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TECHNIQUES AND INSTRUMENTS USED IN CONSTRUCTION PROJECT MANAGEMENT COSTS DIMENSIONING

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The paper aims to establish a series of methods regarding the dimensioning of the main economic parameters specific to the accomplishment of a building design, parameters generally linked to the total cost of the project. The total realization cost of a construction project represents the money expression of all "efforts" (labor force, material resources, equipment and technological units, informational resources, services, taxes, technical-administrative actions, etc.) necessary for the realization of the project in all its constitutive stages.

1. Introduction

By obtaining the information regarding the component activities of a construction project as well as the necessary resources for its realization, in the elaboration phase of the project some estimates can be made regarding the total cost of the activities, resources and of the whole project eventually.

The particularities of the building activity as well as the long period of realization of a construction project impose certain techniques of evaluating the realization costs. One could say that there aren't two construction companies to use the same evaluation modalities.

The evaluation of the realization costs in the phase of elaboration of the construction design has a predictive character representing the best approximation that can be done, corresponding to the time of their realization, depending on the capacity and managerial culture of the company which executes the design. These costs are referred to as programmed costs (or prevision costs).

2. Cost Dimensioning

In the dimensioning of the realization costs of a construction project the following stages are to be referred to:

a) Establishing the sources of information necessary to a most accurate evaluation of the costs.

b) The elaboration of the execution program, by which the duration of realization of the project is set, as well as the realization terms of some component activities or works stipulated in the construction documents thus determining the necessary labor means for carrying out the project. On the basis of the execution program the execution costs can be determined proportional to the programmed duration as well as the costs summing up at certain time intervals.

c) Choosing and applying the evaluation method.

Among the most frequent and well-known methods used in cost dimensioning are:

I. *The method of "units in use"*. Many types of constructions are characterized by repeating the units in use (ex. number of beds in a hospital, number of seats in a school, number of apartments in a residential building, number of offices in an administrative building). This method is used in the first stages of project elaboration as a comparison basis between various variants of the same type.

II. *The "area" method* is one of the most frequently used methods and is based on the total area covered by a building.

III. *The "systems" method*. In this case the basic unit is the same as in the area method, but it considers each category of sub-systems of the building separately (infrastructure, suprastructure, closings, compartments, installations, etc.). For each sub-system the price per square meter of covered area is considered separately.

IV. *The method of evaluation through reference to the revenue costs* consists in establishing the costs of carrying out a construction project starting from the assessment of real costs recorded in the realization of some construction elements, activities, categories of similar processes done by the company which executes the project. In this sense a data base is compulsory, one which should comprise the necessary information.

V. *The method based on "consumption norms"*. The method requires the project to be finalized in the detail phase of execution thus setting the normed consumption of resources for the realization of the construction processes under certain technological and organizational conditions stipulated by the norms.

VI. *The method of detailed evaluation* consists in detailing the quantum of necessary resources needed for each activity or construction process (labor force, materials, equipment and technological units) depending on the site conditions. It is a very laborious yet accurate method.

3. Methods of Cost Dimensioning for the Realization of a Construction Project

3.1. Dimensioning of the Total Cost of Realization of a Construction Project

Is realized utilizing the relation

$$(1) \quad C_T = C_{AT} + C_{INF} + C_{PE} + C_E + C_D,$$

where: C_T is the total cost of realization of a construction project; C_{AT} - parameter

which underlines the group of costs regarding site work; C_{INF} – parameter which underlines the group of costs regarding the realization of infrastructure works necessary for the realization of the construction objects; C_{PE} – parameter which underlines the group of costs regarding the activities of designing and engineering; C_E – parameter which underlines the group of costs regarding the execution of the component construction objects; C_D – parameter which underlines the group of various and unforeseen costs regarding the realization of the project.

3.2. Dimensioning of the Total Cost of Realization of a Construction Project on its Realization Stages

The following parameters related to the realization costs of a construction project can be underlined:

a) The total cost of realization of the project, depending on the component stages

$$(2) \quad C_T = C_E + C_{EX},$$

where: C_E is the cost of the elaboration stage of the project, C_{EX} – the cost of the execution stage of the project.

b) The elaboration cost of the project is given by

$$(3) \quad C_E = C_F + C_P + C_L,$$

where: $C_F = \sum_{i=1}^n C_{A_i}^F$ – the costs of the sub-stage of initiation and feasibility of the project; it can be expressed as a sum of the costs of component activities within this sub-stage; $C_P = \sum_{i=1}^n C_{A_i}^P$ – the designing costs; it can be considered as a sum of the costs of component activities; $C_L = \sum_{i=1}^n C_{A_i}^L$ – the costs of organization; it can be expressed as a sum of the costs of component activities;

3.3. The Costs Regarding the Execution of the Project

a) *Setting the execution cost using the “area” method* is a method by which the execution cost of a project is set depending on the total area covered by the component constructions

$$(4) \quad C_{EX} = \sum_{i=1}^n A_{dci} C_{Adi},$$

where: A_{dci} is the total area covered by a construction, C_{Adi} – the execution cost per square meter of total covered area taken from statistic bulletins and specialty publications; it depends on the type and constructive system of constructions.

As a detail of the execution cost determined by the “area” method may be considered the cost determined by the method of the “systems” through which the total

cost per square meter of total covered area is divided to component systems (spatial, constructive) within a particular construction object,

$$(5) \quad C_{EX} = \sum_{i=1}^n K_i A_{dci} C_{Adi},$$

where K_i is the cost proportion for the i system

b) *The method of evaluation through reference to the revenue costs* consists in dimensioning the costs of realization of a construction design starting from the assessment of the real costs recorded at the realization of certain construction elements, activities, categories of similar processes realized by the company which carries out the project,

$$(6) \quad C_{EX} = \sum_{i=1}^n K_{Ci} C_{Ri},$$

where: K_{Ci} is a correction coefficient for element i ; C_{Ri} – the real costs of execution recorded for certain elements (activities, categories of processes, construction elements, etc.).

c) *The method of evaluation based on bill of quantities.* The bill of quantities in constructions represents the technical-economic documentation performed on the basis of fore-measurements through which the execution cost of the construction objects is set.

This evaluation is structured on four chapters of costs, namely:

A. Direct costs on categories of resources (materials, labor, equipment, transportation).

B. Other direct costs, determined by the quotas for social contributions according to legal provisions (health, insurance, unemployment tax, accident risk fund, other fees).

C. Indirect costs.

D. Profit.

Starting from the structure of the above mentioned analytical bill of quantities the following parameters related to the execution costs of a construction project can be underlined

$$(7) \quad C_{EX} = C_D + C_{AD} + C_I + P,$$

with: C_{EX} – the execution cost of the project, C_D – direct costs on resource categories, C_{AD} – other direct costs, C_I – indirect costs, P – profit.

Direct costs are composed of the following elements:

a) *material costs*: in which is comprised the value of the materials used for the work with prices from the producer/supplier, without VAT, and in the case of import materials plus taxes and customs fees; the costs related to supplying are also comprised;

b) *maneuver costs*, which comprise the labor of the directly productive workers and the labor done in manipulating materials, to which the other salary connected right are added, under the conditions imposed by the law;

c) *construction equipment costs*, resulted from the time of functioning, comprise the expenses done with the equipment and technological units necessary for the realization of the construction processes;

d) *transportation costs*, represent the expenses done for the road transportation of materials and semi-manufactured articles from the destination and/or from intermediate warehouses, technological transports (debris, concrete, plaster), transportation with construction equipment from the equipment basis (or suppliers) to the site and back.

Indirect costs are determined by the application of a quota to the value of direct costs and are set by each company on the basis of their own analyses. The chapter of indirect costs is extremely various, therefore we suggest that these ones may be structured in two main groups, namely

A. Indirect costs related to the execution of construction processes.

B. Costs related to the administration of the contract.

Profit is vaguely stipulated by each company, being set as a percent quota applied to the summed value of direct and indirect costs.

e) *The method of dimensioning of the execution cost based on the cost of activities* consists in the evaluation of the execution costs of a construction project starting from the assessment of the costs for each component activity,

$$(8) \quad C_{EX} = \sum_{i=1}^n C_{Ai},$$

where C_{Ai} represents the costs of an i component activity of a construction project, being defined as the money expression of the resources consumption, labor forces, materials, equipment, necessary for an activity, under given technological and organizational conditions; namely

$$(9) \quad C_{Ai} = \sum_{i=1}^n Q_i(C_{Mi}^u + C_{mi}^u + C_{Ui}^u) + \sum C_I,$$

where: C_{Ai} represents the costs of an i activity, component of a construction project, Q_i – the process quantity for the i process within the activity; $C_{Mi}^u = \sum_{i=1}^n C_{si} P_{Ui}$ – direct costs, unitary with the materials for each construction process component of the activity; C_{Si} – the specific consumption for a certain type (sort) of material used for the realization of a construction design, with the specific measure unit; P_{ui} – the unitary price of the i material on the specific measurement unit; $C_{mi}^u = \sum_{i=1}^n C_{si}^{manop} R_{Oi}$ – direct costs unitary with the labor force for each construction process, component of the activity; C_{si}^{manop} – specific normed consumption of hours of labor for a particular job and qualification category for the execution of an i process; R_{Oi} – hourly

tariff retribution for a certain category and qualification stage; $C_{U_i}^u = \sum_{i=1}^n N_{csi}^U P_i$ – direct unitary costs for the equipment and units used for each construction process component of the activity; N_{csi}^U – the specific normed consumption of hours per equipment for the execution of a measurement unit in a mechanized i process within an activity; P_i – the hourly cost of functioning or program based cost for a certain type of equipment or unit used for the execution of an i process; $\sum C_I$ – indirect costs set for the execution of the i activity

4. Conclusion

The particularities of the building activity as well as the long period of realization of a construction project impose certain techniques of evaluating the total realization cost of a construction project which represents the money expression of all “efforts” (labor force, material resources, equipment and technological units, informational resources, services, taxes, technical-administrative actions, etc.), necessary for the realization of the project in all its constitutive stages.

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TEHNICI ȘI INSTRUMENTE UTILIZATE ÎN MANAGEMENTUL PROIECTELOR DE CONSTRUCȚIE

Dimensionarea costurilor

(Rezumat)

Se urmărește stabilirea unei serii de metode privind dimensionarea principalilor parametri economici specifici realizării unui proiect de construcție, parametri legați în principal de costul total de realizare a proiectului. Costul total de realizare a unui proiect de construcție reprezintă expresia bănească a tuturor „eforturilor” (forță de muncă, resurse materiale, utilaje și echipamente tehnologice, resurse informaționale, servicii, taxe, acțiuni cu caracter tehnico-administrativ etc.) necesar a fi făcute în scopul realizării proiectului în toate etapele sale.