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THE PROJECT ESTIMATION TECHNIQUES' APPROACHES

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ПІДХОДИ ДО ОЦІНЮВАННЯ ВАРТОСТІ ПРОЕКТІВ

Today, the quantity of digitized products development is growing rapidly. The number of the tech startups is increasing every day not only worldwide, but in Ukraine too. The Lviv region has been showing positive growth dynamics for several years in a row by the number of newly opened companies, which in turn indicates an increase in projects' volume growth.

The IT-industry is a market whose competitiveness is increasing yearly, so it is becoming increasingly difficult to keep up with it. Despite the diversify experience, large companies in the Lviv market (Softserve, Global logic, Epam) can give in to their performance indicators, to the small emerging agencies. Therefore, there is a need to investigate the activities of software companies to understand better what indicators should be used to improve projects' estimation and, to stay on the market at the expense of good reputation.

Foreign experts believe that a reliable projects' estimation is the key to its successful implementation and completion for all stakeholders.

Domestic enterprises are not fully acquainted with the cost estimation techniques or do not pay sufficient attention to them. Therefore, there is a need for detailed research and information on the peculiarities of that approaches in the informational technology industry.

The relevance of the topic is to study the main approaches to the cost estimation techniques of IT projects in the domestic market.

The article explores the main project cost estimation techniques at IT-industry. The comparative characteristic of top-down and bottom-up estimation methods is analyzed, to clarify the advantages and disadvantages of their implementation in small business activity.

The project database of the top branding agency named Qubstudio is analyzed for the applied comparison of the techniques mentioned above. Special attention is paid to the main factors such as scope, time, costs, quality, human resources and risks to accurately estimate the

project's cost. The given examples show, that the successful estimation should take into account the informational needs of all project` stakeholders, who can control its cost anyway and anytime.

В сучасному світі, розвиток цифрових продуктів стрімко зростає. Кількість технічних стартапів, збільшується з кожним днем не тільки у світі, а й в Україні зокрема. Львівський регіон показує позитивну динаміку росту вже кілька років поспіль, про що свідчать показники кількості створених нових компаній, а це, в свою чергу - збільшення обсягів проектів.

IT-індустрія – це ринок, конкурентноспроможність якого збільшується з кожним роком, тому втриматись на ньому стає дедалі складніше. Не дивлячись на широкий досвід, великі компанії на Львівському ринку (Softserve, Global logic, Ерат) деколи можуть поступитись своїми показними ефективності, малим новоспеченим агентствам. Тому виникає потреба у дослідженні діяльності підприємств, які створюють софт продукти, щоб краще зрозуміти, якими показними слід оперувати для покращення оцінки проектів, і, відповідно, втриматись на ринку за рахунок хорошої репутації.

Зарубіжні спеціалісти вважають, що достовірна оцінка проекту є запорукою успішного його реалізації та завершення, для всіх стейкхолдерів.

Вітчизняні підприємства не повністю ознайомлені, або ж не приділяють достатньої уваги на залученні основних технік для оцінки вартості майбутнього проекту. Відтак, вбачається потреба у детальному дослідженні та інформуванні щодо технік та їх особливостей оцінки вартості проектів у галузі інформаційних технологій.

Актуальність теми полягає у дослідженні основних підходів до оцінки вартості проектів в IT-галузі на вітчизняному ринку. Проведено порівняльну характеристику методів “зверху-вниз” та “знизу-вгору” для уточнення переваг та недоліків їх імплементації у діяльність малого підприємства.

Проаналізовано діяльність брендингового агентства Qubstudio, на предмет кількості реалізованих проектів та їх вартості за останні 4 роки діяльності з 2016 до 2019 рр. Особливу увагу приділено основним чинникам, які закладені у формуванні вартості проектів, зокрема: обсяг роботи, час, витрати, якість, людські ресурси та ризики. Проведене дослідження дало змогу ідентифікувати те, що успішність в оцінюванні вартості проектів передбачає охоплення інформаційних потреб всіх зацікавлених осіб проекту, які можуть контролювати його вартість в різний спосіб та термін.

Keywords: *estimation; project; IT-industry; techniques; costs; risks; scope.*

Ключові слова: *оцінка; проект; IT-галузь; техніки; витрати; ризики; об'єм роботи.*

Problem statement: The successful projects' cost estimation helpt to increase the volume of the new contracts. For the business activity of the company it is highly important to find out the client's needs and meet them delivering the project's tasks on time and on budget.

The rightly chosen approach for the project's estimate will help you to find out its risks in the early state and to prevent them in the future.

A significant number of foreign companies are actively using projects' estimate approaches as a strategy for the functioning of organizations' activities and pointing it out as a priority area of development.

Foreign project managers believe that the accuracy of the estimated project will help you to build long-term relationships with the client; to optimize your team cooperation; to find out pain points of the project and use the previous experience for the company's development.

Unfortunately, domestic enterprises usually don't take into account all the information about the approaches and are making mistakes at the projects' estimation systematically. In contrast to foreign experience, the percentage of project cost estimation usage in Ukraine is quite low. This is primarily due to the lack of detailed characteristics of the different techniques.

So, the article will be relevant to both for the small companys who just have launched their business activity at the IT-industry and who want to improve the current indicators.**Previous research:** The problem of IT-project cost estimation is considered in researches of many foreign and domestic scientists. Among the scientific articles and literature of project management specialists such as Cohn, M. [1], Sliger, M. [2], Caper J. [3] and Hareton L. [4] as well domestic authors Mazur I. [5], Dithelm G. [6] pays attention to the processes of the project cost estimation.

Despite the great number of works in this field, there is no general systematization of existing methods and approaches that will showcase the difference between the estimation of IT projects and the real cost by the moment it is done.

The aims of the article: Among the main aims of the article are:

- To make an analysis of the difference between the most frequently used project estimate techniques;
- To find out the best techniques of project cost estimate techniques on the basis of the Qubstudio projects;
- The analysis of top-down and bottom-up estimation methods comparative characteristic.

The main material: Ukrainian IT industry has shown a positive trend for several years now, in terms of export activity, and is gradually replacing the usual export sectors - heavy industry and natural resources. In recent years, Lviv has become one of the major IT centers of Ukraine and Eastern Europe. Back in 2009, KPMG named the city one of the most promising outsourcing opportunities in the IT industry.

Lviv was included in the Top 100 European Outsourcing Centers in 2014, according to a Tholons rating. Lviv is attracted by a large number of Ukrainian and foreign companies that open their departments and develop their digital business here. By the last year’s research, 70 new IT companies were launched in Lviv, the quantity has increased from 247 to 317 [7].

The definition of "IT project" is commonly used for the designation of activities related to information technology usage or creation. To this kind of activity the software application development, information systems creation, deployment of IT infrastructure can be contributed. The Law of Ukraine “On the Concept of the National Program of Informatization” means the project of informatization as a complex of interrelated measures, usually time-bound investment use of certain logistical, information, human, financial and other resources and aim to create certain information and telecommunication systems, means of informatization and information resources that meet certain technical conditions and quality indicators . The IT project will mean software, information systems [8].

Cost estimation is an estimate of probable value those resources that you will need to execute works provided by the project. Cost estimation is calculated during the whole project implementation. In order to give the project permission to start, you must first check the conceptual (pre-project) estimates of its value.

Accurate estimation builds the foundation for a realistic schedule and an accurate project budget. Estimates are key inputs for scheduling, budgeting and risk management.

There are several common methods of calculating cost estimates. Anyone can choose a method that provides the required accuracy and fits its financial and employment opportunities conducting its own valuation (tab.1).

Table 1
Overall overview of the main project cost method estimation

| Estimation method | Key characteristics | Example |
|---------------------|---|--|
| Analogous estimate | <p>It is used at the beginning of the project when not there is not much input information.</p> <p>Compares the current project with past similar projects.</p> <p>The three main sources to use: project files, commercial databases, and project team members.</p> <p>Many organizations do not accurately capture this information. The recollection of project team members is the least reliable source. Critical to improving estimate accuracy in an organization.</p> | <p>The task is to develop five websites. Your team already dealt with similar project before with five website and it took 1 week. You take this amount of time as an example. Thus, if you need to develop 10 websites, you multiply 1 week by 2 and get 2 weeks.</p> |
| Parametric estimate | <p>The approach relies on detailed data from previous projects. For this, you need to define each deliverable and what it requires and then research information that will tell you the duration or cost of each deliverable. The</p> | <p>The task left the same, now we search the Web in order to find relevant information about how much time it takes to develop a similar website development. We</p> |

| | | |
|--|--|---|
| | difference between this estimate and analogous one is that here there is statistical proof for the technique. | find that approximately it needs 10 hours. If we need 5, we multiply 10 by 5 and get 50 hours. |
| The weighted average (PERT- Program Evaluation and Review Technique) | Used mainly on a large scale of high-risk projects. This technique is time consumed. Uses three estimates for each activity (weighted average): optimistic (O), most likely (M), pessimistic (P). $E = (O + 4M + P) / 6$ Each estimate is captured for each activity. | Going back again to the example. So, to develop landings we estimate (O) as 40 hours, (M) as 45 hours and (P) as 55 hours. According to the formula, $E = (O + 4M + P) / 6$ we have $(40+4*45+55)/6 = 46$ hours. |
| Bottom-up estimate | Used when there is significant detail about the activity. A detailed assessment of the resources, capabilities, and amounts are used to determine an accurate duration or cost estimate. This is the most accurate method but also expensive form of estimating. | If you need to develop websites, break the whole process, as it was stated, into smaller iterations that can be easily estimated. It requires some deeper analysis with obligatory things to do, but at first view, it includes text writing, design, front-end, and some other phases. After that, sum each estimation up and you'll get the whole estimate. |

The techniques mentioned above base their estimation process on analogy and deduction. It is needed to have knowledge of a previously complete project similar to our current software project. Estimation is done on the basis of the analysis of previous software projects or database.

To compare the optimal variant of the project cost estimation, we used the experience of the Qubstudio branding agency [9].

Qubstudio has 10 years of software design expertise and cooperation with more than 30 countries. Having both domestic and worldwide experience, they have become a TOP agency in Lviv with a great reputation and recognition. Their status of the well-known company became not only because of their core expertise but also thanks to projects delivered on time and on budget. The company carries out a detailed analysis of the given information to provide the team and the client with clear information on project implementation. Software cost estimation is used basically by system analysts to get an approximation of the essential resources needed by a particular software project and it's scheduled.

To find out the frequently used estimation techniques, we searched Qubstudio's cost project basis for the last 4 years. The results are shown in the pic. 1.

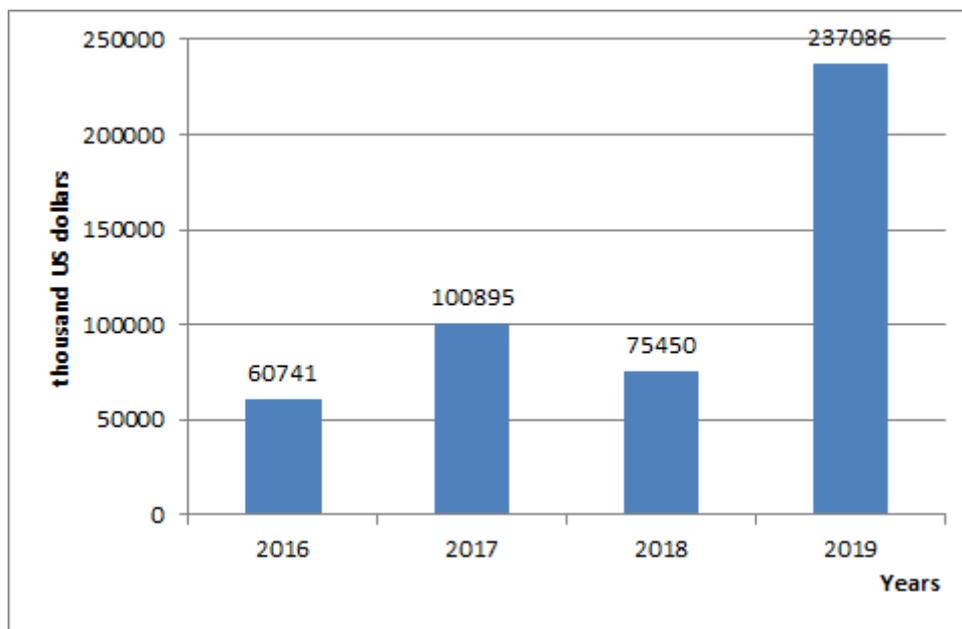


Fig. 1. Qubstudio cost projects basis for the last 4 years

So, the statistics during the last 4 years of the company's income shows gradually increasing comparing the 2016 and 2017 up to 66% and the quantity of the implemented projects by this period changed by 11 points.

Despite the biggest quantity of successfully finished projects by the period of the last 4 years, there is a slight decline in 2018. It showcases that short-time projects bring less profit to the company than long-term.

As you can see the current year shows the rapid growth in the company's activity. For the last year was implemented only 21 projects, which is 12 points less compared to the last year.

Such changes at the company's profit were caused by different factors among them the projects' duration and it's an estimation.

Qubstudio has diversified activities and implements its projects for a range of industries. After, making research, the most frequently applied are showcased on the fig. 2.

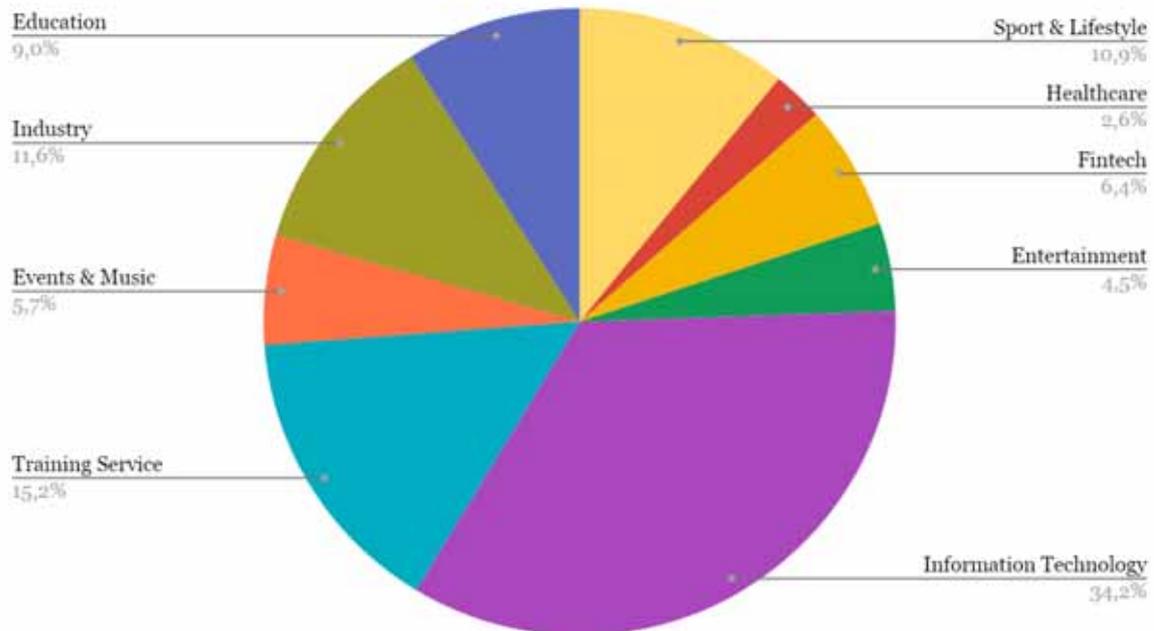


Fig. 2. Project segmentation by business industries for the year 2019

As the 2019 year showed the best profit results during the last year of Qubstudio's activity.

The project segmentation on the fig. 2 showcases that the third part of the profit brings the Information Technology industry. The duration of such a project requires more time that's why they are the most profitable.

Such jumping changes at the Qubstudio's project implementations for the last years might be caused by the approaches chosen by Top management for cost estimate its costs. There is no unified approach for accurate project cost estimation. The company applies an individual approach to each client.

The conducted research on this problem has led to the conclusion that the most appropriate techniques of the project cost evaluation are top-down and the bottom-up. They provide the opportunity to make an express project estimation in the shortest time possible even with incomplete input data about the customer and to make it relevant for all project stakeholders. After projects basis research was made a conclusion that the most applicable methods of project cost estimation are top-down and bottom-up. So, now let's detail on each.

Top-down estimation. The top-down approach to defining project tasks involves starting with the project goal or final deliverable and breaking it down into smaller planning milestones. Each of these milestones is further refined into greater detail, and then work tasks are assigned to team members.

The top-down approach works well when there's a clear vision and date of the a project's details , and the person who is leading it has a big picture of how the project contributes to the organization.

The benefit of top-down is that the major iterations are quickly identified, and the details are later refined by the project team. However, the downside is that details might be missed without a detailed review by the project team.

For incomplete, partial input on the project and the Top-down Estimation is more beneficial in the early stages of software development because detailed information is not available during this stage.

Advantages: It requires very little detail about the project, moreover it, is faster and easier to implement. Unlike other techniques, top-down estimation focuses on activities like integration, management, etc.

Disadvantages: This technique does not take into consideration low-level problems which are difficult and can increase the cost of the system [10].

Bottom-up estimation. The bottom-up approach relies on project team members identifying the tasks and then organizing them into specific groups. If you applied a bottom-up approach to identify tasks for the software upgrade, the entire project team would brainstorm all the tasks required to correctly upgrade the system. There's also a greater chance that a team member will identify an operating system pain point and include a task to improve that feature comparing to the top-down planning. All these tasks can then be logically grouped into sprints according to agile system.

The bottom-up approach results in a more detailed schedule and also a time-consuming approach compared with the top-down task planning. The schedule you create is based on direct input from experts who will be implementing the project (the team that will be involved in the software development). It's also a useful technique for teamwork cooperation. If the organization doesn't have previous experience with the type of project you're trying to plan, this approach helps identify unknown tasks.

The top-down method addresses this key issue, by using the information currently available to provide gross-level estimates. Rolling-wave planning is then used to incorporate new information as it's learned, further refining estimates and iteratively elaborating with more detail as the project progresses. This method of learning just enough to get started, with a plan to incorporate more knowledge as work outputs evolve, allows the project team to react quickly to adversity and changing market demand. Bottom-up estimation is the opposite of the Top-down estimation method. In this method, we derive the cost of each software component and then the result is combined to achieve the overall cost of the software. The goal is to derive a system estimate from the accumulated estimate of the small component.

Advantages: This technique is more stable, helps to identify project's pain points on early beginning, involve team in the process of the task formation.

Disadvantages: It does not take into account the system-level activities like documentation, integration and their associated costs, is more time-consuming compared to the top-down approach. [10].

The top-down and bottom-up approaches are mutually opposite, but both are effective for use at the small company on the IT-industry market. The top-down technique leads the company to form the project database to use it in the future for the projects' estimation as the previous experience. There are peculiarities in each business area and this allows us to increase the evaluation process and make it as real as possible according to mistakes and achievements made before.

The bottom-up technique allows us to improve the microclimate in the team, to involve it directly in the process of tasks' formation, to have an immediate expert evaluation of professionals, which will help to identify risks in the early stages of the project implementation.

These two approaches are optimal for implementation at the small companies' activity. They do not require the involvement of outside resources but instead encourage to use internal professionals and previous experience.

Conclusions: Project cost estimation is an important component of project success. It is used not only for project budgeting but also to provide the information for timeline constraints, cost monitoring and measurement of the project's progress.

Predicting the actual cost estimate required to develop particular software is a tedious task. Planning and budgeting of software project are largely affected by cost estimation, thus it is an essential process in software estimation. Cost estimation if done before the initiation of a project can aid in determining the features which can be included within the limited resources of the project. It also helps in reducing risks. So we can say that overall cost estimation is very impactful for the life and schedule of a software project.

During the last 4 years, Qubstudio's business activity shows a steady increase in the number of successfully implemented projects. The current 2019 year showed incredible profits growth. One of the factors that are a part of the smooth work of the company is realistic project cost estimation.

In the article was proposed two optimal techniques for the IT-industry projects' cost estimation, such as top-down and bottom-up. Among all popular approaches, those are the less time consuming and the most effective from all stakeholders of the project, both from the team's perspective and client's.

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