BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Volumul 68 (72), Numărul 1, 2022
Secţia
CONSTRUCŢII. ARHITECTURĂ
DOI: 10.2478/bipca-2022-0003

METHODS OF ADJUSTMENTS THE COST IN CONSTRUCTIONS

BY

CORNEL ADRIAN CIURUSNIUC*, IRINA CIURUSNIUC-ICHIMOV and ADRIAN-ALEXANDRU ŞERBĂNOIU

„Gheorghe Asachi” Technical University of Iasi, Faculty of Civil Engineering and Building Services, Iasi, Romania

Received: November 24, 2022
Accepted for publication: August 29, 2023

Abstract. The aim of this article is to show the impact of adjustments in construction projects. The methodology and impact of costs in construction are analyzed by applying the formula for calculating the cost of price adjustments based on inflation. The cost of a project is defined by its direct and indirect costs, but in projects carried out by the state, there are adjustments to the cost. The adjustment cost is intended to take over a price increase due to changes that are not related to the project and are related to the market economy of the construction industry.

Keywords: public construction projects, material cost, forecasting, cost inflation model; cost increase.

*Corresponding author; *e-mail*: cornel-adrian.ciurusniuc@student.tuiasi.ro
© 2022 Cornel Adrian Ciurusniuc *et al.*
This is an open access article licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International license (CC BY-NC-ND 4.0).

1. Introduction

In construction projects, time and cost are the most important factors to be taken in the planning of each project. The aim of the project is to be completed in time and the established budget (Anuja Rajguru, 2015).

The PMBOK Guide ((PMBOK® Guide), 2014) defines a project as "a temporary effort, undertaken to create a unique product, service or result.

In 2004, Rihay (Rihay Sonmez, 2004) analyzed the conceptual cost estimation of construction projects through the methods regression, neural network, and range estimation techniques, at the beginning stages of the project.

Construction projects for time framing are detailed in groups of activities, each activity has allocated resources: material, workmanship, equipment and transport. The share of each resource is depending on the type of construction project and its shift, one of the resources will be more involved in the execution of the contract than the others

2. The cost in construction

Most construction projects arise out of a necessity for the development and maintaining of the quality of the population. A large part of the projects related to the development and sustainability of the population is financed by the state through public funds or payment commitments.

A particularity of the construction projects carried out and financed by the state is given by the appearance of the cost from the adjustments, compared to the direct and indirect costs, defined as follows:

a) Direct costs are defined by the resources of materials, labor, equipment, transport involved in the execution of the project;

b) The indirect cost is represented by all auxiliary costs with direct or indirect involvement in the execution of the project, such as but not limited to: remunerations of the management, technical, economic, other specialized personnel, administrative, service, labor protection, arrangement and maintenance of the construction site, insurance of construction works.

$$C=C_d+C_i \quad (1)$$

where: C is the total cost, C_d is the direct cost, C_I is the indirect cost

The cost in construction is affecting the duration of the project, the relation between optimal cost and optimal duration is indicated by figure nr.1.

The first appearance of the cost from the adjustments was regulated by Order 915 of 25.03.2008 on the approval of the contractual conditions. The builders, after completing the auction and signing the contract, benefit from

clause 13.8 for the adjustment of the contract value during the execution of the works, according to the following formula:

$$Pn=a+b(Ln /Lo) +c (En/Eo)+d (Mn/Mo) \quad (2)$$

where:
- "Pn" is the adjustments coefficient for the work performed during the period "n",
- 'a' is a fixed coefficient, representing the unattachable part of the contractual payments,
-"b", "c", "d" are coefficients that represent the estimated share of each relevant cost element in the execution of works and can represent resources such as labor, machinery and materials;
- "Ln", "En", "Mn" are the current indices of price for the period "n"
- "Lo", "Eo", "Mo" are basic price indices.

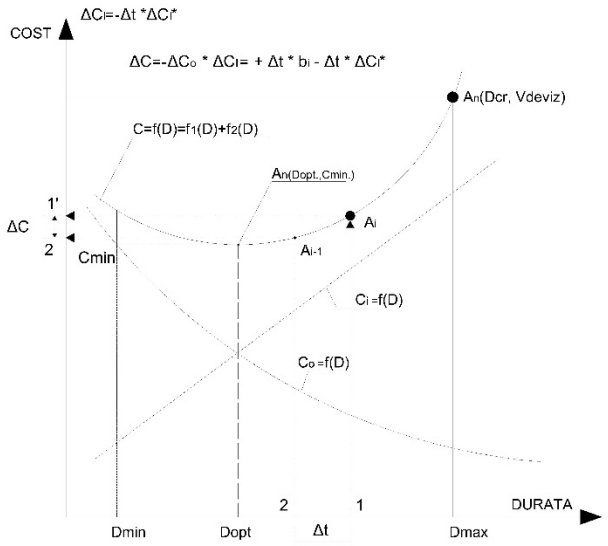


Fig. 1 – Cost-duration dependency for a project (Șerbănoiu Ion, 2008).

In 2009, Order 1059 annuls Order 915, and later in 2010 it is regulated by Government Decision no. 1405 (**) on the approval of the use of some contractual conditions of the International Federation of Consulting Engineers in the Field of Constructions (F.I.D.I.C.) for investment objectives in the field of transport infrastructure of national interest, financed from public funds.

In 2016 by Emergency Ordinance no. 80 the Government Decision nr. 1405, as subsequently in 2018 by Government Decision 1 (**) the general and specific conditions for certain categories of procurement contracts related to the investment objectives financed from public funds are approved, and the result is two formulas for adjusting prices:

a) $An = av + m * Mn / Mo + f * Fn / Fo + e * En / Eo$ (3)

where:

- An is the adjustment coefficient.
- av shall be a fixed coefficient and must be the percentage amount of the advance payment.
- m, f, e are coefficients representing the estimated weighting of each relevant cost element in the execution of the Works. Cost elements are relevant resources such as manpower, machinery and materials;
- Fn, En, Mn are the current price/cost indices or the reference prices for month "n", expressed in the currency of the Contract, as applicable on the date 60 days before the last day of month "n". The price indices or reference prices relate to the relevant cost items;
- "Lo", "Eo", "Mo" are the basic price/cost indices.

The following equation will be checked: $av + m + f + e = 1$.

b) $An = av + (1 - av) * In / Io$ (4)

where:

- "An" is the adjustment coefficient.
- "av" shall be the percentage amount of the advance payment.
- "In" is the cost index in constructions
- "Io" is the cost index in construction - total.

The disadvantage is that it is mandatory only for contracts that have a value of over 5 million euros and with a contract duration of more than 24 months.

On 2021 due to the increase in prices of construction materials, ordinance no. 15/2021 of August 30, 2021 (**) is issued on the regulation of certain fiscal-budgetary measures for adjusting the prices of public procurement contracts, which issues the adjustment coefficient having the following formula:

$$C = (ICCM)n / (ICCMian.2021) \times P + (1 - P) \quad (5)$$

where:

-"P" represents the weight determined in relation to the object of the contract,

-"ICCMn" represents the cost index in constructions for the cost of materials for the month preceding the payment request for which there are values of it officially disseminated,

-"ICCMian.2021" represents the cost index in constructions for the cost of materials for January 2021.

The share of materials can be found on site N.I.S. as well as in the Substantiation Note for ordinance no. 15/2021, therefore.

Table 1

Material weighting (source N.I.S.(**))

Category of expenditure	New residential buildings	New non-present buildings	New engineering constructions
Material	**47.31%**	**45.82%**	**47.21%**
Workmanship	34.05%	24.58%	19.16%
Equipment	4.05%	10.69%	11.07%
Indirect	12.24%	15.17%	17.91%
Transport	2.34%	3.73%	4.66%

We can note that in 2021 for construction projects, the existence of 3 adjustment formulas, which implies an increase in the cost of a project paid by the state to the contractor.

To the total cost we can add the cost from the adjustment, so the formula no.1 becomes:

$$C=C_d+C_i+C_{adjustment} \quad (6)$$

In 2014 appears on the website of the *National Institute of Statistics the first Statistical Bulletin of Prices – Table 15 COST INDICES IN CONSTRUCTIONS BY CATEGORIES OF OBJECTS AND STRUCTURAL ELEMENTS (**).*

Table 2

Evolution of cost indices in constructions 2014-2017 (Source: N.I.S. (**))

COST INDICES IN CONSTRUCTIONS BY CATEGORIES OF OBJECTS AND BY STRUCTURAL ELEMENTS ACCORDING TO TABLE 15 OF THE STATISCTIC PRICE BULLETIN								
	2014		2015		2016		2017	
	IAN	DEC	IAN	DEC	IAN	DEC	IAN	DEC
CONSTRUCTION - TOTAL	111	109.9	108.6	108.4	107.7	115.4	113.8	112.9
of which: Cost of materials	112	105.8	103	91.3	95.4	97.4	100.4	108.9

of the total, by category of objects:								
Residential buildings	109.9	109.7	108.7	109.2	107.8	114.6	114.3	114.2
Non-residential buildings	111	109.7	108.2	108.3	107.5	116.5	114.5	114
Engineering constructions	111.3	110	108.8	108.3	107.8	115.1	113.4	112.2
of the total, by structural elements:								
New construction works	110.7	109.8	108.8	108.8	107.7	114.9	114.1	112.6
Capital repair works	110.7	110.6	109.1	111.1	110.6	119.7	119.2	117
Current maintenance and repair works	112.1	109.8	107.9	105.9	106.4	114.6	110.4	111.3

Table 3

Evolution of cost indices in constructions 2018-2021 (Source: N.I.S. (**))

COST INDICES IN CONSTRUCTIONS BY CATEGORIES OF OBJECTS AND BY STRUCTURAL ELEMENTS ACCORDING TO TABLE 15 OF THE STATISCTIC PRICE BULLETIN								
	2018		2019		2020		2021	
	IAN	DEC	IAN	DEC	IAN	DEC	IAN	DEC
CONSTRUCTION - TOTAL	119.5	127	129.5	136.9	134.4	140	137.9	165.2
of which: Cost of materials	104.9	110.3	108.4	110.3	110.5	109.8	109.8	151.9
of the total, by category of objects:								
Residential buildings	116.4	125.5	128	137	133.8	140.1	135.6	166
Non-residential buildings	122.2	129.8	132.3	140.7	137.7	144.2	139.4	169.6
Engineering constructions	118.9	126	128.4	135.1	132.9	137.9	134	162.9
of the total, by structural elements:								
New construction works	117.9	123.6	126	134	131.2	137.2	132.9	162.7

Capital repair works	124.8	137.2	136.9	146.5	143.4	149.8	146.7	173.5
Current maintenance and repair works	120.3	129.4	133.8	138.1	136.7	141	136	166.4

From the data included in Table 2 and 3, it is noted that in the period 2014-2017, the cost indices in constructions stagnate, but from 2018 until 2021 there is an increase.

3. Implication of the price adjustment formula

This paper is intended to use the adjustment formula to study differences and applicability.

The coefficient result by applying the formula $An= av + (1 - av) * In / Io$, if we take into account January 2018 (119.5) and December 2021 (165.2), representing a duration of 4 years, we notice an increase by inflation of 38.24%, which applies to the entire contract value including materials, workmanship, equipment, transport, profit and indirect.

By applying the formula (CCIM)n / (CCIMian.2021), taking into account the year 2021 for the material index (151.9/109.8), the result is 38.34 % but it applies only to materials for year 2021

4. Conclusions

As the objective of the article is the optimization of costs in construction, it is important to detail and analyze the costs arising from the regulations of the legislation of the contracts established by the state. The results obtained from the use of cost indices for construction projects clearly show an increase in the cost of a construction project. In order to establish a general parameter for various types of projects, in-depth studies and analyses are required so that when optimizing costs in construction, the cost of the update is taken into account.

What we can conclude is that in state-funded construction projects, it is necessary to calculate the cost of a project and enter the cost from updates

REFERENCES

Akalya.K1,Rex.L.K2,Kamalnataraj.D " Minimizing the Cost of Construction Materials through Optimization Techniques", IOSR Journal of Engineering (IOSRJEN), ISSN (e): 2250-3021, ISSN (p): 2278-8719, PP 29-33.

Anuja Rajguru, Parag Mahatme, (March 2015) "Effective Techniques in Cost Optimization Of Construction Project" International Journal of Research in Engineering and Technology Vol. 4, pp. 464-469.

Rihay Sonmez .,(August 2004) "Effective Techniques in Cost Optimization Of Construction Project" International Journal of Research in Engineering and Technology Vol. 4, pp. 464-469.

Guide to Knowledge in Project Management (PMBOK® Guide) – Fifth Edition, Institute for Project Management, 2014.

Ion Şerbănoiu, Adrian Şerbănoiu, Programarea în managementul activităților de construcții (Programming in the management of construction activities), Editura Societatea Academice "Matei-Teiu Botez", Iaşi, 2008.

*** *Ordin Nr. 915/465/415 of March 25, 2008 for the approval of general and special contractual conditions at the conclusion of works contracts*) ISSUER: MINISTRY OF ECONOMY AND FINANCE, No. 915 of March 25, 2008, MINISTRY OF TRANSPORT, No. 465 of 14 April 2008, MINISTRY OF DEVELOPMENT, PUBLIC WORKS AND HOUSING No. 415 of 9 April 2008; PUBLISHED IN: OFFICIAL GAZETTE NO. 424 bis of 5 June 2008*.

*** *Ordin Nr. 1059/555/306 din 20 mai 2009 privind abrogarea Ordinului ministrului economiei şi finanţelor, al ministrului transporturilor şi al ministrului dezvoltării, lucrărilor publice şi locuinţei nr. 915/465/415/2008 pentru aprobarea condiţiilor contractuale generale şi speciale la încheierea contractelor de lucrări (Ordin No. 1059/555/306 of 20 May 2009 on the repeal of the Order of the Minister of Economy and Finance, of the Minister of Transport and of the Minister of Development, Public Works and Housing no. 915/465/415/2008 for the approval of the general and special contractual conditions at the conclusion of works contracts, ISSUER: MINISTRY OF PUBLIC FINANCE No. 1.059 of 20 May 2009, MINISTRY OF TRANSPORT AND INFRASTRUCTURE No. 555 of 24 April 2009, MINISTRY OF REGIONAL DEVELOPMENT AND HOUSING, No. 306 of 12 May 2009; PUBLISHED IN: OFFICIAL GAZETTE NO. 344 OF 22 MAY 2009)*.

*** *Hotărârea Guvernului României din 1405 din 28 decembrie 2010 privind aprobarea utilizării unor condiţii contractuale ale Federaţiei Internaţionale a Inginerilor Consultanţi în Domeniul Construcţiilor (FIDIC) pentru obiective de investiţii din domeniul infrastructurii de transport de interes naţional, finanţate din fonduri publice*) (Romanian Government Decision of 1405 of December 28 , 2010 approving the use of contractual conditions of the International Federation of Construction Consulting Engineers (FIDIC) for investment objectives in the field of transport infrastructure of national interest, financed from public funds*)*.

⁎*⁎ *Ordonanță de Urgență Nr. 80/2016 din 16 noiembrie 2016 pentru stabilirea unor măsuri în domeniul administrației publice centrale, pentru prorogarea termenului prevăzut la art. 136 din Legea nr. 304/2004 privind organizarea judiciară şi pentru modificarea şi completarea unor acte normative (An Emergency Ordinance No. 80/2016 of November 16, 2016 for the establishment of measures in the field of central public administration, for the extension of the term provided for in article 136 of Law no. 304/2004 on the judicial organization and for the amendment and completion of some normative acts)*.

⁎*⁎ *Hotărârea Guvernului României Nr. 1/2018 din 10 ianuarie 2018 pentru aprobarea condiţiilor generale şi specifice pentru anumite categorii de contracte de achiziţie aferente obiectivelor de investiţii finanţate din fonduri publice (Romanian Government Decision no. 1/2018 of 10 January 2018 for the approval of the general and specific conditions for certain categories of procurement contracts related to the investment objectives financed from public funds)*.

⁎*⁎ *Ordonanță de Urgență Nr. 15/2021 din 30 august 2021privind reglementarea unor măsuri fiscal-bugetare (Emergency Ordinance No. 15/2021 of 30 August 2021on the regulation of certain fiscal-budgetary measures)*.

⁎*⁎ *Nota de Fundamentare Ordonanță de Urgență Nr. 15/2021 (Substantiation Note Emergency Ordinance)*.

⁎*⁎ https://insse.ro/cms/.

METODE DE ACTUALIZARE A COSTULUI IN CONSTRUCTII

(Rezumat)

Acest document se adresează categoriilor de proiecte de construcții finanțate din fonduri europene și de stat. Se analizează metodologia și impactul costurilor în construcții prin aplicarea formulei de calcul a costului actualizării de preț pe baza inflației publicate de Institutul National de Statistica.

Costul unui proiect este definit de costurile directe și indirecte, dar în proiectele derulate cu statul apare un cost de actualizare. Costurile directe sunt reprezentate de resursele de materiale, manoperă, utilaj, transport implicate în execuția proiectului. Costul indirect este reprezentat de toate costurile auxiliare cu implicare directa sau indirecta în execuția proiectului, cum ar fi dar a nu se limita la: retribuţii ale personalului de conducere, tehnic, economic, de altă specialitate, administrativ, de deservire, protecția muncii, amenajarea şi întreținerea şantierului, asigurarea lucrărilor de construcții.

Costul de actualizare este destinate pentru a prelua o creștere de prețuri datorită unor schimbări ce nu țin de proiect și țin de economia de piață a industriei în de construcții. Costul final plătit la finalizarea proiectului este definit de costul direct, indirect și actualizare.

Prin aplicarea metodelor reglementate de Hotărârea Guvernului nr.1/2018 și Ordonanța de Urgenta nr. 15/2021, constatăm o diferență în metoda de aplicare. Practic pentru proiectele de construcții la care se aplică formula de actualizare din H.G. nr.1/2018 constatăm că se aplică la toată valoarea contractului de execuție (material, manopera, utilaj, transport și cheltuieli indirecte), față de Ordonanța de Urgenta nr. 15/2021 care se aplica doar pentru materiale fără a lua în considerare costurile de manopera, utilaj, transport, profit ale proiectului.

Rezultatele obținute în urma folosirii metodelor de actualizare a costului în construcții pe baza indicilor de cost arată clar o majorare a costului unui proiect de construcții. Pentru a stabilii un parametru cu caracter general pentru diverse tipuri de proiecte, sunt necesare studii aprofundate și analize.