

Michał WOŹNIAK^{*}, Oksana OLJNYK^{**},
Marcin ZMYŚLONY^{*}

NEW APPROACH FOR ESTIMATING BUDGET COST OF PROJECTS IN MEDICAL AREA

The important and actual problem of health protection systems is to ensure suitable safety during taking care of patient. This can be done by innovative medical systems, which increase satisfaction of patients. That issue cause realization of more and more complex projects in medical area. The problem is that specification for medical projects is not always well defined and it can caused overhead cost and time of realization. Presented in this paper innovated method helps in prevention of situation, where medical project can not be finished because of undefined cost and time framework.

1. INTRODUCTION

It is hard to imagine well managed hospital without complex and flexible hospital information system (HIS). The important and actual problem of health protection systems is to ensure suitable safety during taking care of patient. One element of patients threats are mistakes in proceeding way: delay in identification of health danger or delayed or incorrect therapeutic intervention. Therefore nowadays mentioned above information systems' concepts shift from administrative computing towards clinically cantered. New advanced technologies are being utilized in development projects covering a broad range of a hospital's activities.

Nevertheless, the process of design or selecting software products to build a HIS remains a nontrivial task. Usually we could choose between two offers: fully functional and complete HISs and systems with a highly adapted functionality. On the one hand the first proposition is tempting but we know that solution for everybody is solution for no-one, on the other hand we have to realize that the second solution brings built-in integration problems. In each case costs are high, a budget is limited, but expectations of users are high.

Putting into practice information systems for hospitals involve also problems of changeable users' requirements and changeable hospital's information environment like demands of insurers.

Therefore regardless of solution's choice the crucial problem is a precise cost estimation and an adoption of correct method of change management in information project.

Nowadays there are not exist the one good method of information project estimation [8]. Most of well known methods of cost estimation based on parametric approach (e.g. COCOMO [5,6] or FPA[7]), another ones based on experts' experiences. But all of them do not guarantee high quality cost estimation. In many reported projects [1] the estimation error could increase cost of project. Casper Jones study found a 20% reduction in the costs resulting from missed requirements [10]. This error value is unacceptable for HIS's projects where budget is limited and in many cases could not be increased during the period of a project. Therefore hybrid methods of cost estimation seem to be promising solution for medical information systems projects, additionally they should respect specificity of HIS's projects, among other things that the projects requirements are very difficult and changeable. For such case spiral life cycle should be chosen, which is an evolutionary version of incremental prototyping[4]. Each iteration of the prototype represented as a cycle in the spiral.

This paper presents preliminary concept of hybrid cost estimation method which calculates project's on the basis of results given by different well known cost estimation methods. The hybrid method is dedicated especially to HIS's projects.

The paper is organized as follows. The next section shows advantages of using proper methods in medical projects. Third and fourth sections describe known methods for project management. The last section concludes the paper.

2. ADVANTAGES OF USING PROPER METHOD FOR PROJECT MANAGEMENT

Choosing proper method for project management is the main factor which has significant influence on the successful finishing of most projects. The reason why it is so important is pretty simple – it helps managers in having better [1]:

- project planning,
- project cost estimating,
- project measurements,
- project milestone tracking,
- project quality control.

All of those are major factors which give key information about progress of work and danger of failure of project. The problem is, that even now, when managers have such a great knowledge about the reasons why project can failure, it is very hard for them to get good cost estimating, which has influence on the other part of project. Such problems are the most

^{*} Faculty of Electronics, Wrocław University of Technology

^{**} Faculty of Computer Science and Management, Wrocław University of Technology

significant in areas of life which are new for project managers and there are no information about all of aspects which are important in projects.

Good examples of such situations are medical projects, where plethora of problems and difficulty are recognized during the main part of project. The problem is that if the cost estimating is not prepared in correct way, it is very likely that such a project can failure because of the budget. Carper [1] analyzed over 250 projects and claim that 25 of them were damaged because cost and schedule, while 175 experience major delays or were terminated without completion. Those statistics show that even now, estimating project's parameter is not trivial task.

The question is: "If there is a way to do better estimating project's parameter?" The answer is: "Yes", but for doing this, innovation [3] is needed.

As Capers [2] claims, there are two kinds of innovation that are important for projects:

- product innovations,
- process innovations.

The first could be achieved by improving products and, in consequence may have influence on satisfaction of customer. The second one could be achieved by more approximately methods which give parameter's values, closer to the real one. Such methods should be especially used in medical projects, where even a simple changes could caused diametrically changing of budget. Such a method, which helps to improve cost classification in medical project is presented bellow.

3. KNOWN METHODS FOR ESTIMATING BUDGET

The first basic method is interviewing. Interviews are one of the main sources of information at the beginning of the planning cost. We can conduct interviews with the project's team, with the client's team, with the best experts of this field and with all stakeholders. The main asset of this method is the possibility to do interviews by e-mail and lack of influence of the individual person to the final result.

Next method, which is also based on people's opinion, is Delphi technique. This is a systematic, interactive method, which relies on a panel of independent experts. The carefully selected experts answer to questionnaires in two or more rounds anonymously. The responses are summarized and sent to the experts for further notice. "Right answer" may be reached in a few rounds of this process. Process would be stopped when certain number of rounds is reached, consensus or stability of results is achieved. This method also keeps each person from having undue influence on the outcome. The technique can be adapted for use in face-to-face meetings, which is called mini-Delphi or Estimate-Talk-Estimate (ETE) [11].

Though these two methods are based only on human's opinions, but obtained data are very useful for project managers at the planning phase. It helps them to manage the stakeholders' expectations and control budget cost.

Analogous Cost Estimating method determines the rough cost of a project by comparing it with older and similar projects for which actual costs are available. This technique is very good for medical projects, where technical specifications are the same. In situation when they are only similar it's necessary to divide budget to different parts, which allow to show the budget cost in separated phases. Analogous Cost Estimating is generally less costly than other techniques, but it is also generally less accurate. Database of performed projects always could be good source of cost date and the source of cost changes during the project.

Determine Resource Cost Rates concerns to economy method. Person, who counts the budget cost of medical project, must know the unit cost rate, such as staff cost per hour. After that it will be possible to estimate schedule activity staff costs. If in the project we have also some other resources, for example some build materials or hardware, it will needed to estimate these costs too. The sum of all resources in this project allows to assess activity costs.

Disadvantage of this method is fact that the actual rates can be changed. In this situation there is need to check the rates from time to time and update the activity costs.

Next method, which helps us to estimate medical project budget, is similar to Determine Resource Cost Rates and calls Bottom-up Estimating. This technique bases on estimating the cost of individual work packets or individual activities on particular level. For obtained the exact estimation each task is broken down into smaller components. Then, this individual estimates are summarized for the higher levels to obtain the approximated cost of the medical project. It should be emphasized, that the accuracy of this technique depends on the size and complexity of the work packets and activities. Generally, the less size of activities we have, the better accuracy we get.

Quite opposite to Bottom-up Estimating is *COCOMO* Method. The Constructive Cost Model is an algorithmic software cost estimation model, which uses a basic regression formula with parameters that are derived from historical project data and current project characteristics. There are two models: *COCOMO* 81 and *COCOMO* II. Last one is better suited for modern software development processes and an updated project database. *COCOMO* consists of a hierarchy of three increasingly detailed and accurate forms: basic, intermediate and detailed. Program size is expressed in estimated thousands of lines of code (KLOC). Number of lines of code is the different for different codes, but there are coefficients between all well-known codes. *COCOMO* method applies to three classes of software projects: organic projects - "small" teams with "good" experience working with "less than rigid" requirements; semi-detached projects - "medium" teams with mixed experience working with a mix of rigid and less than rigid requirements; embedded projects - developed within a set of "tight" constraints, for example hardware, software, operational.

Scenario method is not very popular method for estimating costs, but sometimes is used. This method can be the best solution to the medical project with the highest level of innovation. For such project it's quit hard to prognosticate the development of the project, so it can be helpful to have two or three different scenarios for this project. All scenarios have

to have estimation of budget and project plan. In proper time the most appropriate scenario is selected as right variant with known budget.

4. RESERVES FOR UNKNOWN ACTIVITIES

Majority of project managers are afraid to exceed the schedule budget cost most of all. The one part of them estimates budget costs with some budget surplus. But the other part practice Reserve Analysis method. Reserves for unknown events are estimated costs to be used at the discretion of the project manager to deal with anticipated, but not certain events. These reserves for unknown events are the part of the project scope and cost baseline. One option to manage this reserved cost is to multiply budget cost by some coefficient, which is different for various medical projects. For example, if project team has already realized similar project, this coefficient can be only 5 or 10 percents. But if this project is quite innovate, this coefficient can be above 25 percents. The second option to manage reserves for unknown events is to aggregate each schedule activity's cost contingency reserve for a one group of related activities. It means, that we have the same number of budget cost in separated phases and contingency reserves from the separated phases. In this way we can to control in what phase the schedule budget was underestimated. These dates we must take into consideration during next medical project, because it helps us to estimate budget cost more precisely.

It should be emphasized, that even the project manager uses all these methods or most of them, it is uncertain that the medical project will be finished with scheduled budget. Achieving end of the project with scheduled budget depends of number of mistakes, which were done during the project life cycle. The essential ones are presented below:

- lack of cost database from older projects,
- using only one method without verification results, obtained from another methods,
- lack of updating the estimation cost data,
- lack of cooperation between client's team and project's team,
- lack of knowledge of the members of project team and lack of willing to learn,
- using improper methods and techniques for some type of medical project,
- withholding bad information from chief.

It stands the reason that the innovative medical project can be finished with schedule budget. In this case we have:

- possibility of better planning tasks in the project,
- achievement of scheduled budget and quality,
- the better management of budget in the project,
- possibility of better planning projects in future,
- good relationships with the client as the possibility of new projects.

5. MAIN ELEMENTS OF BUDGET

Every project has 4 main elements of total budget [9]:

- direct labour cost;
- overhead cost;
- fringe benefits;
- auxiliary costs.

Direct labour cost is obtained from the unit cost rate per hour or salary per month for staff. This cost is multiplied by number of hours or month in whole medical project. In case, there is no need to buy hardware, these cost are significant part of the project.

Overhead cost is related with work process during the whole project. It includes cost of building materials, bills for electricity and other costs. Overhead cost is proportional to direct labour cost. For example, if direct labour cost increases by 50 percents, overhead cost increases by 50 percents too.

Fringe benefits are the extra incomes, which staff can receive as a bonus to regular salary. This type of budget elements consists from medical insurances, life insurances, payments from the profit-sharing plans, pension contributions and payments for educational program.

Auxiliary costs are not regular cost, but related with the project. For example: staff's travel costs, cost of special equipments and materials and salaries for project's consultants.

So, the best solution to estimate budget lies in using different methods simultaneously and comparing results. In such way the estimation will be done more properly and reliably.

6. PROPOSAL PARAMETRIC METHOD

However, each aforementioned method approaches to estimating cost problem is used. None of them takes into account all aspects of budget cost. For example, almost every methods don't consider innovative aspects of project. Also changing of technical specification and changing of budget cost during the realization of the project are neglected.

Therefore method which pays attention for every aspects is need. In this paper new approach is presented. Proposal method is based on parametric method and is presented below:

$$F(A) = \lambda a + \beta b + \gamma c + \delta d + \theta e + \psi f + \xi h + \omega t, \quad (1)$$

where:

$F(A)$ – project’s budget;
 $\lambda, \beta, \gamma, \delta, \theta, \psi, \xi, \omega$ – weights of the parameters;
 a, b, c, d, e, f, h, t – parameters.

The heart of the matter of this method relies on taking into account all main parameters, which are build the whole budget cost. The direct labour cost is the biggest part of all cost elements in the medical innovative project. So, if the direct labour cost can be estimate correct, it means, that we are already known 70 percents of whole budget cost. Next important parameter is time framework of the project, because this information to allow us to estimate urgent factor of this project and intensity of staff’s work. Number of points of innovation can establish project manager is basing on experienced from former projects. This parameter relies on the time framework directly. Reserves cost for unknown activities appears in each innovative medical project. Existing of reserves cost is not a reason to worry about. Problem is when costs are bigger, than was determined. It means that project team doesn’t handle itself with managing of the project. Such project must be put through the analysis. Other parameter indicates how often client changed project specification and in which phase of the project. At the beginning of each project technical specification is given by client. Judging by experience this technical specification is modified during realization of the project. Influence of changing technical specification on budged cost depends on scale end time of this modifications. It stands to reason that earlier and relatively small modifications have no such impact on budged cost as significant ones done near to finish of project. This scenarios of budget cost are not the main parameters of this method. But if the project has to illuminate "wild cards", scenario’s parameters will be useful.

Demonstration parameters for one of the medical project are presented below:

a – time (hours)
 b – direct labour cost (euro)
 c – intensity with urgent factor (person/h)
 d – innovation (points)
 e – reserves cost for unknown activities (euro)
 f – changing of project’s specification (number)
 h – budget cost of scenario 1 (euro)
 t – budget cost of scenario 2 (euro)

These parameters can be different for different medical projects. The type of parameters and their weights depend of the specification of the project and the main aims, which have to be achieved by this project.

7. CONCLUSIONS

Albeit proposed method is being worked out, it seems to be able to increase the chance for finishing project successfully. It can be done by more accurate estimation of project parameters. Such a direction of medical project management gives bigger possibility of finishing the project with schedule budget, good quality and customer satisfaction. The method would be especially used for innovative medical projects, where the technical specification is not well determined. The main problem in this method are weights which must be determined. Therefore, further study in this area must be done.

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