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The dynamic modeling of the project management process

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Abstract

This paper suggests the method of modeling of project breakdown structures (WBS, OBS, TRM, network model etc.) and its relationships on the basis of ER-methodology. This data model could be considered as a semantic network and application of the logical deduction algorithm for the determination of the project breakdown structures solving sequence is also proposed. The derived sequence defines the specific project management process taking into account the restrictions and priorities of the particular project. This algorithm could be applied for project planning and change management.

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Keywords: change management; planning; project integration management; semantic networks; IDEF-diagram; ER-model; data model; business-process.

1. Introduction

Project planning and change management represents complicated task. Numerous limitations and priorities concerning project scope, schedule, quality, resources etc. characterize large projects. Combinations of these conditions define different problem statements of project management. There are various approaches to the

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management in particular knowledge areas (time management, cost management, quality management etc.), but methods of coordination of these areas have weak unification. Solving this task represents project integration management. The analysis of the main methodologies of project management [1]-[5] reveals the following common principles of integration management:

1. Usage of a universal project management process model in spite of the distinctions between complexity and priorities of different projects. As a consequence: the cyclic sequences of the processes i.e. one of the outputs of the last process is the input of the first one.
2. "Each one to the each one" coordination of the project breakdown structures (WBS, OBS, TRM, network model etc.) on the basis of not uniform methods such as an expert judgment and facilitation techniques (brainstorming, meeting management) that will result in increase of considered options number.
3. Variety of the description models of the project breakdown structures.

So the method of construction of the specific process model for particular project taking into account its limitations and priorities is required.

Nomenclature	
WBS	Work breakdown structure
OBS	Organisation breakdown structure
TRM	Task responsibility matrix
id	identifier
FK	Foreign key (migrated attribute)

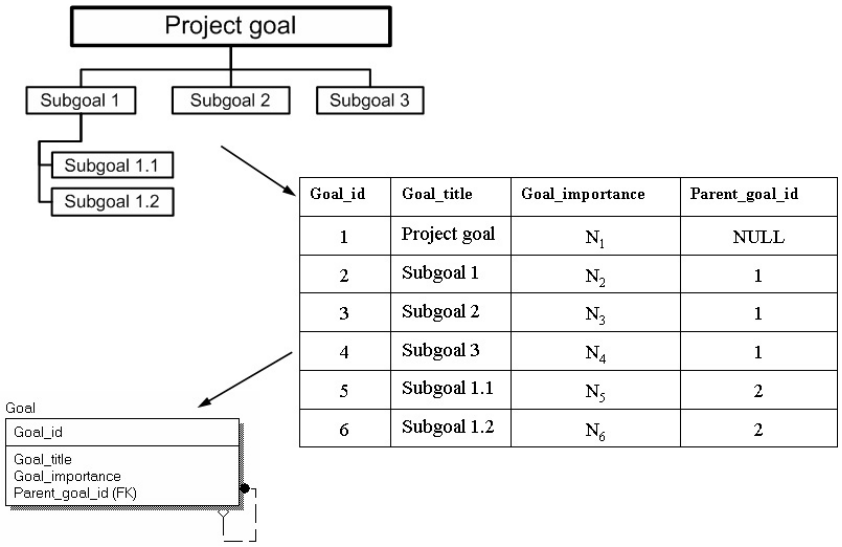
2. Project data model

In order to solve this task we propose to construct the project data model on the basis of the following principles:

1. "Input-output"-relationships between the processes are bidirectional generally.
2. List of inputs and outputs of the processes defines dynamically taking into account particular project limitations, priorities, changes and used methods.
3. The nodal elements of this model are the project breakdown structures due to its invariance under the problem statement.
4. Unified description of the relationships between the project breakdown structures thanks to usage of the unified model.

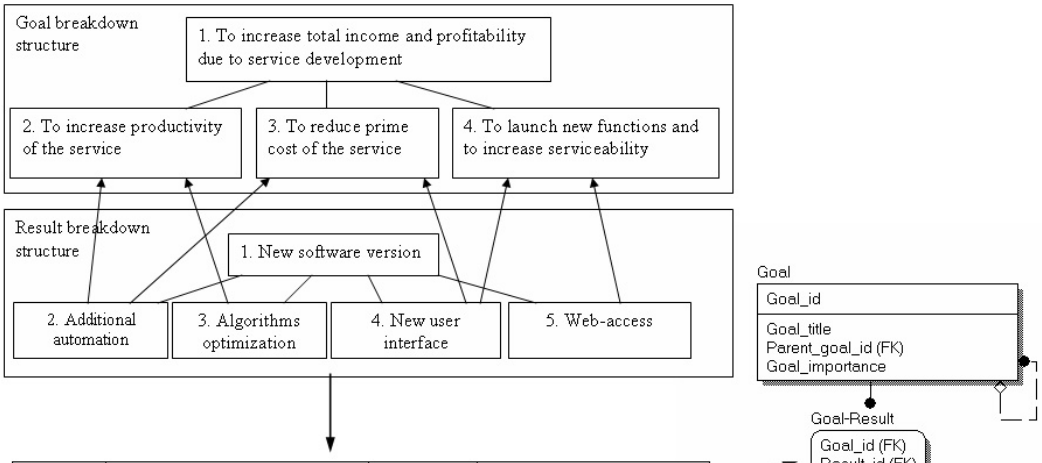
For the purpose of modeling of numerous interconnected data structures the Entity-Relationship (ER-) methodology is used widely [6]. This paper proposes to construct ER-model of project data. Project breakdown structures could be classified to three groups:

1. The trees (WBS, Ishikawa diagrams etc.) are represented as a table (entity) recursively relates to itself (records refer to parent nodes), see Fig. 1.
2. The matrixes (TRM, correspondence of project goals and results etc.) are represented as an additional table to store binary relations between two entities, see Fig. 2. Network models and graphs could be represented as matrixes too.
3. The lists (lists of resources, its availability etc.) are represented as simple table which contains records of each element.



Goal_id	Goal_title	Goal_importance	Parent_goal_id
1	Project goal	N_1	NULL
2	Subgoal 1	N_2	1
3	Subgoal 2	N_3	1
4	Subgoal 3	N_4	1
5	Subgoal 1.1	N_5	2
6	Subgoal 1.2	N_6	2

Fig. 1. Sample of the tree structure



Goal_id	Goal_title	Result_id	Result_title
2	To increase productivity of the service	2	Additional automation
2	To increase productivity of the service	3	Algorithms optimization
3	To reduce prime cost of the service	2	Additional automation
3	To reduce prime cost of the service	4	New user interface
4	To launch new functions and to increase serviceability	4	New user interface
4	To launch new functions and to increase serviceability	5	Web-access

Fig. 2. Sample of the matrix structure

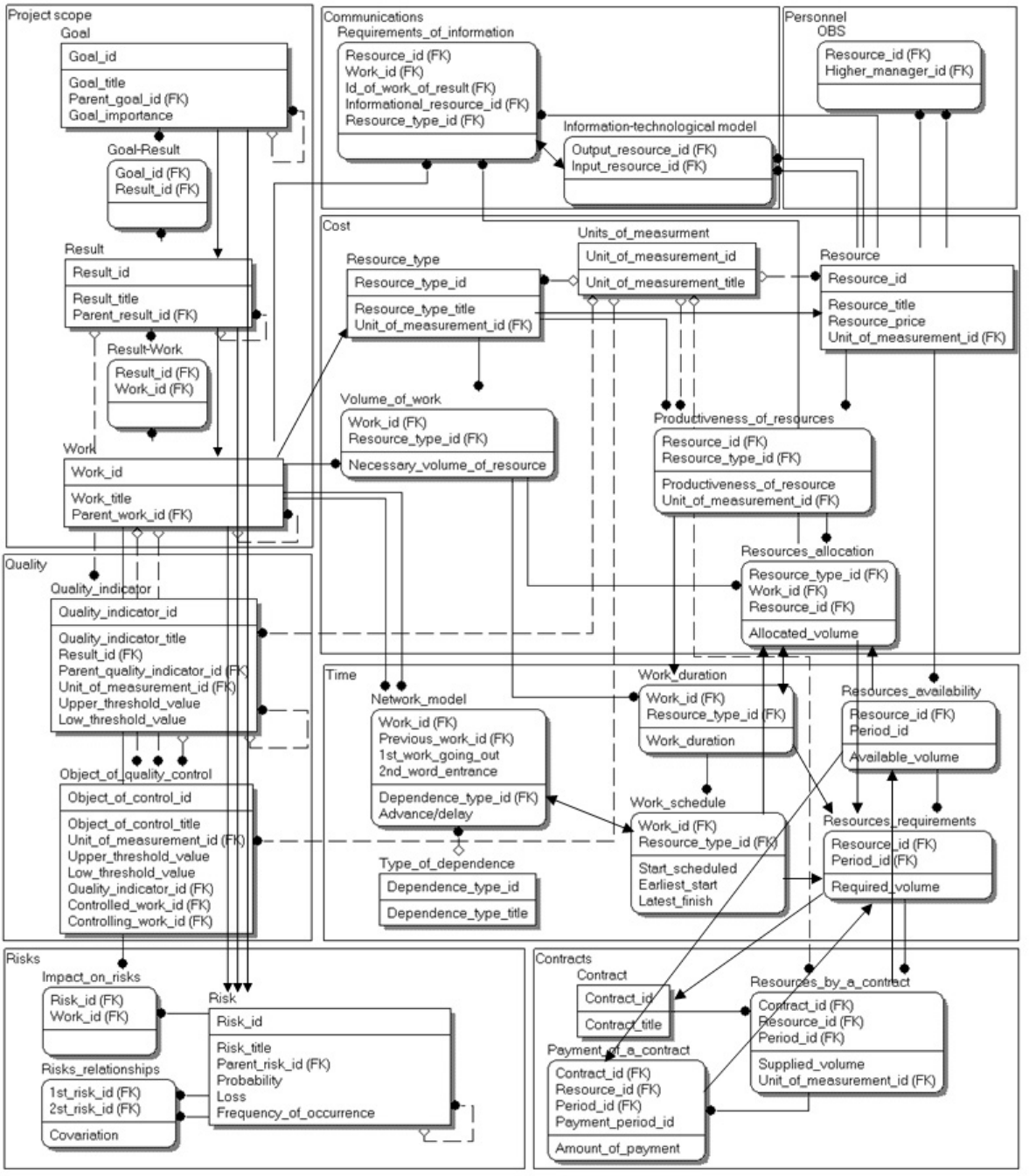


Fig. 3. Project data model (example)

Successive modeling of project breakdown structures and definition its relationships provides the common project data model, see Fig. 3 (example). Besides relationships on the level of attribute migration (“FK” (foreign key)-noted) this model contains “functional” relationships (marked with arrows). For instance the aggregate data of a resource appointment defines the consumption schedule of it. Direction of arrow means that the first entity could have a direct influence on the second one. Depends on project limitations and priorities the relationships could active or inactive.

For the purpose of the modeling of compound limitations which contain more than one project parameters we propose to create additional tables with these parameters as the FK-attributes.

This data model is opened i.e. it allows the usage of different models and methods by means of the appropriate table or relationship changing. For instance OBS could be both the tree or the matrix.

3. Project management process modeling

We propose to consider this project data model as semantic network and to apply to it the algorithm of predicate logic [7], [8]. This algorithm realizes logical deduction of interrelated nodes values of the network on the basis of its relationships. The sequence of the logical deduction defines the sequence of project breakdown structures determination, the inputs and outputs of particular subtasks, i.e. it dynamically defines the project management business-process taking into account the specific limitations, priorities, models and methods in use, see Fig. 4. We propose to use this algorithm on the stages of planning, monitoring and controlling.

This algorithm consists of three phases in less detail on the stage of planning:

1. The sequential evaluation of influence of limitations on project breakdown structures, the “tolerance range” search.
2. The search of the most reasonable set of project plans (i.e. values of project breakdown structures) on the “tolerance range” taking into account the priorities, the “indifference range” search.
3. The basic plan is to be chosen if alternatives remain.

This algorithm could not be executed automatically because some tools and techniques require the human decision making.

As well as for planning, information about a change extends over the semantic network for the change analysis. If limitations have been broken or priority values have made worse, the sequential search of corrective actions is carried out.

4. Conclusion

The application of suggested method allows to reduce labor expenditures of coordinated project plan elaboration and change analysis due to the algorithmic sequence of solving, more clear responsibilities distribution and cooperation interfaces within project management team, reduction of number of the cyclic relationships and concerning options that also increases efficiency and quality of these processes.

Depending on project scope, parent company etc. the project data model could be differ but proposed modeling principles could be applied to various fields.

It is advisable to realize suggested method in project management decision support system for the purpose of the workflow organization, simulation and sensitivity analysis, typical projects and solutions dedication, project management consulting, automatic response on inessential changes.

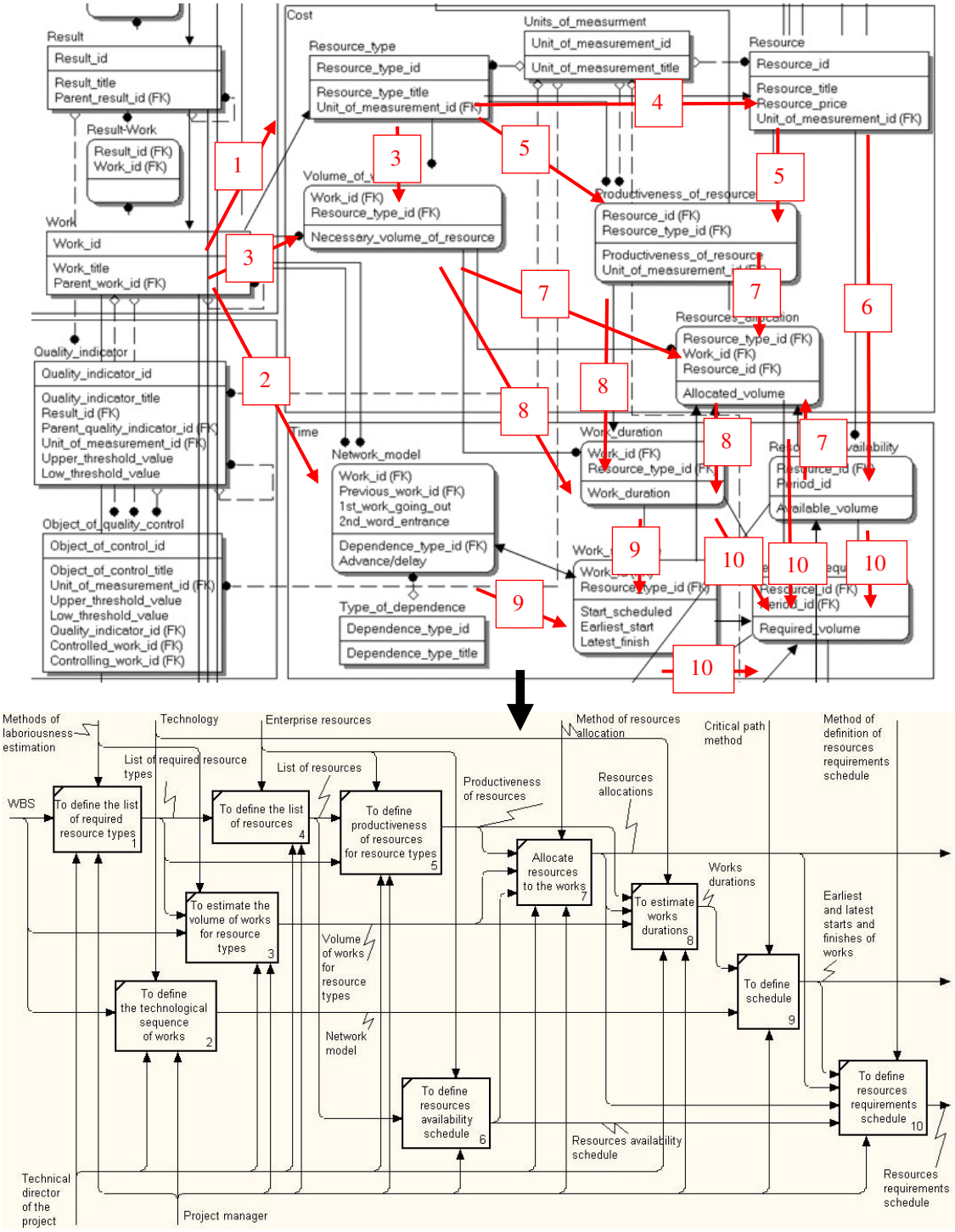


Fig. 4. The sample of dynamic project management process modeling (fragment)

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