

*signalling devices,
process management,
exploitation process modelling*

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PROCESS MODELLING IN SIGNALLING DEVICES EXPLOITATION SYSTEM

This paper discusses the problems of managing the process in signalling devices exploitation systems. Process modelling has been described in information-decision frame. Possibility of implementation of the models in simulating processes and creating tools assisting decision making in management of signalling devices has been presented.

MODELOWANIE PROCESÓW W SYSTEMIE EKSPLOATACJI URZĄDZEŃ STEROWANIA RUCHEM KOLEJOWYM

W referacie przedstawiono zagadnienie zarządzania procesami w systemie eksploatacji urządzeń sterowania ruchem kolejowym (srk). Omówiono modelowanie procesów w ujęciu informacyjno-decyzyjnym. Przedstawiono możliwość zastosowania modeli do symulacji przebiegu procesów oraz tworzenia narzędzi wspomagających podejmowanie decyzji w zarządzaniu eksploatacją urządzeń srk.

1. INTRODUCTION

Signaling devices exploitation process covers period from the end of the phase of production until their physical termination (or reselling). In this process several sub-processes can be recognized. The basic [12] are:

- pre-usage processes including: storage, transportation, installation, technical tests, etc.,
- usage processes,
- servicing processes, including: inspections (periodic, guarantee), conservation, adjustments, repairs, replacement, modernization etc.,
- logistic processes, including: energetic, material, information reinforcement hiring devices' operators etc.,
- termination of the devices and their parts processes (selling, recycling, utilization and waste storage),
- processes assisting management of exploitation processes (diagnostic, research).

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Processes presented above are called controlling processes. In exploitation phase we also encounter non-controlling processes – destructive, including: tribologic, corrosive, erosive, chemical expenditure.

2. PROCESSES MANAGEMENT IN EXPLOITATION SYSTEM SIGNALING DEVICES

Looking from systemic point of view, organization management is being treated as information-decision process [3,6,8]. Decisions are made as the effect of information processing. As the result, for the efficient functioning of any organization system, its information system is essential, especially managers' information subsystem used on different levels [9].

Management is defined [13] as „decision process realized on many levels of organization, which should detect and eliminate threats, take advantages of upcoming chances and effectively realize all organization functions necessary for achieving the proposed goal”.

Looking from cybernetic point of view, management is being treated as controlling of processes existing in the organization [8]. Notions of controlling and management concern only processes being the changing chain of events caused by any action and resulting in transformations of the system or its elements (resources). It means purposeful information influence on the processes, so that the performance of the system is accordant with changing pattern [4]. The pattern describes desired course of actions of processes in the system.

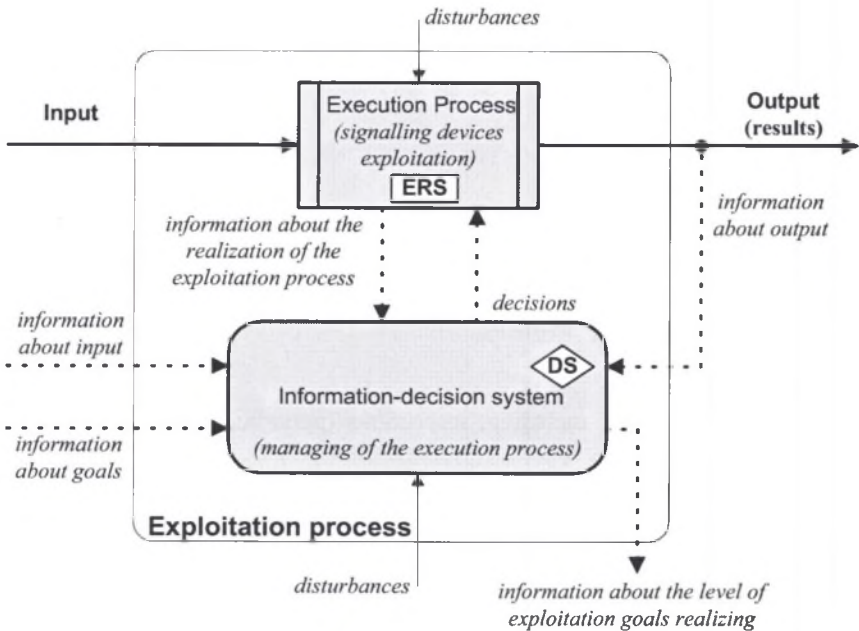


Fig.1. General schema of signaling devices exploitation system in cybernetic frame

In exploitation system there can be extinguished two basic subsystems:

- exploitation realizing system - ERS
- decision system - DS.

Picture 1 presents general schema of signaling devices exploitation system in cybernetic frame.

The pattern is optimized model of functioning and development of exploitation realizing system (ERS). By comparing the real states of ERS and the desired states (described by the model, norm), the decision system (DS) approximates the ERS functioning and corrects detected deviations using feedback.

Taking into consideration the variety of realized goals in exploitation systems, relations with environment and the need for quick responses for changes, the pattern should be a variable. It is also the effect of the features of open system (organization), such as adaptively, efficiency and ability for improving. So the algorithms and methods for modification of the pattern must be created to ensure its constant optimization.

3. DECISION MAKING IN PROCESSES MANAGEMENT

Among the basic functions of managing the following can be defined [3,8]:

- planning (tasks and resources division among workers and assigning responsible persons),
- guidance (meaning actions coordination and motivating the workers),
- controlling (monitoring of the plan realization).

In every of those management functions, the common feature of the actions taken by managers is decision making. Decision problems and situations are encountered in every subsystem of the organization, e.g. in fields of:

- goals,
- structures,
- people (social subsystem),
- technical subsystem.

They are caused by interactions between organization and environment, and are influenced by processes and events that take place in organization.

The most crucial for this paper is decision making problem in technical subsystem. Decisions concern both resources selection and methods of realizing the functions and duties in the organization [10, 11].

The decision process is usually divided into following phases [8]:

- perceiving and defining the problem,
- gathering information that describe the problem and allow to analyse it,
- proposing alternative solutions,
- evaluating the alternative solutions and choosing the best one,
- controlling of the effectiveness of the chosen solution during its realization.

Choosing between different, alternative actions that allow solving the problem is called decision making.

There are a number of mathematical tools allowing systematization of the process of choosing the solution. Evaluation of possible solutions and making the decision is up to the manager, who usually uses both rationality and intuition.

4. GOALS OF PROCESS MODELLING

Constructing the models always concerns concrete systems, phenomena (processes) and precisely defined applications. The goal of process modelling has to be always well defined [5]. The basic goal of modelling is creating tools, which allow foreseeing system behaviour in changing environment without intercepting the functioning of the real object or process. Depending on the type of systems and phenomena being modelled and the goals of modelling, the following main areas of appliance are defined [5]:

- description and explanation of functioning of the system or process,
- foreseeing of the behaviour of the system or process in future in different conditions of the environment,
- choosing the proper (fulfilling given conditions) input influences, especially choosing the optimal ones,
- choosing of the structure or parameters of the system, fulfilling given tasks.

Especially practical is modelling of managing of the systems, described by cybernetic definition. Analysis of such systems concerns influence of input on output and evaluating features, structures and mechanism of its functionality [5].

The models, used for solving concrete decision problems, are applied directly in process of management. With their aid the following objectives are realized [7]:

- recommendation to make a given decision,
- foreseeing the system behaviour,
- training the workers for decision making.

In management process, information treated as resources are converted into different kind of information, called decisions. (picture 2).

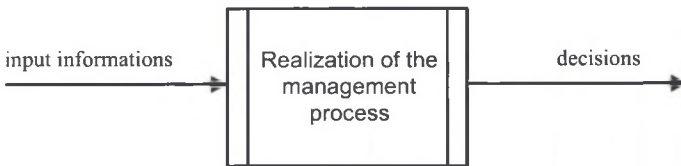


Fig.2. Conversion of information into decision in management of exploitation processes

Basing on knowledge (or hypothetical knowledge) of system behaviour in real-life conditions, the model allows to transform given input information into output information, including information helping to make a decision. So it has a function of information generator.

Information-decision models of the processes are the basis for building the informatics systems assisting management. They are called Decision Support Systems – DSS. By gathering, storing and processing information, they simplify the problematic situations

analysis. User gets processed information according to his/her requirements, which helps to make necessary decisions.

Among the systems assisting in decision making the following ones can be defined [7]:

- evidence-report systems,
- information searching systems,
- managers' information systems,
- systems having mathematical models, allowing to simulate or optimize process of decision making,
- expert systems.

First two types of the systems belong to the class of systems simplifying decision making, the rest assist in decision making.

5. PROCESSES MODELLING IN INFORMATION-DECISION FRAME

In case of organizations such as Railways Department, decision making is related to management of all of the processes appearing in exploitation phase of signaling devices. Especially it concerns two basic functions: planning and controlling. During planning process, manager must make decisions about dividing the resources, methods and moments of realization of all the tasks. Controlling means evaluating the progress made with the initial plan and making corrections to the plan and the way it is realized. The decisions made about changes of the initial plan should also be controlled.

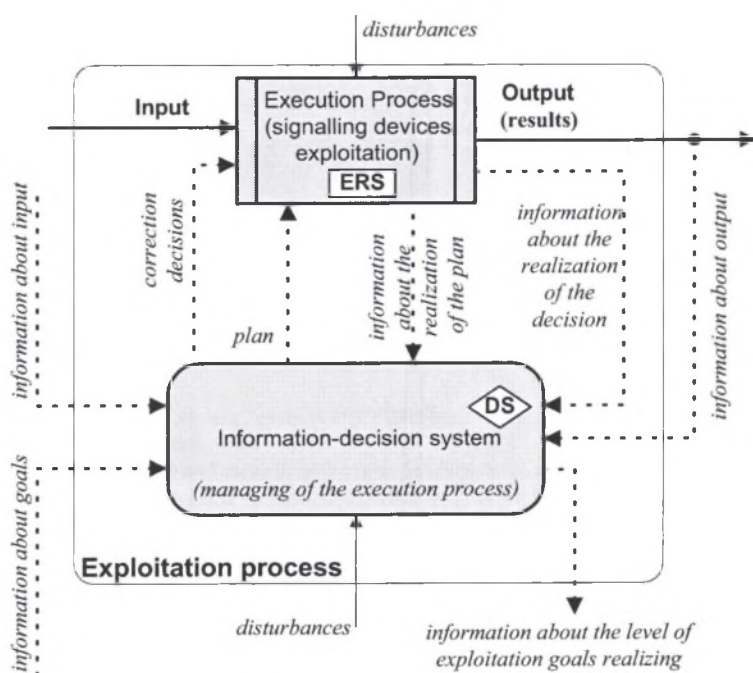


Fig.3. Information flow in the management of exploitation process

In order to create plans and control their realization, it is necessary to systematically gather and distribute data and information as well as competently use them. The information is called *material* of each management process. *Data* is just a “raw” fact - opinions or evaluations, presented in descriptive or numerical form. Data after proper evaluation become useful information [1]. The flow of the information in managing of the exploitation processes is presented on picture 3.

Controlling the project realization [2] merges organizing, employing and guidance with the goals (planning). It often causes formulating the new goals and new plans their realization. It allows measuring the correctness of the plan realization and it helps to make necessary corrections to the plan.

We should remember that, realization of controlling tasks is expensive and may lead to too many correction decisions. On the other hand, the quality of decisions made –affecting the efficiency of the plan being realized - depends on the number and location of the control points. Because of those reasons, the selective control applied in the critical and vital points of the plan, is considered to be most effective

On picture 4 the model of decision making in the process of controlling the plan realization is presented.

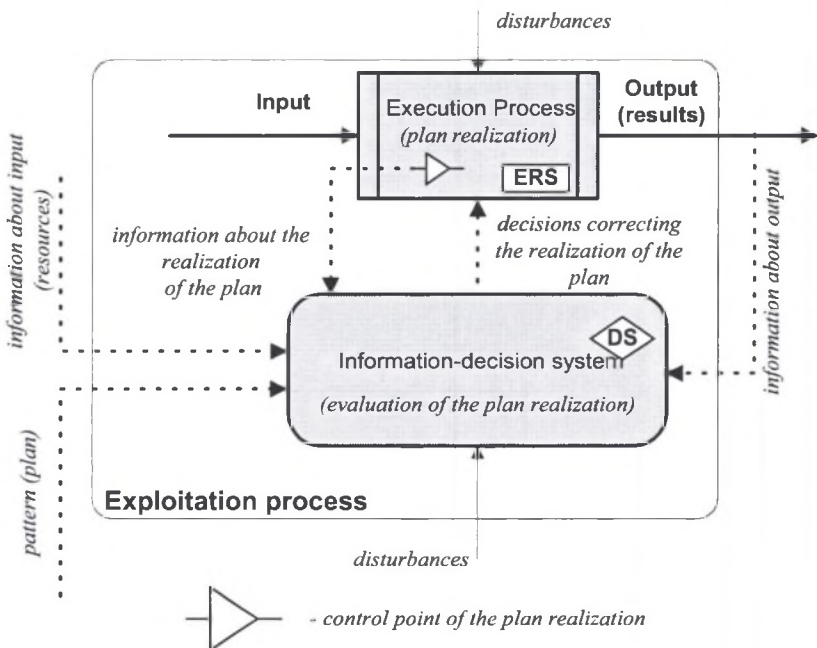


Fig.4. Decision making in the process of controlling the plan realization

The above controlling function should be understood as monitoring, evaluating, diagnosing and making the necessary corrections in both the plan and its realization. The common feature of the management, on every level and in every described functions is decision making, which is choosing one of the possible action variants. In the signaling

devices exploitation system, decisions concern the selection of the resources and the methods of realizing the functions and tasks.

6. SUMMARY

Managing in any organization is treated as information-decision process. Because decisions are made as the effect of evaluation of the information, the information subsystem is crucial for the efficient performance of any organization system [9]. Process modeling realized in signaling devices exploitation system, in information-decision frame, aims to improve decision making processes and increase the effectiveness of the exploitation system. Among the partial goals we can define, e.g.:

- optimization of the division of the resources among different tasks,
- optimization of the realization schedules of the tasks,
- selection of the optimal strategy of exploitation of signaling devices in a given organization unit,
- simulation of the size and organization structure of the exploitation system, that justifies its effective functioning,
- projecting and building the information and informatics systems for assisting in decision making in the system,
- pointing out the information sets vital for effective management of each processes and ordering them according to their value,
- finding the number of control points in realized process (or the system that the process is realized in) and their location,
- finding the frequency of attaining the information from different sources.

Information is the basic element in the process of management of the exploitation. Ability to observe the realization of the process, analyze the gathered information and correctly evaluate the processes that take place in the system, allows to make the optimal exploitation decisions in a given conditions.

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