

INFORMATION SUPPORT FOR DECISION MAKING IN ORGANIZATION MANAGEMENT

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Abstract: An approach is proposed to decision support in the information systems of organizational management by using of process ontologies. The approach is based of analysis of data, collected in data bases to discover processes that take place in the organization. The analysis of the results allows to construct process maps and to form strategies for implementation of management decisions.

Keywords: systems of organizational management, process ontologies, process map, decision support

INTRODUCTION

THE effective analysis of information flows in an enterprise is a base of successful management. It is observed that organizational information system accumulates huge volumes of data during their work that are stored in separate subsystems. The analysis of possibilities of using the accumulated information is recognized as an important trend to support management activities.

Every year organizations continue to increase spending on information technology (IT) and their budgets continue to rise, even in the face of potential economic downturns. New generations of software systems are constantly developed. The tools for modeling, data management and deployment of information applications evolve rapidly. The investigations are directed towards automation of the modeling of business processes and analysis of data flows with the purpose to reduce the time and the resources, necessary to achieve efficient solutions in the work of enterprises and organizations.

Many efforts are done to construct business process models for enterprise management. However there is a need of new tools for business process modeling that provides rapid and universal integration of various software applications based on business processes and prospects for the enterprise growth and progress. Review of the literature shows extensive engineering efforts on using relational database as a data source for this aim.

Large databases often contain interesting hidden knowledge model that could be extracted using data mining [1]. Review of the literature shows that both objective and subjective methods for the extraction of the interesting links have to be applied. Ontologies allow to reveal hidden implicit knowledge and to make them explicit by means of conceptualization, which can be used in different applications and organizations.

In this work an accent is put on how to identify implicit

regularities in flows of data in the organizational management systems. It is proposed to use a lot of data collected in the information systems, to develop methods for decision support, based on previous experience in implementing similar tasks. Observations show that in the systems of organizational management a mixture of workflow and dataflow technology can be seen. Thus this work focuses on how to identify implicit patterns (as processes) in the streams of data available in the documents held in the systems of organizational management.

EXTRACTION AND USE OF KNOWLEDGE FROM INFORMATION STORED IN THE OPERATION OF INFORMATION SYSTEMS

The success of administrative activity in organizational management essentially depends on the rationality of management processes implemented in the organization. These processes are classified as hard to be formalized and studied from different scientific points of view, which include cybernetics, psychology, economics, sociology, and such interdisciplinary areas as psychology of administrative activity, industrial sociology, sociology of organization and management, etc.

In context of information management systems processes can be divided into core processes (associated with the creation of a product or service); providing processes (varying depending on changes in the composition of the basic processes and technology) and external processes of interaction. Additionally, processes can be identified that determine the trends and directions of development of basic processes, depending on the analysis and estimated trends aiming in improving management procedures in the organization.

The use of ontologies for data mining and knowledge discovery in databases is proposed by many researchers [2], [3], [4], [10]. Most approaches are based on converting a database (DB) schema to the ontology [2]. To construct a hierarchy of classes it is necessary to use

the analysis of the database schema with the identification of hierarchies in the data itself [5], i.e., to involve methods of machine learning.

The term "ontology" in the context of knowledge management is considered as a formal explicit specification of shared conceptualization, which covers the agreed knowledge.

Process ontology is ontology in which all entities are processes [6], [7]. The term "process" has ambiguous meaning in comparison with practical organizational management.

The formal description of ontology consists of:

- nonempty set of classes that describe concepts of some domain;
- set of binary relations over the set of concepts. The set is antisymmetric, transitive, non-reflexive; it gives partial order on the set of concepts and associative relations;
- set of standard types;
- set of attributes that describe properties of every class;
- set of restrictions on concepts attributes;
- set of axioms that define additional semantic of the classes and relations in the ontology.

The following types of restrictions can be defined:

1. semantic attributes;
2. syntactic compatibility;
3. structural-textual restrictions.

A triple that consists of arguments, classes and relations forms schema.

We consider process as a compact topological space T . The space T contains start and end points that are shown on fig. 1. The start point a is an event, which is included in the open set O_1 , and, similarly, the endpoint b is an event, which is included in the open set O_n . The simple chain from a to b consists of sequences of events interpreted as a set $\{O_1, O_2, \dots, O_n\}$ of open sets. The temporal-space order is consists of relations between events e_1, e_2, \dots, e_n .

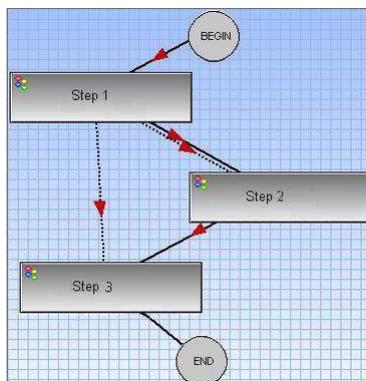


Fig. 1.

In accordance to the systems of organizational management the process ontology can be used for discovering processes that brought to events that are

reflected in documents of the organization and to make prognoses of future events on the base of the past.

The process is formed as a result from the solution of certain problems that are implicitly stored in the database.

PROCESS ANALYSIS

Every document reflects specific event and relationship between documents define a process. The information from the documents and the documents themselves are stored in DB. Such information is structured and includes numerical data and text fragments.

The process analysis suggests investigation of one or set of business processes in the whole organization.

Different variants of process definitions can be formulated as follows [8]:

- *Process* is a set of internal steps of activities with one or more inputs that ends as the final product for the client;
- *Process* is a workflow where one task moves from one specialist to another;
- *Process* is one or more connected operations (functions) which in common realized some business task;
- *Process* is mutually independent component of production system, that converts an input into one or several outputs in accordance to previously settled rules;
- *Process* is a connected set of repeated activities which converts initial information into final product (service) in conformity with specific criteria.

Process-based approach to modeling allows:

- To move on from textual description of activities to formalized graph-based operation description that relies on models of business processes [9];
- To distinguish and use processes as control objects;
- To change management from vertical to horizontal orientation; that means putting emphasis on client, not on chief. The client may be internal or external, but this is a person who evaluates the results of the process implementation.

There are different criteria for process estimation - effectiveness, efficiency, flexibility, the suitability of the value, the suitability of the strategic problem resolving [11].

The following classification of business processes can be made:

- *Basic processes* are persistent processes that are oriented to design of final product or service. Basic process can contain an activity itself and also the monitoring tools.
- *Providing processes* are processes ensuring implementation of main functions. The providing processes can change under the influence of different conditions.
- *Processes of external interaction*;
- *Processes that determine tendencies* and develop directions of basic processes in dependence on analysis and prognosis.

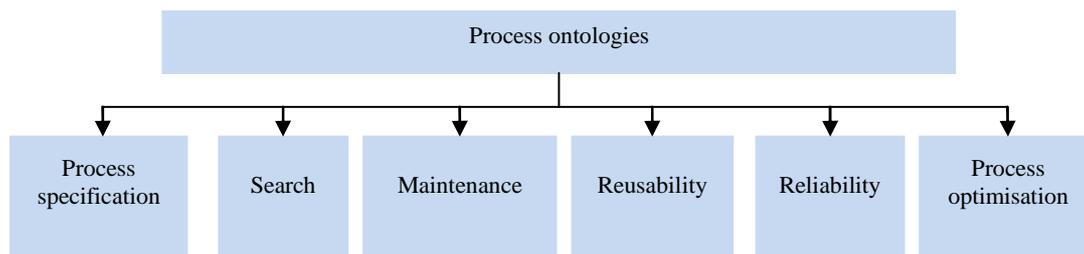


Fig. 3.

Components of the processes are as follows:

- Name;
- function that is realized by the process;
- participants;
- process owner;
- process limits;
- inputs and outputs flows;
- needed resources;
- process goal;
- possible risks.

Input processes are materials, services and/or information that convert to the output flows. Output processes are the results of this conversation. Resources are additional factors in the output flow. Process owner is a person carried out the responsibility for the process.

To construct a business process model the following parts are essential:

- Functions (activities performing by participants in the process);
- Resources (technical, material, systematic);
- Documents and data;
- Process participants;
- Materials/products/services.

USING ONTOLOGY TO SUPPORT THE DECISION-MAKING IN INFORMATION MANAGEMENT

Extracting knowledge from a specific domain can be considered as the construction of the ontology (fig. 2). Using a hierarchy of concepts as the main (basic) knowledge allows the expression of the identified knowledge at a higher level of abstraction.

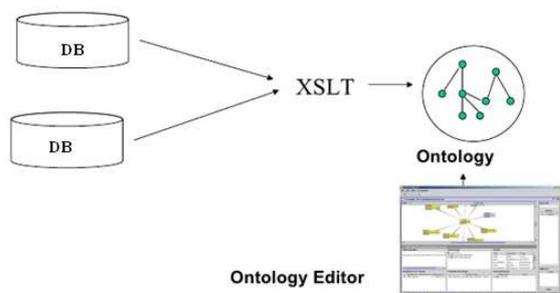


Fig. 2.

The process ontology can be used for process definition, search and detection of suitable process, its maintenance, for the aims of reusability, reliability and process optimisation (fig. 3).

The aim is to analyse information to discover real way of realizing processes in the organization on the base of log files that contains information of the process as:

- the name of the task;
- the time of starting the given task;
- the time of finishing the task;
- which resource is involved in the task accomplishment; which role it has in the organization.

The result of treatment of the information is a process map. The map contains different views of the process that can be filtered for more visibility.

Some quantitative characteristics can be calculated. This can be average time of the process duration, or waiting times of every task, pauses between tasks accomplishment, etc. Additional processing and filtering allow distinguishing the slowest process and some exceptions that took place during process operation/execution.

However, not in every information system there are sufficient amount of needed information. It is not possible to provide automatic processing of the data at this moment. Manually manipulation is needed to provide semantically rich data at this stage of software development. Such tool can be additional module in more sophisticated software for decision support of organizational management.

CONCLUSION

Decision support is one of the main objectives of ontology-based knowledge management systems. However, there is no standard method that would define how to model decisions in ontologies. Despite many research efforts and established methods for decision modelling [12-14] and support, they have not yet been systematically applied to the field of ontologies [15].

In this paper, emphasis is placed on the use of process ontology. The approach, proposed in this paper, involves the use of process ontologies (as an objective method) for the implementation of decision support, based on

previous experience in implementing similar tasks in the information systems of organizational management.

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The problem of inclusion of intelligent information systems constitute a scientific problem, ensuring that the theoretical development of decision support (DSS) in real-world application areas is based on their specificity. The inclusion of modules to support decision making in information systems is focused on specific goals and objectives of management.

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