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THE DETERMINATION OF THE COSTS ASSOCIATED WITH CONSTRUCTIONS' DEMOLITION AND THEIR PLACE IN THE GLOBAL COST IN CONSTRUCTIONS

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Abstract. The more and more pronounced phenomenon of resources limitation imposed a new approach concerning the decision of investing. The investors, beside the initial costs of a construction project, exploitation costs, should also take into account the cost of post-using which consists in works concerning the constructions' decommission, disassembling and demolition, reconditioning and reusing the elements and the savable products, as well as the recycling of wastes insuring environment's protection according to the laws.

The main aim of cost estimations in a demolition project is to provide a measure of reference for costs' control, in order to verify if the resources used during the demolition works execution are comparative with the costs previously evaluated.

Based on these aspects, some formulas to determine the cost of demolition are proposed.

Key words: demolition; cost; global cost; price; profit.

1. Introduction

Through the acquirement of data concerning the constituent activities of a demolition project, as well as of the resources needed for its realization, in the

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projects' elaboration phase there can be formulated prognostics about the total cost of the activities, resources and, finally, of the entire project.

The particularities of the activity of demolition, the uniqueness of demolition projects and the medium to high duration (depending on the chosen demolition method), impose certain techniques of realization costs evaluation.

The evaluation of execution costs in the design stage has a predictive character, representing the best approximations that can be done, in concordance with the moment when they are realized, depending on the capacities and the managerial culture of the company that executes the project. These are called *programmed* or *foreseen costs*.

2. The Global Cost

The global cost represents one of the many methods of investments' economical analysis through which it is assured the rational use of the financial resources needed for an investment concurrent with the achievements of the demands increased by exigency.

The global cost can be defined, after content, as representing the sum between the initial and the subsequent costs (Fig. 1).

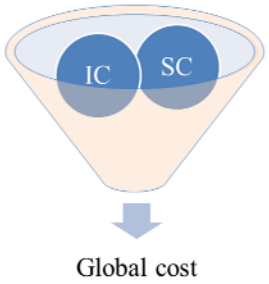

Fig. 1 – The structure of global cost.

2.1. The Global Cost in Constructions

The global cost in constructions may be expressed through an analytical expression, namely

$$GC = I + \sum_{t} \sum_{i=0}^{n} C_{it} F_{it} , \qquad (1)$$

where: I represents the initial investment considered for simplification as being consumed at the time marker taken for the analysis; n – the period of analysis, expressed in years, from the construction's life period; C_{it} – the costs from

category i at moment t_i (Fig. 2); F_{it} – the factor of transformation of some costs, C_i , consigned at a moment, t_i , in values equivalent at marker date or factor of update; L_c – the life cycle of a construction; t – the time period expressed in years.

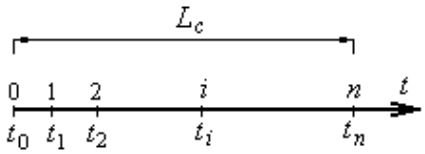

Fig. 2 – The structure of the investment's life cycle.

GC represents the sum of relevant expenses, afferent to the respective investment, on a certain period of time, realized in values equivalent at one time.

A period of time represents a fraction of construction's "life period".

In Romania, the name of global cost was adopted based on following arguments:

a) The attribute "global" expresses the costs' structure and the idea of deployment in time.

b) It avoids the discussions over "the life cycle".

c) It aligns with the terminology from the world practice.

d) It avoids the confusion with the name of total cost, used in accountancy.

2.2. The Structure of Global Cost

Analytically, the *global cost*, name accepted in special literature may be expressed as (Fig. 3)

$$GC = C_R + C_F + C_M + C_{PU}\,. \tag{2}$$

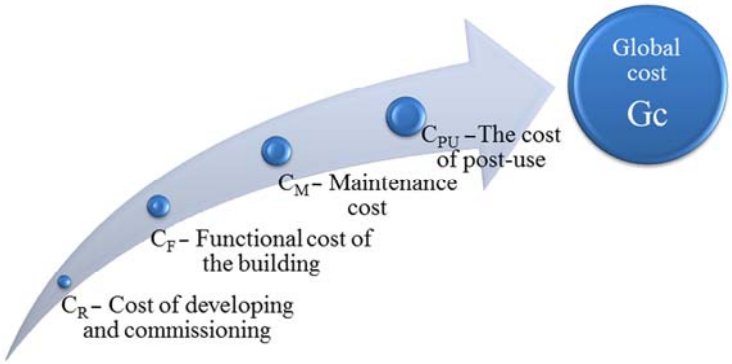

Fig. 3 – The structure of global cost for a construction.

The cost of construction's realization and putting into function (C_R), may be found in special literature under the name of *investment's initial cost* or *fund cost*. This can be structured in

a) The cost of feasibility studies.

b) The cost of the terrain on which the edifice will be built.

c) The cost of consultancy (the cost of design and of technical assistance).

d) The cost of construction's realization (which has the significance of price for the builder).

e) The cost of utilities (water, gas, electric energy, drainage, TV cable, telephone cable, internet, etc.).

f) The cost of reparation which have to be done both at the preliminary and at the final reception.

g) The "promotional" cost and the cost of the formalities connected with selling-buying (if the construction is sold to another owner).

h)The costs of financing for construction's realization (the cost of fixed or loan capital).

The cost of construction's functioning (C_F), (the cost of exploitation, application), represents the sum of expenses connected with

a) The heating cost.

b) The maintenance cost.

c) The house management cost.

d) The commissions' cost, during the entire exploitation of the construction.

These expenses are tightly connected with the way of the building's origination and execution.

A truly important problem nowadays is the thermal shield, which if it is designed and executed according to active norms will lead to smaller expenses for the thermal energy during the entire construction's exploitation, therefore resulting a global cost as small as possible.

The maintenance cost (C_i) consists of the following elements:

a) The maintenance activities' cost.

b) The current repairing' cost.

c) The capital repairing' cost.

d) The moments when the current and the capital repairing should be done are brought under regulation by some active norms.

The cost of post-usage (C_{PU}) gathers the decommission, the disassembling and the demolition of constructions, the reconditioning and reusing the savable elements and products, as well as the recycling of wastes with the assurance of environment protection according to the law;

From the things pointed out so far, we appreciate that there must be done the following assignations:

a) The constitutive elements of the global cost interfere in every life step of a construction. To be able to form an exact image of global cost's dimension, its elements must be expressed in equivalent units, which must have the same meaning, because money values change over time because of the inflation.

b) The calculation of global cost is realized in order to form an opinion about total expenses that interfere in the life of a construction. We know the fact that investing more money at the beginning (in the step of construction's realization), these will bring subsequent economies in building's exploitation. Therefore, an analysis must be performed to know if the money extra-spent at construction's realization will be recuperated (amortized) and if so, in how much time.

c) A construction may represent an investment if it will bring a subsequent profit. In this case, the investment is represented through two distinct steps:

1° The proper investment (for construction's realization).

2° The step in which the investment brings income.

In this case, there must be compared the expenses of investment's realization with the subsequent income (resulted from rents, etc.).

3. Cost's Evaluation in the Management of Constructions' Decommission–Demolition

In dimensioning the realizations' costs of a demolition project it is necessary to get over the following steps:

a) Establishing the sources of information needed for a proper evaluation of costs.

b) Elaborating the demolition program, through which it is established the duration of the demolition project realization, as well as the realization dates of certain activities determined through specifications, in this way being defined the working means needed for project's realization. Within the demolition project there can be established the costs proportional with the programmed duration, as well as the costs accumulated at certain time intervals.

c) Choosing and applying the evaluation method.

Among the well-known methods the most frequently used in the case of demolitions are the following:

a) The area method, which is one of the most used methods being entirely based on the total uncoiled area of a building.

b) Detailed evaluation method, consisting in pointing out for each activity or process displayed in the demolition project the consumptions of necessary resources (work force, materials, facilities technological equipments), taking into account the actual needs and conditions on the field. It is a very laborious method, but at the same time very precise.

Further, the authors propose and present two methods concerning the dimensioning of the realizations' costs of a decommission – demolition project.

3.1. Dimensioning the Total Cost of Realizing a Demolition Project

For the dimensioning of the total cost of realizing a demolition project, the relation

$$C_T = C_{AS} + C_{LP} + C_{PE} + C_E + C_D + C_{EA*} - P_{VM*}, \tag{3}$$

is proposed where: C_T represents the total cost of realization of a demolition project; C_{AS} – parameter that accents the group of costs concerning the enclosing and enhancing the site; C_{LP} – parameter that belongs to evaluating the costs of the works preceding demolition; C_{PE} – parameter that takes into account the group of costs concerning the activities of design and guidance; C_E – parameter that takes into account the group of costs concerning the demolition's execution; C_D – parameter that takes into account the group of diverse and unforeseen costs concerning the project's realization; C_{EA} – parameter that belongs to the costs of settlement's liberation; P_{VM} – parameter that represents the profit obtained as a result of salvaging the materials resulted from demolition.

O b s e r v a t i o n. The parameters C_{EA} and P_{VM} are taken into account (C_{EA} , P_{VM}) only when the activities of settlement's liberation and the salvation of the resulting materials fall to the company that takes care of the demolition project's execution.

3.2. The Dimensioning of the Total Cost of a Demolition Project's Realization on Realization Steps

There can be render evident the following parameters:

a) The total cost of realization of the project expressed in function of the constituent steps

$$C_T = C_E + C_{\mathrm{EX}}, \tag{4}$$

where: C_E is the cost of the project's elaboration step; C_{EX} – the cost of the project's execution step.

b) The expression of the project's elaboration step

$$C_E = C_F + C_P + C_L, \tag{5}$$

where

$$C_F = \sum_{i=1}^{n} C_A^F, \tag{6}$$

represents the costs of the project's feasibility and initiation steps; it can be expressed as sum of the costs of the constituent activities in this activity;

$$C_F = \sum_{i=1}^{n} C_A^P , \tag{7}$$

represents the designing costs;

$$C_F = \sum_{i=1}^{n} C_A^L , \tag{8}$$

representing the costs of auction's organization.

c) The expression of the costs concerning the project's execution are the followings:

c_1) establishing the execution cost using the area method is a method through which it is established the demolition cost of a construction in function of its gross building area

$$C_{\mathrm{EX}} = \sum_{i=1}^{n} Ad_i C_{Ad_i} , \tag{9}$$

where: Ad_i represents the gross building area of the construction that is to be demolished; C_{Ad_i} – the execution cost on each m^2 gross building area taken from statistical bulletins and special publications; it is a function of the type and the construction system of to-be-demolished constructions and of the chosen demolition method;

c_2) the evaluation method based on economic assessment.

The economic assessment is structured on four costs elements, namely

A. Direct costs resources categories (materials, labor, facilities, transport).

B. Other direct costs, determined by the listings for social contributions according to the legal provisions (CASS, CAS, unemployment relief, fund for risk of accidents, other taxes).

C. Indirect costs.

D. Profit.

From the analytical device's structure, previously presented, there can be the following parameters connected with the costs of execution of a construction project:

$$C_{\mathrm{EX}} = C_D + C_{\mathrm{AD}} + C_I + P , \tag{10}$$

where: C_{EX} is the cost of project's execution; C_D – direct costs on categories of resources; C_{AD} – other direct costs; C_I – indirect costs; P – profit.

4. The Dimensioning of the Total Price of a Demolition Project

This price can be evaluated with relation

$$P_T = P_1 + P_2 + P_3 + P_4 - V_T , \tag{11}$$

where: P_T is the total price of the project; P_1 – the price for the feasibility study; P_2 – the designing price; P_3 – the price for execution; P_4 – the price of the materials' capitalization; V_T – the total income obtained after materials' capitalization.

Then, it results

$$P_T = \sum_{i=1}^{4} P_{iT} - V_T . \tag{12}$$

In relation (13) the total price dependents on the total cost, the total profit and the gain

$$P_T = C_T + P_{fT} - V_T , \tag{13}$$

in which

$$C_T = C_1 + P_2 + C_3 + C_4 , \tag{14}$$

which represents the total cost expression, and where: C_1 represents the cost for the feasibility study; C_2 – the designing cost; C_3 – the cost for execution; C_4 – the cost with the materials' capitalization. Consequently

$$C_T = \sum_{i=1}^{4} C_i , \tag{15}$$

$$P_{fT} = P_{f1} + P_{f2} + P_{f3} + P_{f4} , \tag{16}$$

representing the total profit formula, where: P_{f1} represents the profit from the feasibility study; P_{f2} – the profit from the design; P_{f3} – the profit from the execution; P_{f4} – the profit from materials' capitalization;

$$P_{fT} = \sum_{i=1}^{4} P_{fi} . \tag{17}$$

Capitalizing more types of materials resulted from demolitions, we will obtain more kinds of the incomes and colligating them we will obtain the total income

$$V_T = \sum_{i=1}^{n} V_{T_i} , \tag{18}$$

where: V_T represents the total income.

Finally, if we introduce the relations (15), (17), (18) into relation (12), we will obtain

$$P_T = \sum_{i=1}^{4} C_{T_i} + \sum_{i=1}^{4} P_{fT_i} - \sum_{i=1}^{n} V_{T_i} \ , \tag{19}$$

5. Conclusions

Lately, the more and more pronounced phenomenon of resources limitation imposed a new approach as regards the decision of investing. The investors, beside the initial costs of a construction project, exploitation costs, should also take into account the cost of post-using which consists in works concerning the constructions' decommission, disassembling and demolition, reconditioning and reusing the elements and the saving products, as well as the recycling of wastes insuring environment's protection according to the laws.

The main aim of cost estimations in a demolition project is to provide a measure of reference for costs' control, in order to verify if the resources used during the execution of demolition works are comparative with the costs previously evaluated.

The success of a fair estimation of a demolition project consists in a thorough studying of the objective that is to be demolished, the capacity of choosing the proper method of demolition, the evaluation of resulting materials' quantities that will be capitalized.

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ESTIMAREA COSTURILOR ASOCIATE DEMOLĂRII CONSTRUCŢIILOR ŞI LOCUL ACESTORA ÎN COSTUL GLOBAL ÎN CONSTRUCŢII

(Rezumat)

În ultima perioadă, fenomenul tot mai accentuat de limitare a resurselor a impus o nouă abordare a deciziei de a investi. Investitorii, pe lângă costurile iniţiale ale unui proiect de construcţie şi costurile de exploatare, ar trebui să ia în calcul şi costul

post-utilizarii ce constă în lucrări privind dezafectarea, demontarea şi demolarea construcţiilor, recondiţionarea şi refolosirea elementelor şi produselor recuperabile, precum şi reciclarea deşeurilor asigurând protecţia mediului conform legilor.

Scopul principal al estimării costurilor, în cadrul unui proiect de demolare, este să furnizeze o mărime de referinţă pentru controlul costurilor, pentru a verifica dacă resursele consumate în timpul execuţiei lucrărilor de demolare sunt comparabile cu costurile evaluate anterior.

Se propun o serie de formule pentru calculul costului unui proiect de demolare, execuţia acestuia şi valorificarea materialelor rezultate în urma demolării.