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STRATEGICAL METHODOLOGY THAT FOSTERS EFFECTIVE CONSTRUCTION PROJECT MANAGEMENT

Introduction/background of the study

“Time - Money”. Effective construction project is of increasing importance to the owners (clients) and contractors. The acceptance of a decision in any activity determined by the project including performance of certain complex works is impossible without stating the purpose, coordination of works in time and space, and development of criteria of estimating production efficiency of works. In connection to this the project management is a creative activity directed on coordination of efforts of all participants including work logic, and other related resources for the interests of achieving the project in view, i.e. performance of complex works in optimum terms, with the minimal expenses and reception of necessary project quality.

To ensure that the set objectives concerning time, money, quality, and safety are met, various team members may apply several project management tools during the different project phases, but the applied tools should deliver at the end favourable condition with regards to project cost.

The projects management has received global recognition [1]. It is difficult to name even one significant project, which is carried out today without the framework of a method of project management and application of the proper methods of work organization. Unfortunately, in theory and practice of projects management, not enough attention is given to coordination of works in time and space. Common connections such as “Time - Money” and “Resources - Money” are proved insufficient at the project management. Efficient usage of workers, machines, materials and money is the essence of construction management.

When the accomplished project result in performance, the budget and duration meet the designed and planned values, the project is a success. In this respect the construction organization is also said to be successful. On the other hand, the same project could be a failure from the point of view of future development if the organization strategy (work organization) which has created the project in question, has lost its validity by the project completion.

Time is money - manage delays. Construction delays costs the construction industries billions of dollars and pounds every year and can make the difference between a profitable and unprofitable contract. No construction industries have time to waste. Therefore, construction works are carried out through workflow organization methods (continuous usages of resources, work front and critical path approach). The construction industries use these approaches in order to regulate the work front to meet-up with the stipulated time on the contract with the aim of achieving the profitable contract. However, despite the use of any of these methods there have always been factors not allowing companies meeting up the time, which leads to contract sum overrun [2-4].

Afanaseyev and Afanaseyev [5] and Tsado [4] developed workflow organization methods which include continuous usage of resources; continuous usage of work front and critical path etc. used at the project management in the construction industry. The global experience in projects management shows that from all varieties of known methods of workflow organization in construction project practice, it's only traditional line methods with critical works (i.e. with the immediate beginning of each subsequent work after the previous one with the presence of a resource and work front) that is being practiced. At the execution of individual projects, unfortunately, other methods of works organization, in particular, project flows with continuous use of resources, continuous development of work fronts and continuous performance of critical works revealed with the present or other combination of resources, frontal and crew connections are not also fully in practice. Besides, for the execution of more than one project (group of projects) at the workflow approach, complex workflow organization which includes combine (keeping projects structure), aggregate (ensuring work fronts of each team that is insufficiently used at the transition (change) from one project to another) and condense (ensuring the minimal duration of whole complex of works) are also available to avoid wastage of time and resources. The work delays due to some certain factors, differential and integral criteria of quality, and also cost criteria taking into account additional expenses arising during construction works should find a due recognition in application of these workflow organizations. The account of these expenses will allow choice in concrete conditions of the most effective variants of work organization, since these expenses vary in work organization methods.

With reference to each concrete case it is necessary to develop all competitive methods of workflow organization to make their estimation by the most important criteria (in particular, by criterion of additional cost expenses arising during construction, repair and reconstruction of projects) and to reveal the most effective variant. In the development of work organization variants it is necessary to take into account influence of all sets of factors on final results, in particular time and work organization factor.

More costs are involved with the project time reduction because construction expense is a function of time and more resources have to be employed. Although management discretion may occasionally dictate otherwise, an effort is usually made to achieve gain in time at the least possible increase in project cost. If project

management is to make schedule adjustments at the least additional cost, then it is necessary to understand how the costs of construction operations vary with time or in other words, the connection of project duration with the project's fundamental entities.

The fieldwork experience shows that to each project or group of projects, in concrete conditions, deviation from the optimum duration of works results to a rise in construction project cost. On the other hand, if reduction is done to a certain level, it gives positive results but if this level is exceeded, costs begin to accelerate [1]. According to this, there is no assurance that existing work duration codes that determine the project costs in many countries meet the optimum duration. Indirectly this proves that the code(s) do(es) not take into account the time and work organizational factors, i.e. the fact that any complex of work (separate or group of project), as a rule, can be executed by various methods that are characterized by their concrete condition of works duration.

According to [5-7] the effective variants of work organization in construction projects, ensuring optimum duration, reveal that the results of project(s) cost accounts do not always coincide with the recommendations of project work duration imposed by the client on contractors without rise in budget cost. However, theoretically and practically, there's possibility for profit return despite the fact that there is additional cost, if appropriate work organization method is applied. The research reveals great interest in the civil engineering and building organization as well as clients, as it requires development of various variants and choice of optimum duration of project works organization guaranteeing minimal project cost. The code of practice (standard codes of construction duration) if any, can and should be considered only as an initial reference, if the codes improve the economic parameters, otherwise it should be discarded from use.

In the search for optimum duration of construction project(s) it is necessary to take into account opportunities of time reduction if possible from the pre-scheduled duration at the aim of achieving a positive economic effect in the project(s) in question and increase of profits from the final product despite some increase in the construction cost. Tsado [7] and Tsado and Bolotin [8] stated that reduction in duration of construction projects with respect to normative is 1.5-2.0 times proportional to cost increase for the investor.

It is necessary to point out that the definition of optimum duration of construction projects ensuring minimal costs is especially needed today in those countries where local codes of work duration and its cost do not exist, and the use of foreign codes is not rational in connection with essential distinction of project work conditions. Contemporaneously, the defined optimum duration of construction projects should be made in view of influence of all major factors (time, and work organization) resulting in cost rise at a deviation from the estimated duration and budget costs.

Consequently, the construction companies use various workflow approaches in order to regulate the work front and to meet up the stipulated time on the contract with the aim at achieving the profitable contract. However, despite the use of any

of these methods there have always been factors of the company not meeting up the time [2, 3, 6].

The failure or difficulties of a construction project management process are caused by factors of different nature [1, 2]. The circumstantial factors that lead to the increase of work duration and its cost are numerous; they could have the character of determinacy and indeterminacy. The determinate factors could be controlled by human efforts while the indeterminate cannot. However, in the research of the factors that leads to the increase of the work duration resulting into rise in construction cost cannot be overwhelmed.

1. Materials and methods

The materials for the research are work organization in engineering and construction management including duration-cost, and the method adopted was comprehensive review of relevant literature and statistical analysis of factor affecting project management.

2. Results and discussions

According to [9] common risks faced by parties engaged in project include: changes in work, delayed payment on contract, financial failure of owner, labour disputes, labour, equipment and material availability, productivity of labour, defective materials, productivity of materials, safety, poor quality of work, unforeseen site conditions, financial failure of contractor, political uncertainty, changes in government regulation, permits and ordinances, delays in resolving litigation/arbitration disputes, inflation, cost of legal process and force majeure.

Tsado [7] stated that the workflow organizational main factors are the factors that have the indeterminate (uncertainty) character, which includes and must be considered during the determination of the actual expected work duration in order to obtain the reliable and profitable construction project completion. The factors that are indeterminate in nature and have the probability character include the following:

- Assumption that the work front is going to be carried out evenly;
- Unforeseen work front break during the work;
- Undefined work;
- Statistical character in the time rating of works.

Consequently, in the determination of the probabilistic project duration these indeterminate factors are major factors that affect the duration and must be considered when determining the effective work or project duration. These factors should be distributed in individual work or may be considered in the whole project duration, and behaviour of these factors are in sinusoidal form and not in linear. In this case the probability (most likely) of work duration should be calculated through the following formula in combating the uncertainty factors

$$t_{prob} = A \left[1 + \left(\frac{B}{A} - 1 \right) Y \right],$$

where A - optimistic and B - pessimistic work duration; Y - uncertainty fortuity number which varies at the range between 0-1.

Since time is money, the increase in the plan duration should be regulated (controlled) in order to obtain profitable construction through the following formula

$$Q_{i+1}^{plan} = \left[\frac{100 - \sum_{i=1}^i Q_i^{actual}}{n - i} \right] \frac{100i}{n \sum_{i=1}^i Q_i^{actual}}.$$

Where n - project % duration control period; index of the individual period (i) = (1, n); Q^{plan} , Q^{Actual} - volume of the plan and actual, work respectively.

Figure 1 shows graphic control comparison of construction project work delay using the above formula to achieve the actual project duration.

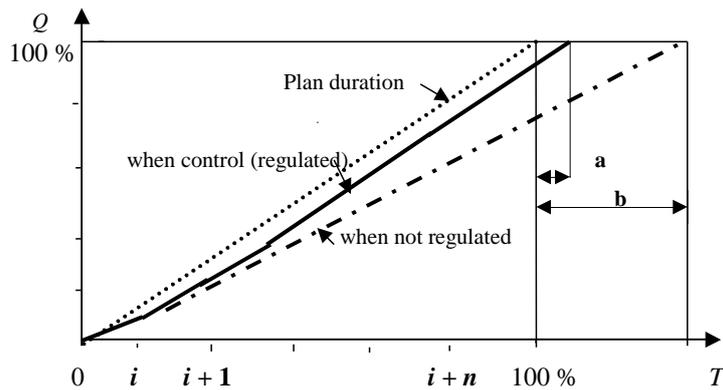


Fig. 1. Graphic control comparison of the construction project work delay

Where a - value of work lateness when the delay is controlled; b - value of work lateness when the delay is not controlled; T - project duration.

Conclusion

Based on the analysis of the results obtained it can be concluded that the strategically methodological approach makes it possible to significantly reduce the cost of construction as well as the total cost of owning, operating, maintaining plants and facilities under the work delay situation. The cost or time savings are due to streamlining the construction chain, bidding more competitively, understanding

the trade-offs between first cost and mean time. The means by saving some time and cost can also be achieved by insurance of time and cost to achieve profitable contract.

Recommendation

To achieve profitable construction project at its initial stage and management process, the work flow method of work organization should be used and corresponding strategically management methodology suggested should strictly be adhered to, that fosters effective construction project management.

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Abstract

It has become almost impossible to have engineering and construction projects completed within the initial time and cost; this is a result of many factors the industry is being plagued with ranging from estimating time and cost. This paper presents strategic methodology that fosters effective engineering and construction projects management with respect to duration/time - cost. The project success is a two-faced phenomenon. On the one hand, project success can be approached from a triangular point of view of project objectives. Performance, cost, time, quality, and safety of a given particular project should be in accordance with the strategic objectives of work logics and methodology at the workflow organization. The main objective of this research is to develop methodology that will help company or individual construction practitioners achieve profitable objectives in the execution of construction projects. For this reason, use of multiple methods of work organization and their competitive model involving several considerations of a wide range of factors, (besides profit maximization and competition) that affect the margin-size decision; use of qualitative and subjective appropriate work organization, to more realistically capture the decision-making process were suggested. The defined optimum construction project works duration should be made in view of all major influential factors as pointed out in this paper (determinate and indeterminate) resulting into deviation of the estimated time and budget cost. At the consideration of the factors the most likely project duration time and it corresponding cost should be regulated (controlled) and some part of the estimates should be saved in form of insurance, and consequently profitable project would be achieved despite the influences of all factors affecting the project.