On an Approach to the Design of a Logical Model of Innovation Project Data

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Abstract—Questions concerning the development of a logical model of innovation project data, as well as those concerning the design of information systems for decision-making support in the management of innovation projects, are discussed.

Keywords: management, a model, decision-making support, information system, design, innovation

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INTRODUCTION

Innovation projects are dealt with in a variety of areas that are studied separately (technical, technological, organizational, economic ones, knowledge management) and employ various management mechanisms that are typical of these systems. This is why the theory and practice of innovation management were previously developed by solving local problems. These detailed problems generated many methods and approaches that solve minor specific problems. Because managing innovations as an entire system poses a problem, it is proposed that local problems should be solved as a subsystem of an innovation project, as the same innovation type, or as the same scientific and technical, organizational, technological, etc. idea. There are so many of these local problems that choosing and verifying the developed approaches becomes a whole new problem, which allows us to work out what types of innovation can exist and what challenges one faces when choosing ways of realizing them.

No management is possible without first collecting necessary information and presenting it in a suitable form. Presently, managing any information-based process (knowledge of a subject field) is inconceivable without information technologies.

Automation of innovation project management is problematic, due to the fact that no software systems exist that could cover all of the basic needs of the given area (Fig. 1).

The development of an appropriate information system is of iterative character depending on the type of problem in question. Viewing management systems primarily as information-based ones, many common features can be found (i.e., necessary information is

Marketing

\begin{itemize}
  \item Project finance management
  \item Marketing Project finance
  \item Specialized database
  \item Investment analysis systems
\end{itemize}

Manufacturing

\begin{itemize}
  \item Manufacturing
  \item CAD/CAM/CAE
  \item SCADA/MES
\end{itemize}

Sales

\begin{itemize}
  \item Sales
  \item Sales automation systems
  \item Retail systems
\end{itemize}

ERP/ERP II

CALS

SAP R/3

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Management mode of a process or data model used making a decision (decision-making) object in decision-making phenomenon for which a decision is made. Management effort on an object. Forecast data. Object state data. Data model used in decision-making. Data supporting the decision. Making a decision.

Fig. 2. Decision-making scheme using modern management methods.

Supposed to be stored somewhere). Regardless of the used method of decision-making support (methods based on processing accurate practical data and presenting them in a form suitable for a person in charge of decision-making, or methods that process data from expert evaluations and polls), all of them use a limited range of data-storage methods. The differences lie merely in the logical model used in a concrete data model.

Logical data model

Decision-making theory is underpinned by the assumption that management can be adequate, provided that two data sources are combined: a model and data obtained in a management object [1]. Thus, adequate management of an innovation project should be combined with model management and data management (Fig. 2).

For this purpose, a modular data model needs to be developed that could make use of the experience from applying already existing methods and information presentation. Using both of these techniques is possible, provided that one succeeds in designing a hierarchical structure of goals and decisions similar to the one proposed by Thomas Saaty [2].

Decisions can be made at each stage of project realization. In order to understand a problem, a tree should be designed that is similar to the one that is used in the hierarchy analysis method (HAM) [2] with the decomposition process (splitting the criteria into constituent criteria) lasting as long as necessary, as in the HAM. The major distinction of the HAM that results in its being non-applicable to the management of innovation projects is that possible outcomes are not known. The solution thus cannot be reduced to choosing one of the variants.

When a project is performed, information on the resources at hand exists, as well as on the additional resources that can be used. The distinction of decision-making methods is that basically they do not help one to make a decision but assist in building a coherent decision-making structure and presenting the information in a suitable form for a person in charge of decision making. This approach is realized based on specific data structures that do the job of organizing and analyzing the available information. A data structure normally reflects a tree-like structure or a graph, provided that a subject field requires counterbracing on a relational data model and further detailing of the hierarchy given in Fig. 3.

In this approach, the leaves of the tree (see Fig. 3) represent the maximum possible detailing of a project. The corresponding tree-like structures can be considered as measurements (in the terminology of the systems of analytical data processing) and the numerical values that are compared to them as measures. The apparent simplicity is made complex by the fact that some decisions can be interconnected, i.e., can depend on each other (e.g., either this solution or another, or both). This fact is taken into account if the connections of the elements are viewed as the logical operators “AND” or “OR.” We then obtain a morphological tree, which is well-known in the theory of design. Unfortunately, these interconnections can be more complex than logical operators. For example, for innovation projects, there are always some restrictions that can be made on each specific project. These are such data as the time of a project payback and expenditures spent or planned to be spent on realization, as well as those that can be determined using the development curve of an innovation project. The description of complex interconnections is used in expert systems of the production type (Fig. 4). During comparison of the rules to the connections of the tree-graph, complex interconnections can be considered in an innovation system.