost every activity.

5. MEAT SUPPLY – DSS SYSTEM OF PURCHASING RISK EVALUATION

5.1. Goal and function of the MEAT-SUPPLY DSS system

MEAT-SUPPLY information system has a goal to improve the business process of meat supply and manufactured meat products inside the business system of the company ``Beos export-import`` from Belgrade.
Its basic function is to reduce the purchasing risk and analysis of possible events when this business process is in question.

First of all, the MEAT-SUPPLY is a union of data bases united by a unique questionnaire which has as a goal to give warnings, proposals or analysis as a final solution of this information system. Its technical application is unique, it is not demanding and adapted to conditions of the dynamic process of every day meat and manufactured meat products supply.
Its function has a preventive character, because it warns the user about a possible purchasing risk even a week before the critical period of purchase.

5.2. Factors of the MEAT-SUPPLY decision making support system

The MEAT-SUPPLY decision making support system alone consists of the following data bases:

- Base of the entry shipping
- Base of sale price calculations
- Meat and manufactured meat products supply in groups for the year 2008
- Meat and manufactured meat products supply in groups for the year 20089
- Meat and manufactured meat products supply in groups for the year 2010
- Group purchase analysis per year
- Analysis of total weight purchase
- Analysis of average purchase per year
- Analysis of average purchase per week
- Critical purchasing dates
- Analysis of purchasing critical periods
- Base of knowledge related to the purchase
- Base of suppliers

In creating the databases already existing tools MS SQL RDBMS

(Relational database management system) and MICROSOFT EXCEL, a part of the program package MS OFFICE were used.
In creating the databases the data about the purchase of dominant products in three previous years, as well as the data about the important and critical dates of the purchase were used. In order to evaluate the purchasing risk a method of maximum and minimum risk was used, analyzing the maximum and minimum orders through the selected period of the business year.

5.3. Characteristics of the MEAT-SUPPLY decision making support system

The MEAT-SUPPLY is an off-line decision making support system, it does not use the exit towards the global network, but that option is not excluded in its future application as a part of a bigger decision making support system.
It is also an open type decision making support system, since it is possible to change the entry parameters in every moment during the work on the very system.

The MEAT-SUPPLY is the DSS system created on basis of a model for giving suggestions and risk evaluation.
The exit of this system is numeric as well as textual data in the form of charts, formatted textual massages or possibly graphic reviews of data and analysis.

5.4. Application and results of application of the MEAT-SUPPLY decision making support system

The software usage alone is simple. Depending on the dates when the purchase is carried out, the system automatically generates all the data from the databases and analysis it, related to that period and on basis of the entry purchasing parameters, determines the suggested quantity and informs the user about future critical periods of purchasing, as well as about the changes related to the prices of entry raw materials by the suppliers. The application of the on-line connected systems is possible, in which it is also possible to integrate the external parameters in the decision making support system, that then become inputs of models and that can significantly influence the risk evaluation of the purchase alone. Such data can be change of prices on the market, reducing the quantities of raw materials on the market, reducing the demand for those products, etc…

The results of the application of the applicative software and the software alone will be shown within the presentation of this work at the ``Quality Festival 2011`` in Kragujevac.

6. CONCLUSION

Such approach to the data analysis becomes more popular, because it enables the OLTP systems to be optimized for their purpose, and that the data analysis can be transferred on the OLAP systems. The possibility of prediction finding relevant criteria of decision making itself, that influence the analyzed changes, gives them great advantage in comparison with all the other approaches in the process of modern decision making. The application of many such close-specialized systems is a formula of successful decision making. The essence is that a manager, decision bearer, in front of himself has all the available analysis, before he really shows his skill of making a correct decision. It would be ideal if such particular systems would be united in one bigger, created as a plan by the team of economists and managers of one economic branch and when a so-called GDSS group decision making support system would be created, where the analysis of entry data would include important external factors of company business, which would improve the model precision, as well as the exit

from such a system. We can only expect the application of such way of thinking in the near future, but for such an information revolution in the economy of the Republic of Serbia, it is necessary to have a different policy of development subventions and application of modern information systems in business of small and medium companies.

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