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STRUCTURAL-LOGIC MODEL OF TIME FORECAST OF SOFTWARE DEVELOPMENT PROJECT REALIZATION

The paper consider the problem of structural-logic model of time forecasting of software development project realization. MS project database is improved, this enables the realization of suggested technology.

Key words: *model, planning, software development*

Introduction

Nowadays the problem of projects management are selected in the separate branch of management, making considerable contribution to the development of information technologies, intended for simplification of projects management process. Since modern projects can be large enough, involving many people, and long-term, there appears the problem of software usage that enables facilitate the work of managers, for instance, Spider Project [1], Primavera [2], MS Project 2007 [3]. But the analysis of these basic packages showed that in greater part of them require accurate setting of time evaluation needed for execution of separate problem. They do not have the mechanism of problems and performers parameters analysis that would allow evaluating this time.

Methods of time estimation of tasks and project execution in general can be divided in such a way:

- use of time typical norms [4]. In the time typical norms the methods of time calculation at the initial stages of project are pointed. However, disadvantages of these norms are their obsoleteness and their maladjustment to modern technologies of developers work automation. Besides, some parameters of these methods do not have the exact method of determination;
- expert estimations. A disadvantage of such estimation method is that such estimation completely depends on qualification of the manager, his/her experience and, whether similar tasks were executed by this team of developers;
- statistics of previous works.

In projects on software development the manager task is complicated by the fact that greater part of tasks contain creative component. As result most estimations of time for the tasks execution are inaccurate enough. Such estimations fully depend on manager qualification.

Consequently, the problem of computer-aided technology creation of time forecasting for the software development projects tasks execution appears. Such technology will allow to take into account basic factors on which time estimation for tasks solution can depend. These factors are in certain logical dependences between themselves. Determination of such factors and establishment of logical connections between them are actual task and will allow to determine time on the task execution more exactly. Development of structural-logical model of time forecast of software development project realization is **the aim** of the article.

Problem Solution

Experts involved a number of managers from different companies be means of the Internet as well as project managers from LTD «Aricent Ukraine» projects and Vinnitsa National Technical University for determination of necessary parameters.

For solution of the problem dealing with elaboration structural-logic model of time forecast of project realization we will divide all factors into two groups: project parameters on the whole and potential project performers parameters (Fig. 1).

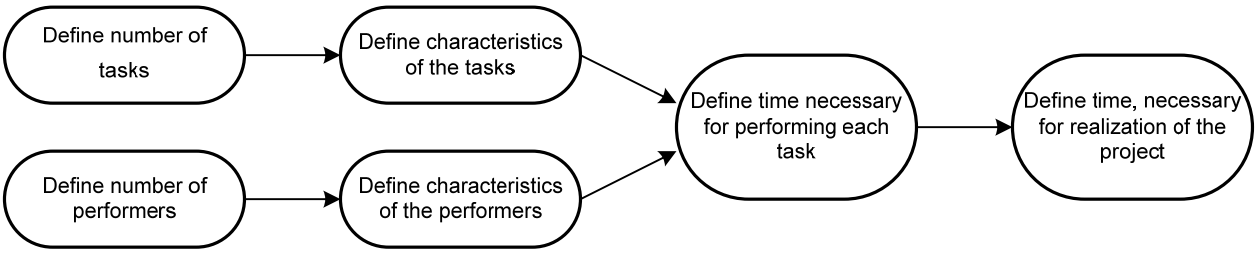

Fig. 1. Connection between time needed for one task execution and the whole project

After determination of parameters and characteristics the manager distributes tasks between performers (the optimum distributing of tasks between performers goes beyond the scopes of this article) and can, finally, define approximate time, necessary for realization of the project. It should be noted that this time determination is optimistic and does not take into account unforeseeable events.

In order to define time, necessary for project realization, it is necessary to take into account such parameters that are showed in Fig. 2.

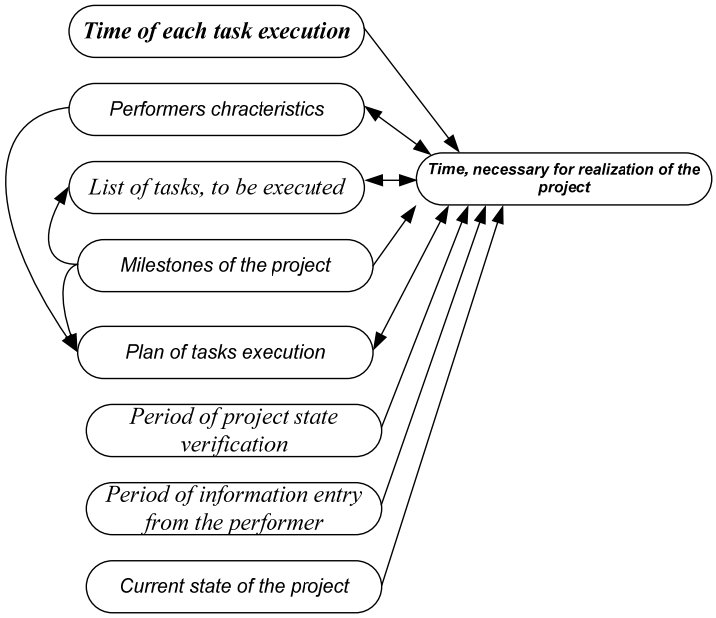

Fig.2 Parameters influencing time realization project

In Fig. 2 and in all subsequent Figures of the article, parameters determined by experts are in Italic type, parameters which can be determined exactly or on the basis of previous data regarding this parameter are in Bold type, parameters with are determined either by an expert or on the basis of previous data regarding this parameter which for instance can be stored in knowledge base are in Bold Italic type.:

- list of tasks, to be executed
- plan of the tasks execution: who of performers executes which tasks and in what sequence
- time of each task execution
- milestones of the project. In any project there are dates by which it is necessary to present the results of tasks. This parameter also influences, what tasks will be executed: if there is a lot of time, it is possible to execute many tasks, if there is no – then it should be determined, how task can be simplified, or which of the tasks are least priorities, and will be executed only in the case when

there is time for them. In same way milestones of project influence the project realization plan;

- management parameters: period of project state verification by the project manager, period of information entry from the performer about the state of the tasks execution, current state of the project is the stage of project and necessity to optimize the schedule at this stage. The given parameters evoke the feedback in the system, this means that system is dynamic and closed.

In what way certain parameters influence project realization time (PRT) in same way parameter of PRT influences these parameters:

- on the list of tasks - if PRT is small then the manager will search, what tasks are of least priorities, and may not be executed, if the time of realization is lager then the manager will check, whether all is taken into account during planning;

- on the amount of performers – this influence is observed wherein someone tries to reduce the terms and it is possible to involve additional resources to the project;

- on task execution plan - depending on PRT and project milestones the plan can be changed in order to attain optimum assignment of tasks between performers.

Thus, we get feedback which must be taken into account during determination of PRT. Feedback influences the dynamic of planning process, which in the existing projects control systems [1-3] is not taken into account.

Estimation of time needed for one task execution depends on the parameters shown in Fig. 3.

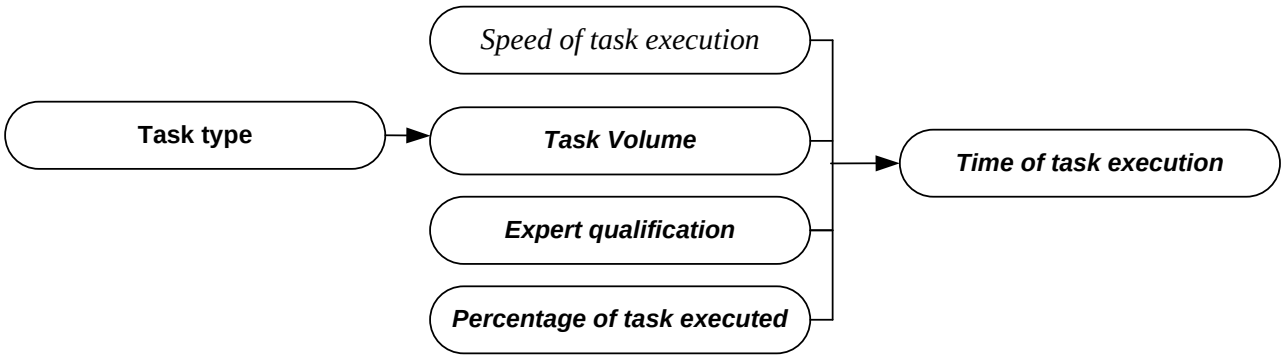

Fig.3 Parameters influencing time of the task execution

- speed of task execution by the performer;

- task volume in units of work being execution (for instance, for programmers - in the written programe units, for testers - in an amount of tested test-cases). The volume depends on the type of task - what type of work the task belongs to, for example, either it is document creation , or coding or testing etc.;

-expert qualification estimation all parameters of the project, performers and tasks. As a rule, for obtaining more objective results that are based of expert estimations, several experts are invited and their estimations are averaged. The indexes of experts qualification are used as weight coefficients. We should note that qualification of the expert is a parameter, that influences determination of time of project realization from the beginning of the planning to its completion at all stages of planning;

-percentage of task executed part. Depending on fact what part of the task is realized the correction of time needed for execution of the rest of the task is carried out

No we consider in details the parameter of expert qualification. The given parameter is to show, how reliable the data obtained by the expert can be. It is quite obtains that qualification of the expert depends on how accurately he/she suggested the data before, i. e. what the difference was between the real data of the project completion and the data foreseen by the expert. We will name this parameter the delay. Projects can have different duration, that is why it is more expediently to take

into account not absolute delay but comparative delay that is attitude of delay days amount toward general duration of project in days.

$$w_i = \frac{W_i}{D_i} \tag{1}$$

where W_i is delay in days on a i project, D_i is duration of i project in days, w_i is comparative delay. Qualification of expert depends on the parameters presented in Fig. 4.

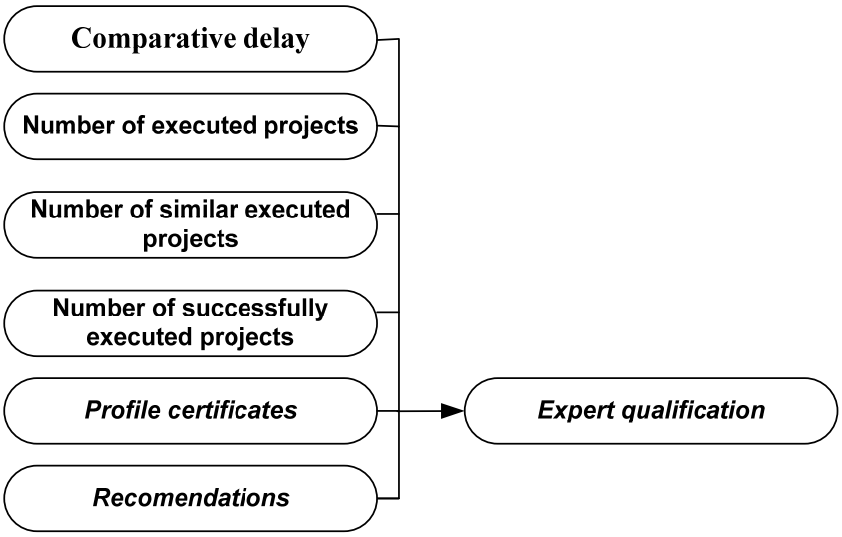

Fig. 4. Parameters that influence on expert qualification

The parameter of work speed depends on many parameters of performer and task complication.

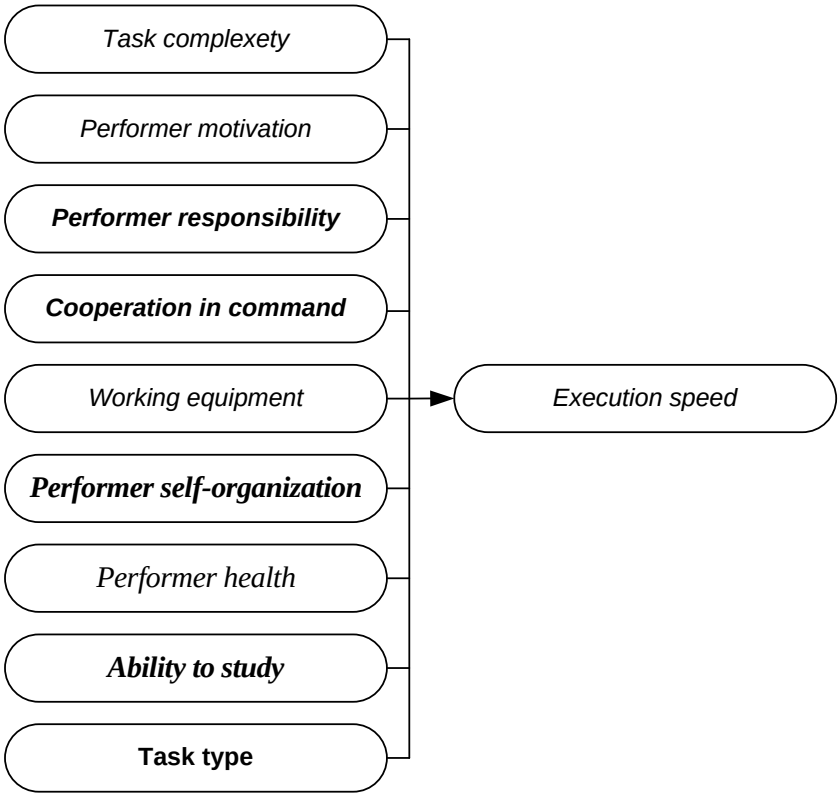

Fig. 5. Model of time estimation for task execution

Basic parameters from which task execution speed depends from (Fig. 5):

- task complication;
- task type;
- performer motivation, this means how big motivation to with a complete efficiency;
- performer responsibility;
- co-operation in a command - how easily performers can co-operate between themselves (for example, if they work alongside, both can quickly co-operate, and if performers in different times zones and can only write to each other so co-operation is difficult enough);
- working equipment;
- performer self-organization - how he/she can organize own work, properly distribute time for tasks execution;
- health of performer (physical and moral) during the task execution;
- ability to study - this parameter shows, how quickly a performer can study some new knowledge and skills which correspond to his(her) qualification.

Task complication depends on the parameters presented in Fig. 6.

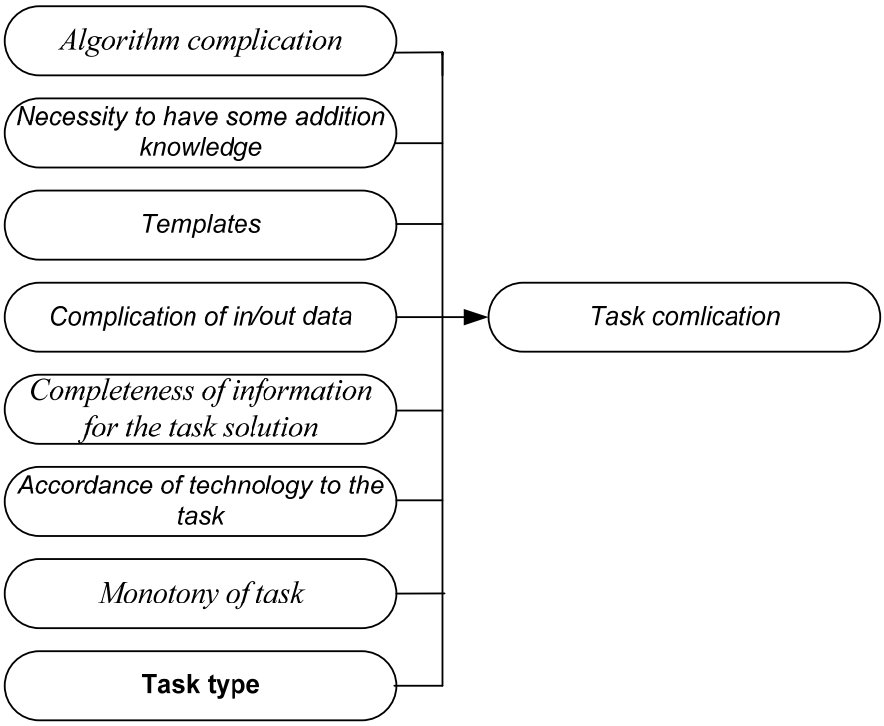

Fig. 6. Model of task complication estimation

- necessity of performer to have some additional knowledge from some narrow area of knowledge;
- monotony of task and necessity of identical operations realization during long period of time;
- templates, that means existence of the prepared algorithms for the task solution;
- accordance of technology to the task: it is often enough, that task needs to be executed with usage of definite technologies, and this limitation can lead to complication of task solution comparatively with usage of, more acceptable technology;
- complication of input/output data - some data is simple enough in treatment, but some of it is complicated enough, for example, data can contain complex command for the program, that is hard enough in treatment;

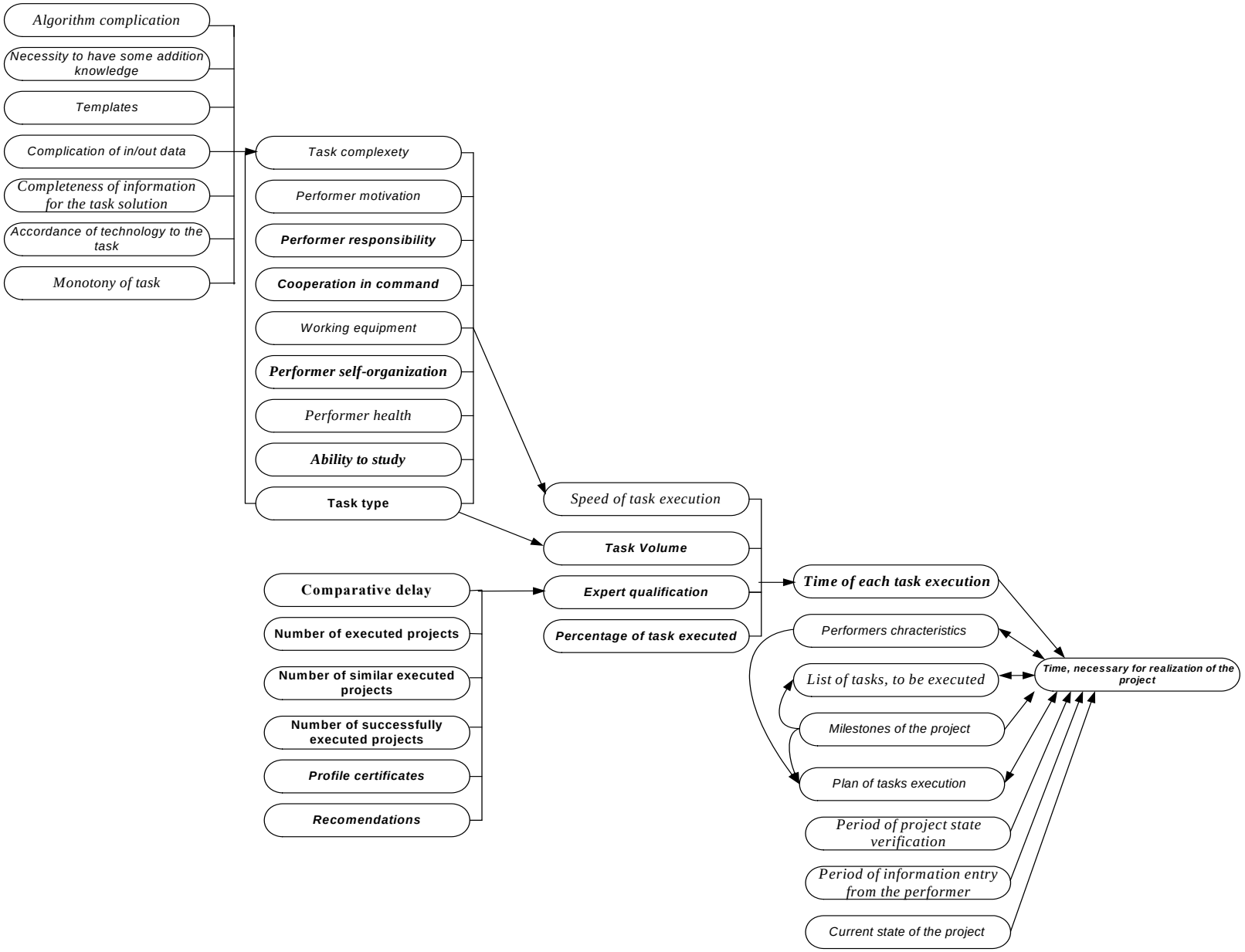

Fig. 7. Structural-logic model of time forecast of software development project realization

- completeness of information for the task solution;
- researches: whether necessary additional researches for the task solution;
- algorithm complication – it is defined in accordance with correspondent methods, for example, in the conditions of uncertainty complication of algorithm is defined by the order of functional model of algorithm [6];
- task type.

Connecting schemes in Fig. 2-6, we can get the general structural-logical model of time forecasting of project realization for software development, represented in Fig. 7.

Database for realization of technology

The parameters of tasks and performers can be defined expertly, using experience and using a database which can contain information about previous tasks and previous descriptions of performers. Absence of such database that would contain similar information considerably complicates work of projects managers. Especially this is noticeable, when a manager runs into tasks which team did not do before, but similar tasks was done by other teams, and with performers which were transferred from other managers. Information about all task and performers can be stored in a database and can become in case at the subsequent planning. In order that the offered technology will be able to integrate with widespread management software of projects, we build a database as addition of the existent system. Among basic packages [1-3] we will choose the package MS Project 2003 as such, that has the centralized database and has most necessary functions for planning [3].

In accordance with the developed structural-logical schema all data can be treated as attributes of following objects:

- tasks
- projects
- performers
- experts
- teams.

Data can be united in separate tables, or can be added to already existent tables. We will point the simplified schema of including additional parameters to the database (Fig. 8).

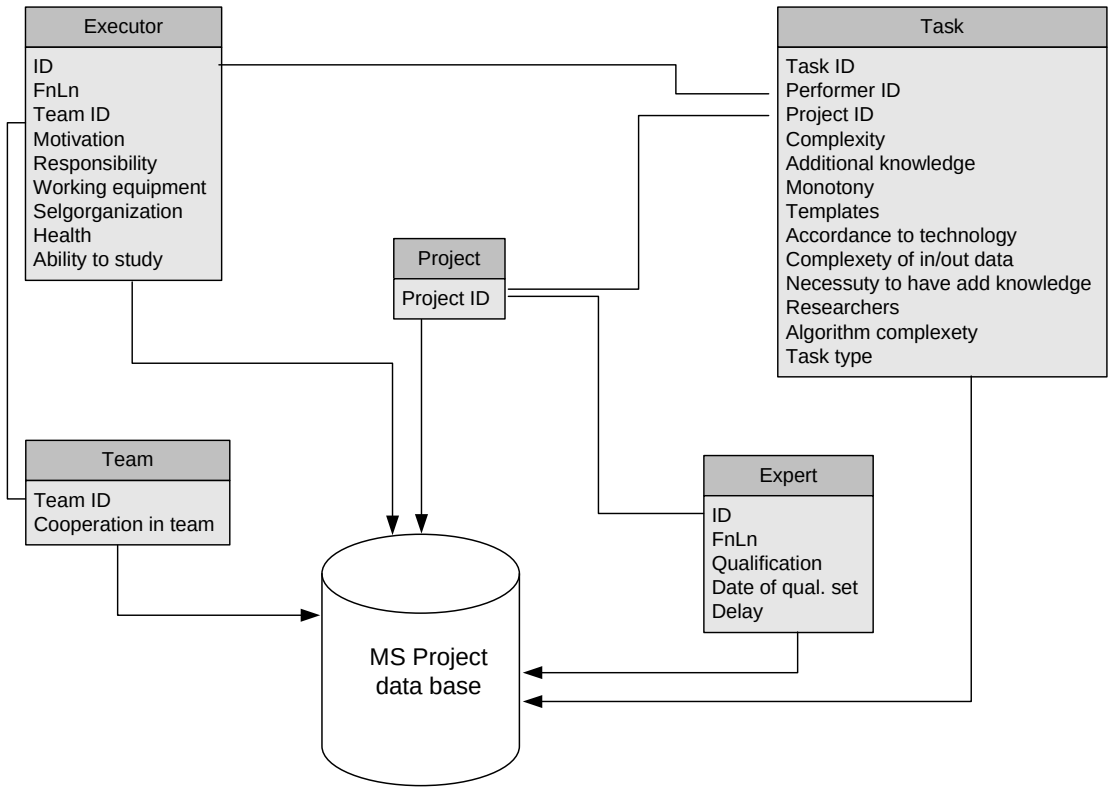

Fig. 8. Simplified sheme of additional parameters and characteristics inclusion into data base

Except parameters that are pointed before, we will take into account such parameters:

- the key-identifiers of task, performer, command, project, expert they are an unique numbers, that allows simply to define task, performer, command, project, expert;
- SN is the surname and name of performer and expert;
- qualification of expert is what qualification was set to the expert, all cases when qualification was proposed are saved,;
- date of set of qualification to expert - when exactly qualification was set;
- delay - on how many days project was delayed compare with estimation of expert (if a project finish before expert date the value will be negative).

Such parameters, as the volume of task and percent of the done work for the task are already laid in the database of MS Project.

Conclusions

The developed structural-logical model is basis of information technology for planning of resources redistribution (time and performers) for projects management of software development. A model is intended for subsequent development of programmatic system that must help managers in forecasting and projects management. Technology is easily integrated with the existent projects management software by including additional parameters and utilities to the projects database of the MS Project

REFERENCES

1. Спайдер Проджект: Управление Проектами Project Management консалтинг обучение Spider Project. – 2008. – Режим доступа: http://www.spiderproject.ru

2. Project and Portfolio Management. – 2008. – Режим доступа: http://www.primavera.com

3. Project Home Page – Microsoft Office Online-2008. – Режим доступа: http://office.microsoft.com/en-us/project/FX100487771033.aspx

4. Типовые нормы времени на программирование задач для ЭВМ. – М.: НИИ труда, 1980. – 28 с.

5. A. Yousefli, M. Ghazanfari, K. Shahanaghi, M. Heydari A New Heuristic Model for Fully Fuzzy Project Scheduling. – Режим доступа: http://www.worldacademicunion.com/journal/jus/jusVol02No1paper07.pdf

6. Дубовой В. М. Застосування алгоритмічної моделі до оптимізації інформаційно-обчислювальних систем в умовах комбінованої невизначеності / В. М. Дубовой, О. Д. Нікітенко // Вісник Вінницького політехнічного інституту. – 2005. – № 6. – С. 9–13.

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