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Reducing Execution Costs by Using Different Organizational Models in Housing Construction

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Abstract: *The construction processes require ways to align different steps of the project, from the beginning and development of the execution in time and space of two or other processes, between which there is a dependency, which lead to the re-fabrication of construction elements as needed.*
The development of execution procedures, based on the path method, leads to the analyze of the most parameters of a construction project, the cost, the dominant parameter, which ultimately measures the efficiency of housing constructions.
The cost of a construction activity is defined (Hagiu, 2003, p.250) as the general expression of labor, construction materials, and all other equipment needed for the execution of technological and organizational conditions of the construction project to be implemented.
The cost must be interpreted as a general resource of a project, therefore an optimization criterion, has the meaning of the financial resource requirement, as it results from the summation of the partial costs of the resources and can be used for the analysis and optimization of the program for carrying out a final construction work.

Keywords: *cost of constructions*, *construction methods*, *construction processes*, *profit*, *strategy to changes*.

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1. Introduction

It is necessary to establish the time course of the main execution activities. The routine works is established quickly and often informally, but a great project works requires a much more detailed analysis, because in the construction activity, each day of execution steps involves the payment of wages and the use of different machinery, as well as general expenses of the project directly proportional to the duration of the execution. In addition, the general execution schedule estimates the weather conditions in which each component of the project will be executed, which provides extremely valuable information regarding work productivity and equipment yield, the need to take measures for working in cold weather, the need to increase the number of shifts and so on.

2. Methodology

For the documentation of the present article, we analyzed the evolution of housing construction in Romania and in the other parts of the world, with some of the examples that are mentioned by the authors from the present domain.

In this sense, we proposed the presentation of the methods for building houses in Romania and other European locations.

We have identified in the specialized literature the solutions and their application, the effects produced and the way in which they have contributed to the development of the construction sector until now. I also mentioned the future trends depending on the adaptation of the houses to the environmental conditions.

3. Aspects by using different organizational models in housing construction

The three methods of organizing the execution of construction processes are: the successive method, the parallel method and the chain method.

The realization of a construction work is not the result of the application of only one of these methods, since for the realization of different elements, a combination of the three methods is adopted, depending on the constructive technological and organizational conditions.

A. The successive method proposes an unfolding in time and space, through which the processes are executed one after the other, on

successive sectors, so that, at a given moment, only one process is carried out on the construction site. This method can be applied in two ways:

a) In the first variant, it is aimed that through the sequence of processes on each sector, it is finished in the shortest possible time, at the same time, executing a single process on a sector, the execution of the sectors, as a finished work, is carried out by adding up the processes.

The application of this variant of the successive method has the following advantages:

1. It requires a reduced number of workers on the construction site, which determines the reduction to a minimum of constructions for the organization of the construction site with a social character (accommodation, changing rooms, dining rooms, etc.);

2. The daily consumption of materials is reduced (associated with the reduced number of workers) which determines a minimum of means of transport and constructions for the storage of materials;

3. Sectors are finished quickly, corresponding to a certain stage (stages) of project execution.

The application of this variant has the following disadvantages:

1. The total execution time of the works is very long.

2. The fundamental principle in organizing the execution of the processes is not ensured, the continuity, the interruptions being large in the activity of each formation of workers, between the end of a process on one sector and the beginning of the same process on the next sector, which implies the stationary of the machines with which the respective formations are equipped, implicitly non-productive expenses. The use of this variant is conditioned by the application of the following corrective measures:

- ✓ Combining the execution of several works, so that in the given time interval, the formations are moved to other works, in order to ensure their continuity. The solution is not applicable to those processes where machinery that cannot be moved participates, as the cost of moving them is very high;
- ✓ Execution of all processes with a single complex formation that includes multi-skilled workers, capable of executing all processes. The solution is applicable for those processes between which there is technological compatibility, but it has the disadvantage of reducing labor productivity.

b) A second variant of the organization of the execution of the processes, through the successive method, is determined by the idea of ensuring continuity in the work of a formation that executes a process on all

sectors, after the completion of which the execution of the second process on all sectors begins, etc.

The application of this option has the same advantages as the previous option, in addition, it ensures the continuity of work of the groups of workers in their transition from one sector to another, within the same work.

This variant has the disadvantage of a long total duration, the occurrence of periods of interruption between the end of a process on one sector and the beginning of the next process on the same sector.

There are successive processes between which no interruptions are allowed. Thus, excavations for the foundation of a building must not be left uncovered without concreting, because water or rainfall causes damage to the excavation and leads to additional costs caused by the restoration of the work.

B. Organization of the execution of the processes through the successive method, can be used especially in the case of isolated works where there are difficulties with the recruitment of the labor force, the supply of materials, and the commissioning period allows for a long execution time. The adoption of one of the two options will be done depending on the concrete conditions of execution of the houses.

The parallel method provides for the arrangement and deployment in time and space, so that a number of formations simultaneously execute a process on a corresponding number of sectors. At the maximum limit, the total formations number is equal to total sectors envolved in the project.

The application of this method requires the introduction of a considerable number of workers, which involves ensuring the supply of materials and equipment, in appropriate quantities that allow the activity to be carried out without interruptions.

The essential advantage of this method of organizing the housing construction activity consists in reducing the duration of execution, a reduction that can be maximum when the formations are equal to total number of sectors. The parallel method is applicable when there are at least two working formations.

The parallel method has the following disadvantages:

l. It requires the total work area, in case the method is applied at the maximum limit, in order to simultaneously introduce the formations of workers in all sectors;

2. It requires large concentrations of materials and equipment at the work point;

3. The expenses for site organization constructions (social, administrative, warehouses, warehouses, etc.) are considerably higher compared to the successive method;
4. Coordination is difficult.

The two mentioned methods (successive and in parallel) are located in diametrically opposite positions, as a way of conceiving the layout, start and development in time-space of construction works and from the point of view of production costs.

The task of the project manager includes the control of all aspects related to receipts and payments: the preparation and transmission to the beneficiary of estimates and periodic payment requests, tracking their collection, tracking payments (for salaries, material purchases, to subcontractors and other partners) , preparing the necessary documentation for the final payment.

Thus, the construction contracts provide for the way in which the payments between the beneficiary and the builder must be made. Usually the beneficiary pays the builder a monthly amount equal to the value of the works carried out in the previous month, which is based on payment statements, drawn up by the builder, which determine the required payment, depending on the type of contract.

The profile of the cash flows of a general contractor or a subcontractor generally follows the evolution of the works performed for which the investor pays periodically based on the status of the works.

The total value of the contract paid in monthly installments, by the investor, constitutes the management expenses as well as the contractor's profit, and the receipts are reduced with deductions for any advances and guarantees reimbursed by the investor at the end of the construction.

The payments made by the contractor generally appear continuously, throughout the execution of the houses, while the collections are periodic and ahead of the time of making the payments. The cash flows of payments and collections are different depending on the type of construction and the provisions of the contract.

The net cash flow (A_t) at the end of a period t:

here:

$$A_t = I_t - P_t$$

I_t = the proceeds from the investor at period t;

P_t = payments the entrepreneur made in period t;

A_t = is positive for a surplus of funds in favor of the entrepreneur and negative for a deficit.

The net cumulative cash flow (F_t) from the beginning of the housing execution program to the end of period (t-1), before the receipt of I_t

$$\mathrm{Ft} = \sum_{0}^{t=1} At - Pt = Fnt - 1 = Pt$$

where:

F_{nt} - 1 = net cumulative cash flows from 0 to period (t-1).

The cumulative net cash flow (F_{nt}) after the collection from investor I_t at the final moment of t (t>l) is:

$$F_{nt} = F_t + I_t = F_{nt} -1 + A_t$$

The total profit (P) for a housing construction completed in n periods is equivalent to the net cumulative cash flow at t = n and is given by the formula:

$$P = \sum_{t=0}^{1} (It - Pt) = \sum_{0}^{n} At$$

The use of "P" as a measure of total profit has the disadvantage that it does not capture the evolution over time of the entrepreneur's cash flows, the current value of the money and finally does not signal the negative influences that periodic payments in advance of the investor's receipts have on the entrepreneur's profit.

Therefore, the builder must constantly monitor his receipts and payments and achieve the best possible balance of them in the short term, maintain a good relationship with the beneficiary, send him payment requests on time and follow up on the performance as much as possible possible payment soon. It is also advisable that the monthly payments for material purchases and to subcontractors be made after receiving the advances from the beneficiary.

The evolution of the project cost is typical for most housing projects, and the distance between the two curves represents the amount invested by the builder up to that point in the project.

Minimizing the negative flow of income and expenses can be achieved by shortening the period of preparation for the construction of the

houses and the organization of the related construction site. It should be noted that the beneficiary pays the contracted value of the work, not its costs, and when the builder realizes savings, they will lead to an increase in profit and conversely, if he records losses due to his fault, the profit will decrease (Radu, 2000, p. 359).

There are situations when the beneficiary requests some changes to the project or these changes are requested by the builder, given the conditions on the construction site. They are negotiated between the beneficiary and the builder, being the subject of an additional contract. The builder must estimate the new value of the work, redoing the scheduling schedule of the activities to be executed and their value. Usually, these changes extend the execution time and negatively affect the work schedule by postponing some activities from the warm season to the cold season, which implies additional costs.

The extension of the execution period of the houses has implications on the increase of expenses general, having as a consequence the corresponding increase in the value of the construction project. It is obvious that the simultaneous satisfaction of these three requirements (reduction of costs and duration of execution, in parallel with the increase of quality) is difficult to achieve, being possible only in the case of technical or organizational changes of the scope of the construction project.

These objectives must be solved taking into consideration the conditions imposed on the execution of the houses: the duration and cost established by the contract, maximum available level of resources, etc.

The adaptation of construction companies to changes in the natural environment is seen as a measure to develop reaction mechanisms to climatic shocks, which means reducing CO2 emissions, using recyclable materials, making ecological constructions, etc. (Taşcă, 2009, p. 22). Greening includes the actions to achieve a balance between the company and the environment, oriented towards the optimization of results, which aims to know, analyze, anticipate climate risks, make insurances that cover climate risks, develop action plans in case of calamity, carry out projects with the aim of reducing the effects of climatic shocks and ensuring financial reserves for emergency situations (Porter, 2007, p. 3; Şerbănoiu, 2009).

The effects of the climate on the operations of the enterprises have always been tangible and certain because the activity takes place even in winter conditions. Moreover, the adaptation of strategies to climate change is topical not only in Romania but in the whole world, but without permanent concerns that lead to practical actions to a sufficient extent.

Through good management of climate change, the impact can be positive through the existence of real opportunities that derive from changes in the business environment. Thus, it is considered that the company's financial performance will not be negatively influenced by climate change, even if its strategy will not be adapted to climate change.

Active adaptation to climate change manifests itself in the sense that climate change is anticipated first, concrete measures are taken in this direction, and the results are improved, although a small number of the companies active in construction have strategies regarding changes in the natural environment.

There are also a series of objectives specific to the process of adapting the strategy to climate change that aims at the loss prevention process that contains the elimination or modification of construction production processes (example: frost, high temperatures, etc.) vulnerable to climatic shocks, exposure to risk not being justified by the benefits brought by the respective activity of the company.

Another objective pursued is the reduction of their losses, which can be achieved by developing a package of measures to be taken after the occurrence of climate shocks, based on a tactical action plan, developed in advance.

Risk transfer can be one of the company's strategic objectives regarding climate change, by outsourcing activities subject to climate shocks, giving up activities that can be seriously affected by climate change (wet processes).

Among the external opportunities, the financial ones provide financial incentives to adapt the company to explicit environmental changes, or in the form of non-refundable financing.

In turn, the legal regulations in the field can represent a constraint or an opportunity. Compliance with certain legal norms related to production, financial management or asset insurance can lead to a calculated behavior, which includes anticipations regarding climatic developments, their impact and solutions to avoid potential consequences.

Apart from the opportunities, there are also a series of constraints of a financial, technological, informational, time nature, related to access to viable alternatives or adverse or uncertain regulations.

A possible limitation of the adaptation of enterprises to climatic changes is expensive, considering the expenses incurred from its implementation, it being advisable to carry out a cost-benefit analysis to study the necessity and opportunity of such an initiative.

Analyzing the relevant information, it is possible to determine the possible impact of climatic changes on the activity of the construction company and proceed to the stage of developing scenarios regarding possible future developments, which may refer to the best or worst variant of climatic impact, the most likely option or other scenarios can be developed and considered relevant. Regarding the possible impact on the activity of the construction company, it is necessary to determine to what extent this impact can be positive or how this impact can be maximized. In this context, it is necessary to determine the exposure to environmental risks. Thus, it is possible to identify and analyze the risks that cannot be avoided during the activity and their impact cannot be reduced, the risks that cannot be avoided but whose impact can be reduced, as well as the risks that can be avoided in the process (the inappropriate quality of toys made in cold weather).

Environmental risk assessment involves estimation (including the identification of hazards, the extent of potential effects and the probability of a dangerous manifestation) and risk calculation (including the quantification of the importance of hazards and consequences for people and/or for the affected environment (Rojansky, 2004, p. 23).

A desired is represented by the development of the activity of the enterprises in the perspective of a good development, which satisfies the expectations of the present without reducinf the ability of future generations to satisfy their own needs. For the construction company, sustainable development means the adoption of business strategies and activities that meet the needs of the company and its stakeholders today, while protecting, supporting and developing the human and natural resources that will be needed in the future.

At companies larger level (Taşcă, 2021), changes in the natural environment have clear and significant financial implications, in the sense that companies are not currently prepared to face the effects of changes in the natural environment that have a predominantly negative impact on the financial resources of companies, as assets can be damaged by some shocks climatic conditions, turnover may decrease or other effects of this type may appear.

In this context, a preparation is required in the perspective of the production of changes in the natural environment, which involves the allocation of financial resources regarding the realization of studies and researches regarding the potential impact of climate changes; strategy adaptation process; making insurance contracts; the implementation of

specific personnel trainings, as well as the creation of financial reserves, an internal fund created for the reaction to environmental changes.

In the situation when the process of adapting the strategy to changes in the natural environment was not carried out correctly or when these changes could not be anticipated, unforeseen expenses of a significant volume appear.

In addition to these financial implications that belong to the internal resources of the enterprises, the existence of an external framework is necessary to coordinate the financial aspects of environmental changes, in this sense it seems appropriate to create some financing mechanisms for economic agents in the perspective of climate change. Insurance services, in their classic operation, cannot adequately ensure the protection of companies in the face of large-scale changes. Some radical changes in the natural environment can produce changes in the business environment large enough to block the classic systems of protection against risks and compensation in case of calamity.

We believe that in order to ensure an adequate reaction of construction companies to changes in the natural environment, especially from the point of view of financial performance, it is necessary to complete the institutional framework that offers both informational and financial assistance.

The present context, characterized by an important economic and financial crisis, is not a factor that stimulates the understanding of the existing relationships between own development, sustainable development; the changes in the natural environment and the process of developing their own strategies and will not have the chance to properly face the challenges caused by both the global economic context and the ecological context. At the same time, it is necessary to start some programs designed to facilitate companies' access to consulting services or specialized training.

4. Conclusions

A duration of execution can be calculated under specified technological and organizational conditions, just for a shor example: good temperatures; quality materials according to standards; good machinery and tools, the newest in the domain; the supply of work; the formation of workers, the work front provided according to the dimensions of the workers, for the development of work, etc.

The duration of the activity in line with normal working conditions is considered the maximum duration, because exceeding this duration leads

to the use of equipment and labor under capacity and the normal execution cost can be calculated based on the corresponding consumption of materials, labor and equipment.

The cost of capital supply can be reduced if, during the construction of housing, the activities are rushed, which requires the concentration of additional resources (materials, labor force, machines) and as such, increases the cost of the activity. The shortening of the normal duration of the activity and the related additional expenses depend on the nature of each individual activity. The technological explanation for the increase in the general resource, cost, with all other specific resources, is that acceleration means additional consumption of resources, respectively disadvantageous conditions: payment of overtime hours, night increments, expenses for teams brought exceptionally above the site's availability, costs additional for the creation of material warehouses, the purchase or rental of additional machines, etc.

The cost of machines and construction equipment and stuff have an important role in the cost of housing. When a work in progress requires important machinery involved (excavators, har transportation machines, etc.), it is necessary to carry out studies at a highest level of ambition. That's why it is necessary to make early decisions regarding the type, size and number of machines that will be used, as well as the method of procurement. In this context, renting can be a solution when the construction site is at a far long distance from the other projects of the constructer or when the company does not have his own necessary equipment. In the event of a shortage of machines in the endowment, it is possible to resort to purchasing through leasing, a method preferred to buying. If the equipment is on his property, the hole range of expenses with the equipment are expressed as a sum of different factors: cost depreciation, increasing taxes, insurances fro equipment and machines, storage of the materials, etc.

Consequently, planning the execution of housing is defined as a design concept activity, with the following objectives:

- establishing all the actions to be carried out for the execution of the project;
- the clear description and representation of the actions and the correlation between them, in their unfolding in time and space;
- dimensioning of the required resources for housing construction.

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