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Features of Execution and Financing Housing Construction in Romania

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Abstract: *The execution of housing constructions is carried out on the basis of a preliminary, orderly thinking, on the concrete ways of realization, by concentrating the human and material forces, resorting in this sense to a multitude of technical solutions (Taşcă, 2012).*
All the activities, actions and natural process that take place for the organized, led and carried out transformation of people, of the objects of work with the help of means of labor after obtaining "some products specific to the construction activity: new constructions, current and capital repairs, consolidations, modernizations, construction services, etc.
The minimum requirements for housing provide that it consists of rest area, space for food processing, bathroom, access to electricity and drinking water, controlled discharge of wastewater and household waste (Şerbănoiu, 2009).

Keywords: *housing financing, technical project, Kelly's algorithm, cost of construction, Gantt chart, insurance contract.*

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1. Introduction

The activity of housing construction is carried out in accordance with the technical project and specifications that are developed based on the feasibility study and represent the written and drawn documentation for which the construction permit is issued. At the same time, they provide the contractors with the necessary information for drawing up the execution offer and are attached to the contract for the execution of the housing, which is concluded between the financier (or the beneficiary of the project) and the contractor.

The construction of a house involves two distinct stages:

- in a first stage, the technical project (PT) is elaborated, which establishes the dimensions, the form and the structure of the construction elements and the work in its totality, rendering the designer's conception on the technical constructive solution of the house;
- in the second stage, the execution of the work is carried out, through a complex of construction processes and actions of a technical, economic, organizational, administrative nature, for the transformation of materials into housing.

Another trend that manifests itself in the elaboration of the technical project is maximum utility, in the sense that it must propose solutions for the house to be functional (resistance structure, installations, closures, partitions, etc.) and to best satisfy the beneficiary.

The organization of the execution of the technical project of the construction work represents the totality of the conception-design activities regarding:

- description of the development in time and space of the execution of the technical project related to the construction;
- sizing the necessary manpower, materials and equipment;
- time distribution, location, sizing, evaluation of constructions and site organization installations.

2. Methodology

For the correct estimation of the project (housing construction) it is necessary to establish the development in time of the main execution activities. The schedule of small and routine works is established quickly and often informally, but that of large works requires a much more detailed

analysis, because in the construction activity, each day of execution involves the payment of salaries and the use of equipment, but also expenses of the project directly proportional to the duration of the execution.

For this study, we have to look to the perspectives of housing constructions in Romania, the literature written in the domain (both construction and finance) and from these points to indicate, to analyze ant to interpret the results that we expect from the technical point of view and also the ways of financing them properly.

3. Phases of execution/financingof a housing construction project

The phases of execution and financing housing construction can be observed by stages, as shown below:

a) The technical project represents a set of written and drawn pieces related to the future dwellings.

I. The written parts of the technical draft include:

1. General description of the works that are the subject of it, namely: location; topography; climate and natural phenomena specific to the area; geology and seismicity of the area;
2. Presentation of the project by volumes, brochures, chapters;
3. Site organization
4. Temporary access roads;
5. Water sources, electric power, gas, telephone (for site organization and final);
6. Access roads and communications;
7. Work execution schedule;
8. Protection of the executed works and of the materials from the construction site;
9. Cleaning on site;
10. Sanitary services.

b) The specifications are the written description of the execution works of the houses and are elaborated by the designer, being an integral part of the technical project. They are documents by which the designer expresses the requirements and performances of the works being executed, the description of the technical and technological solutions, the characteristics of the materials used, their testing and the works, the order of execution and assembly, the final appearance, the technical elements mentioned in the drawings and provides information. Specifications and prescriptions complementary to the plans regarding the determination of the

quantities of works, the costs of works and equipment, the labor force and the endowment necessary for the execution of the dwellings.

At the same time, the specifications stipulate the obligations and the way of monitoring the time behavior of the constructions, as well as the measures and actions of dismantling, demolition and reintegration of waste in the natural environment at the expiration of the life of the dwellings.

c) The lists with the quantities of works include the elements necessary for the quantification of the value and the duration of the execution of the investment: the centralizer of the objects, by objectives; the centralizer of the categories of works on objects; lists of quantities of works by chapters of works, with their detailed description; lists of quantities of machinery and technological equipment; technical specifications.

d) The general schedule for the realization of the investment presents the overall staggering of the activities in order to achieve the investment objective.

II. The drawings of the technical project consist of:

1. General plans (location of level landmarks and planimetric, topographic, location of construction objectives, vertical systematization of land, for underground construction);

2. the main drawings of the objectives;

3. the main plans with dimensions, dimensions, distances, areas, etc., (specifying their finishes and quality);

4. structure (drawings with the composition and execution of the resistance structure for each construction object, differentiated by infrastructure and superstructure, with dimensions, characteristic sections, recommended construction solutions, execution and assembly technologies, transport, handling, storage, assembly);

5. installations (drawings for execution on each object, plans of location of the equipment, main schemes of the installations, etc.);

6. technological endowments and installations, etc .;

7. furniture equipment, household inventory, fire protection, labor protection.

For the proper construction of the dwellings, the execution details are elaborated after their contracting, by contractors or designers for investment execution needs and are based on the information provided by the technical project, specifications and pre-measurements, but take into account the technical, technological solutions. and constructive measures adopted by contractors in the execution of housing construction works.

The execution of construction processes involves specific ways of arranging the start and development of the execution in time and space of two or more processes, between which there is a strict and unique dependence, which lead to the realization of construction elements.

In the elaboration of the technical-economic documentation of the houses, a special place is given to the design activity in order to manage the funds with maximum efficiency, which uses a system of indicators - of volume, structure or economic efficiency - from which we mention:

1. The area occupied by the entire investment objective - block of flats, detached house, (At) and expresses the entire area removed from the agricultural circuit or disused on which the objective will be located.

2. The built surface (A_{cl}), represents the area of the construction land included in the outer perimeter of the surrounding walls, determined at ground level, which includes not only the house itself but also the warehouses of materials, barracks, etc.

3. The developed built surface (A_d). Most of the houses built are on several levels, thus extending vertically, which leads to an intensive use of the built surface. This developed built-up area consists of the sum of the built-up areas of their horizontal section, basements, ground floor, floors and attics (excluding circulating or non-circulating bridges) included in the outer contour of the surrounding walls.

4. Usable area (A_{cl}) Its size depends on the built-up area and the thickness of the walls. It consists of the sum of the areas of horizontal sections of all rooms, measured by interior dimensions.

5. Circulation surface (A_{cc}). It consists of the built surface, useful, intended for the movement of people, horizontally and vertically.

6. Degree of land occupation. This indicator expresses the share of an area of the built-up area in the total area occupied by the dwelling and is calculated according to the following relation:

$$G_1 = 100 * A_{cl}/A_t$$

in which:

G - represents the degree of occupation of the land with buildings;

A_{cl} - the built surface;

A_t - the area occupied by the entire investment objective.

Normally, this indicator should have as much value as possible, although the remaining unbuilt area is intended on the one hand for the external movement of people and vehicles, but also to create a more pleasant environmental system around the house.

7. The density of buildings expresses the developed built-up area, which is 1 square meter of land area.

The calculation formula is:

$$G3 = A_d / A_t$$

in which:

G3 represents the density of constructions.

8. The degree of use of the developed built surface characterizes the proportion in which the useful area is compared to the developed area and is determined according to the following relation:

$$G_4 = 100 * A_u / A_d$$

in which:

G_4 - represents the degree of use of the developed usable area;

A_u - usable area.

In addition to the construction processes, technical, economic, organizational and administrative actions appears in the realization of a construction project. The execution of construction processes imposes a need for resources, and their provision, quantitative, qualitative and at the right time, conditions the execution of housing. Thus, the supply, storage and handling of materials is a set of actions essential for the execution of processes. Another set of actions is conditioned by the provision of utilities on site: water supply, electricity, spaces for workers' accommodation, storage spaces, etc. Also, during the execution of the construction processes, the control actions take place, on which occasion the quality conditions of the previous processes are verified (obligatorily, according to the norms and standards), before moving on to the next ones.

The set of start and end dates of all actions related to the realization of a construction project, forms the program of deadlines.

The timing of the completion of an action depends on the timing and duration of an action. In turn, the duration of an action depends on the amount of resources available. However, they are, on the one hand, a function of total availability and consumption due to other actions taking place in the same period of time, consumption which is not entirely known, because at the time of scheduling an action not all other actions are already scheduled. Corresponding to a program of deadlines we have a program of resources, in the form of the total necessary quantities and the distribution in time, on the periods of execution of the actions for which they are destined. The program of resources depends on the program of deadlines and, in turn, conditions the program of deadlines.

For scheduling the execution of housing construction projects, the literature indicates the application of the Kelley algorithm, on resource allocation, which requires the following steps:

1. Solving all problems related to the elaboration of the program with time analysis: project analysis and establishment of the list of activities, elaboration of the network schedule, establishment of activity durations, calculation of network schedule elements, analysis of temporary constraints, integration and condensation of the schedule, calendar transposition of the network schedule, assuming the start of activities at the minimum term, which is the reduced program);

2. Draw the profile of the analyzed resource, corresponding to the program. If it falls within the limit imposed by the maximum availability, then the program is considered good.

3. The process of scheduling the activities from the first day begins; scheduling each activity as early as possible, within the limits of what is available, proceeding as follows:

a) If an activity cannot be scheduled on time, due to exceeding the available, it leads to the postponement of the start by one day (implicitly to the postponement of the activities immediately following);
b) among several activities that simultaneously compete in the programming, the activity with the lowest total reserve, available at the time of programming, has priority, so after part of the total reserve has been consumed, as a result of previous trips, critical initial activities or who have become critical will have first priority;
c) between two or more critical activities (some initially critical, others that have become in progress) that compete for allocation, the one that has already started has priority (it is considered that a started activity cannot be interrupted); the others are postponed;
d) between two or more activities having the same priorities, from point "b" and "c", one or more are used that make the most complete use of the available resource;
e) between two or more activities having the same priorities, from the point "b", "c" and "d", the activity with the shortest duration is preferred;
f) following the application of the rules from the previous points, it is normal for the loyal duration of the program to exceed the

initial duration, if it is considered unacceptable, the initial data (available, duration of activities, network schedule) change.

This algorithm can be used to develop the program that deals with the allocation of electricity for the construction of a home, as shown in the graph.

The terms of the nodes in the network graph and the total reserves of activities are calculated. With these elements, the reduced program is elaborated, reproduced through the calendar plan, from which we remind: the activities are ordered after the minimum start term, for two or more activities with the same minimum start term, the following priorities are given: 1. critical activities; 2. activities with the lowest total reserve; 3. activities with the shortest duration.

The development of execution scheduling procedures, based on the critical path method, leads to the examination of the most important parameter of a project, cost, the dominant parameter, which ultimately measures the efficiency of housing construction.

A program developed, by the critical path method, with the analysis of the time parameter, has a normal duration, because each activity has an evaluated duration for normal execution conditions, these being expressed either by time norms or by the conditions underlying the calculation. duration.

Activities can be expedited, accepting additional expenses. The possibility of reducing the duration and related costs depends on the nature of each activity. In this sense, there are often a large number of possibilities to carry out certain activities, using different technologies, machines of different capacities, different concentrations of workers, different regimes and work programs, etc.

Moreover, the cost of a construction activity is defined, as "being the monetary expression of the consumption of resources - labor, materials, equipment - necessary for a quality execution, in given technological and organizational conditions" (Hagiu, 2003).

The cost interpreted as a resource, therefore an optimization criterion, has the meaning of necessary financial resources, as it results from the sum of the partial costs of the resources and can be used for the analysis and optimization of the construction program.

For any construction activity, an execution time can be calculated under specified technological and organizational conditions: ambient temperature above + 5°C; quality materials according to the STAS in force; machinery and tools in good working order; rhythmic supply of the workplace; the workers formation, the working front ensured according to

the dimensions of the workers' formation, for the normal development of the work, etc.

The duration of the activity determined by the normal working conditions is considered the maximum duration, as exceeding this duration leads to the use of the equipment and labor under capacity and its normal execution cost can be calculated based on the corresponding consumption of materials, labor and machinery.

The cost of capital sources can be reduced if in the construction of housing activities are accelerated, which involves additional concentrations of resources (materials, labor, machinery) 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 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, at a disadvantage: overtime pay, night bonuses, team expenses for the creation of material warehouses, the purchase or rental of additional equipment, etc.

The reduction of the normal duration of the activity, through the additional allocation of resources, has a technological limit, respectively: a minimum duration, representing the physical impossibility of speeding up the work. Thus, a work that requires 500 man-hours will not be able to be done in an hour with 500 people.

As a rule, the builder requests and receives price offers for most of the materials needed for the work. All material costs must have a common basis of calculation and include transport, unloading, storage and reception and are calculated without VAT, which is added at the end, globally.

Labor and equipment cost reports must be made sufficiently frequently to detect in a timely manner any cost overruns foreseen by the estimate. The intervals at which it is drawn up depend on the type and size of the project and the type of contract (Florea, 2017) and there must be a direct relationship between the costs of drawing up the reports and their usefulness. The daily reports are drawn up for the projects that are being worked on in several shifts; for large projects, with extensive classifications of works, monthly reports are prepared and even at longer intervals, but for most construction projects it is good to prepare weekly reports.

In order to estimate the housing costs as accurately as possible, it is necessary to make decisions on how the execution will be conducted and organized, the main methods used in construction, the order of operations, the equipment to be used, etc.

A project cannot be evaluated unless it is determined how it will be organized. In order to adopt such decisions, a useful method is to organize an analysis with the future project manager, as well as the future site manager, where the main aspects of the work, the elements necessary for execution, the various construction alternatives, etc. will be discussed.

The general schedule of the project is a Gantt chart, which estimates the start time, duration and end time of the main components of housing construction.

In the construction activity two categories of general expenses are used:

a) Overheads of the project, which represent the overheads incurred on site and which are determined exclusively by the project, usually 5-15% of the direct costs of the project but may vary substantially from one project to another, and the only way to correctly estimate these expenses is the detailed analysis of this type of costs.

b) General office expenses represent a share of the general expenses of the construction company (office rent, insurance, heat, electricity, telephone, office supplies, etc.) and have a level between 2% and 8% of the turnover of manufacturer.

The addition is added at the end of the project and represents between 5% and 20% of the estimated cost and includes a whole range of risk margins as well as the builder's profit. It depends on the size and complexity of the project, location, estimated risks and difficulties, the brand name of the builder and other intangible assets.

Conclusions

For the correct estimation of the project it is necessary to establish the development in time of the main execution activities. The schedule of small and routine works is established quickly and often informally, but that of large works requires a much more detailed analysis, because in the construction activity, each day of execution involves the payment of salaries and the use of equipment, but also expenses of the project directly proportional to the duration of the execution. In addition, the general execution schedule estimates the weather conditions under which each component of the project will be executed, which provides extremely valuable information on labor productivity and machine efficiency, the need to take measures to work in cold weather, the need for increases: the number of exchanges etc.

One of the most difficult problems is determining the costs of labor and equipment. These are inherently variable elements and difficult to estimate. Therefore, a complete analysis of the work and the use of an extensive database on the productivity and costs of the activities carried out in previous projects is necessary. The estimate must also be based on a detailed decision on how the construction will be carried out.

The cost of machinery, installations and construction equipment has an important weight in the cost of housing. When a certain work requires important equipment (excavators, concrete mixers, etc.) it is necessary to carry out detailed studies. Therefore, it is necessary to make early decisions on the type, size and number of machines to be used, as well as how to purchase. In this context, renting can be advantageous when the site is far from the other work being carried out by the builder or when he does not have the necessary own equipment. in the event of a shortage of equipment, leasing can be used, a preferred method of purchase. if the machine is the property of the manufacturer, the costs of the machine are expressed as the sum of operating costs, depreciation, taxes, insurance, storage, etc.

In developed countries, all construction contracts, including housing, provide for the general contractor to provide the beneficiary with financial protection against non-compliance with its contractual obligations. Through the contract concluded with the beneficiary, the constructor assumes two clear responsibilities: to execute the works provided in the contract and to pay all the expenses associated with this.

A contract insurance is an agreement by which an insurance company undertakes to take over the obligations of the manufacturer, if he fails to comply with them. For the two categories of obligations, there are two types of insurance: "execution insurance" and "insurance for the payment of material and living expenses". The manufacturer must procure these insurances from the insurance company he works with. The cost of these insurances is substantial and must be included in the price estimate.

All categories of expenditure must be summed up and reported at regular intervals, usually on a monthly basis. This report includes both direct and indirect costs, being used to forecast the final cost of the work.

In order to make the forecast, it is assumed that the ongoing activities will be completed with the current productivity, and the activities not yet started will be carried out according to the budget. Exceptions are cases where better cost information is available or there is a visible reduction in unit costs.

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