

# Journal of Engineering Research

## THE IMPACT OF INFLATION ON CONSTRUCTION MATERIALS - AN OVERVIEW

---

***Cornel Adrian Ciurusniuc***

PhD student, Faculty of Civil Engineering  
and Installations, Gheorghe Asachi”  
Technical University of Iasi, Romania

***Irina Ciurusniuc-Ichimov***

PhD student, Faculty of Civil Engineering  
and Installations, Gheorghe Asachi”  
Technical University of Iasi, Romania

***Adrian-Alexandru Șerbănoiu***

Prof., Faculty of Civil Engineering and  
Installations, Gheorghe Asachi” Technical  
University of Iasi, Romania

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



**Abstract.** This study explores the challenge of managing construction costs, which can be unpredictable until the project is completed. It's crucial to consider the parameters established during the planning phase to assess the impact of costs accurately. One significant factor is the calculation coefficient, which considers inflation rates for completed work. Other parameters can arise from modifications to the project due to design and construction worker risks during execution. The calculation method involves collecting and evaluating costs from previous projects that have gone through the life cycle, resulting in considerations such as adjustments for changes to minimum wage requirements for construction workers, price increases due to inflation, and modifications related to obtaining permits and agreements. The study underscores that there will be an increase in the initial project cost until its completion. However, a thorough understanding of costs necessitates a risk analysis, other comprehensive studies, and automated calculation programs.

**Keywords:** Cost overrun, Risk factors, Project cost, Forecast cost, Cost Management.

## INTRODUCTION

Every project or investment goal requires an estimated initial cost, which is budgeted by the entity funding the project or by the government. During the initial stage, the following factors are determined:

- The specific objective and expected outcome;
- The initial conditions that inform the cost estimation, including architecture, structures, installations, and equipment.

According to Romanian law [1], the initiation stage includes:

- Developing the design theme and concept note;

- Preparing the approval documentation for intervention works;
- Conducting a feasibility study;
- Completing a pre-feasibility study for investments that exceed EUR 50 million.

In the Romanian public system, for investment objectives, the constructor has to follow various stages, which are established by the Beneficiaries as follows:

### OPTION 1

1. The beneficiary draws up all the technical and economic documentation, representing the documentation for approving the intervention works or the feasibility study, technical documentation for building authorization, technical design documentation, and execution details with detailed quantity lists.
2. The published documentation contains all the design documentation on an online platform, and builders submit bids for the execution of works; after evaluation, the builder is established.
3. The constructor signs the execution contract at a value lower than that established by the Beneficiary and executes the investment objective according to the detailed technical documentation.

In option 1, the risk of additional costs falls on the Beneficiary since he has provided the manufacturer with detailed documentation. If, during the execution of the works, there are various changes or mismatches with those on-site, the Beneficiary will bear any costs.

### OPTION 2

4. The beneficiary draws up only the documentation for approving the intervention works or the feasibility study

5. The documentation is published on an online platform, and builders submit bids to carry out the design and execution of works; after evaluation, the builder is established.

6. The constructor signs the design and execution contract at a value lower than that established by the Beneficiary and executes the investment objective according to the detailed technical documentation.

In option 2, the risk of additional costs decreases to the Beneficiary. Still, the risk is transferred to the Builder because he must draw up technical documentation and perform the works based on those drawn up.

As a result of the public consultation on the SEAP platform (Electronic Public Procurement System) [2] for CPV code 45200000-9 for the complete or partial construction of public works, 90 projects have been identified for 2019-2022. The following information was gathered from the consultation:

- Contracts were signed following auctions with an average of 95% compared to the estimated value.
- Of the 90 projects, 68 were selected for design and execution.
- The contract duration was more than 24 months for 50 projects and between 12 and 24 months for the remaining 40 projects.

## INFLATION ON CONSTRUCTION MATERIALS

### RESEARCH BACKGROUND

The European Central Bank [3] describes that inflation *occurs when there is a broad increase in the prices of goods and services, not just individual items.*

Ahmed Yousry Akal (2023) [4] investigated the effect of inflation on the market value with which concrete iron used in construction is purchased. The analysis was conducted based on market values in Egypt during 2011-2019. The study found that material prices are closely related and directly impacted by inflation.

The construction sector has a significant economic and social impact on the development of strategic projects in European states. As a result, inflation indices specific to construction have been gradually developed.

### INFLATION IN GERMANY

The contractual conditions for the execution of public works are defined by framework contracts called (V.O.B.) (German: "Vergabe- und Vertragsordnung für Bauleistungen") [5]. They are divided into three parts: Part A is the general characteristics relating to the award of the works contract; Part B is the general conditions of contract relating to the execution of works; Part C is detailed specifications on labour rules, measurement and accounting for the 67 technical standards used.

Data collection for the construction branch deals with the Federal Statistical Office [6], as shown in Fig. 1. It is notable that from 2013 to 2018, cost indices in construction increased progressively. Still, from 2019 to 2020, there was accelerated growth, and then in 2021 and 2022, it maintained a constant level.

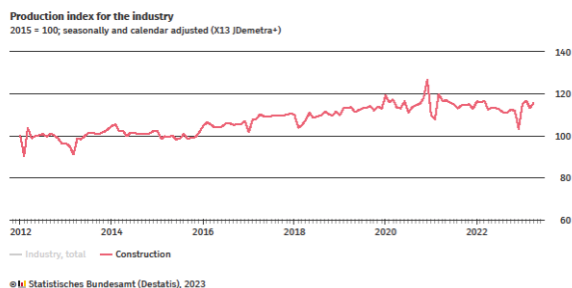


Fig. 1. Construction cost indices Germany (Source: F.S.O.)

## INFLATION IN FRANCE

The contractual conditions for the execution of public works are defined by framework contracts bearing the name General Administrative Conditions of Contracts (*Cahiers des clauses Administratives Générales*) (CCAGs)

Data collection for the construction branch deals with the L'Institut national de la statistique et des études économiques - l'INSEE [7], and France has 2 indices, and is shown in table 1 :

Index BT 01 (referred to as the buildings index- *Index du bâtiment* ) [8] is a national and official index, published every month, that serves as a reference to know the evolution of construction costs in France.

The general index IM (Indice de réactualisation des actifs matériels dans la construction)[9] represents all types of works and is obtained by weighted average of the other public works indices.

From the analysis of the BT01 index it is seen that between 2014 and 2020, it had an average increase of 2 percentage points, but since 2020 the average increase has been 5 percentage points each year.

From the analysis of the IM index, they had a small increase by an average of 3 percentage points, but in 2021 the increase was 23.15 percentage points, and in 2022 the index stagnated, with an increase of 0.11 percentage points.

## INFLATION IN U.K

The contractual conditions for the execution of public works are defined by The New Engineering Contract (NEC) forms of contract and Joint Contracts Tribunal (JCT) forms of contract

Data collection for the construction branch deals with the Office for National Statistics [10], and is shown in table 2 :

We note that during 2014-2020, cost indices in construction had a small increase by an average of 3 percentage points, but in 2020 the increase was 6.2 percentage points, and in 2022 the index increased by 10.7 percentage points

## INFLATION IN ROMANIA

The contractual conditions for the execution of public works are defined by Government Decision 1 /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.

Data collection for the construction branch deals with National Institute of Statistics [11], and is shown in table 3

We note that during 2014-2018 the fluctuation is minor and does not affect the construction market, being a plateau level, but starting with 2018 there is an accelerated growth for 2018 and 2019, and in 2020 the index will stagnate, but in 2021 and 2022 we find again an increase in indices by 22.45% for total constructions

## THE INFLUENCE OF CONSTRUCTION COSTS VERSUS EXTERNAL FACTORS

Construction costs are defined by the direct cost and the indirect cost

External factors refer to those factors that have a significant impact on the cost from the initiation date to the completion date of the project, such as:

- a) Legislative changes:
  - Changes to the minimum wage for the construction branch – Cwage

| Year        | 2014   | 2015  | 2016   | 2017   | 2018   | 2019   | 2020   | 2021  | 2022   |
|-------------|--------|-------|--------|--------|--------|--------|--------|-------|--------|
| Index BT 01 | 104,5  | 103,6 | 105,2  | 107,4  | 109,7  | 111,6  | 113,6  | 119,7 | 126,8  |
| Index TP01  | 1,0552 | 1,039 | 1,0965 | 1,1326 | 1,1723 | 1,1453 | 1,1775 | 1,409 | 1,4101 |

Table 1. Indices France BT01 and IM

| Year             | 2014 | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  | 2021  | 2022  |
|------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| All construction | 99.1 | 100.1 | 103.1 | 106.0 | 108.9 | 110.7 | 112.7 | 118.9 | 129.6 |

Table 2. Construction cost indices in U.K.

| Year               | 2014  | 2015  | 2016  | 2017  | 2018 | 2019  | 2020 | 2021  | 2022  |
|--------------------|-------|-------|-------|-------|------|-------|------|-------|-------|
| Construction total | 109.9 | 108.4 | 115.4 | 112.9 | 127  | 136.9 | 140  | 165.2 | 184.9 |

Table 3. Construction cost indices in Romania

| Minimum salary for the construction branch | Period                | Difference |
|--|-----------------------|------------|
| 3.000,00 Ron                               | 2019-2022             | -          |
| 4.000,00 Ron                               | 01.01.2023-30.10.2023 | 33,33%     |
| 4.582,00 Ron                               | 01.11.2023-N.A.       | 52,73%     |

Table 1. Minimum wage for the construction

We see that in 2022, the minimum wage for a project starts and has a 24-month duration in execution; it turns out that there is an increase of 52.73% in the workforce.

- During the planning phase, project changes may occur due to modifications in legislation- Cplanning
  - b) Changes generated by obtaining approvals/agreements/authorizations (Environmental, Fire safety, Monument...) - Capprovals
  - c) Changes generated by inflation on construction materials - Cinflation
- Upon analyzing four countries, we have

noticed that their growth rates differ from one another, as she show in Fig.2 :

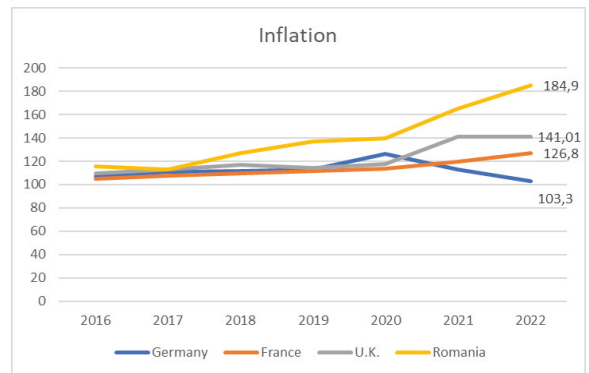


Fig. 2. Inflation in four country

We can observe that while inflation slightly increases in Germany over time, it eventually recovers, whereas Romania experiences continuous inflation growth each year.

In order to better understand inflation in Romania, the market cost was analyzed for relevant materials between 2019 and 2022, and is shows in table 3

|                                 | U.M. | 2019     | 2019     | 2020     | 2020     | 2021     | 2021     | 2022     |
|---------------------------------|------|----------|----------|----------|----------|----------|----------|----------|
|                                 |      | February | November | February | November | February | November | November |
| Masonry                         | mc   | lei      | lei      | lei      | lei      | lei      | lei      | lei      |
|                                 |      | 262      | 343      | 343      | 365      | 390      | 442      | 580      |
|                                 |      | 30,9%    |          | 30,9%    | 39,3%    | 48,9%    | 68,7%    | 121,4%   |
| Reinforcing bars (OB 37; PC 52) | kg   | 2,85     | 3        | 3        | 3,35     | 3,25     | 7,2      | 7        |
|                                 |      | 5,3%     |          | 5,3%     | 17,5%    | 14,0%    | 152,6%   | 145,6%   |
| Concret C16/20                  | mc   | 221,5    | 225,57   | 225,57   | 247      | 259,3    | 262,65   | 317      |
|                                 |      | 1,8%     |          | 1,8%     | 11,5%    | 17,1%    | 18,6%    | 43,1%    |

|                                     | U.M. | 2019<br>February | 2019<br>November | 2020<br>February | 2020<br>November | 2021<br>February | 2021<br>November | 2022<br>November |
|-------------------------------------|------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Extruded polystyrene 10<br>cm thick | mp   | 26               | 26               | 36,95            | 36,95            | 36,95            | 56,9             | 76,6             |
|                                     |      |                  | 0,0%             | 42,1%            | 42,1%            | 42,1%            | 118,8%           | 194,6%           |
| Inflation rates for<br>materials    |      | 108,5            | 112,6            | 110,1            | 110              | 110,2            | 157,2            | 175,5            |
|                                     |      |                  | 3,8%             | 1,5%             | 1,4%             | 1,6%             | 44,9%            | 61,8%            |

After analyzing the table data, we observed that the market value of certain building materials is higher than their inflation index.

By applying all costs described, the total cost for a given project can be seen in Eq. (1) :

$$C = C_i + C_d + C_{wage} + C_{planning} + C_{approvals} + C_{inflation} \quad (1)$$

## CONCLUSION

This study only refers to the construction cost without considering the resulting costs from design/supervision costs and taxes. The study underscores that there will be an increase in the initial project cost until its completion.

## REFERENCES

1. DECISION No. Law no. 907 of 29 November 2016 on the stages of elaboration and the framework content of the technical-economic documentation related to the investment objectives/projects financed from public funds
2. Electronic Public Procurement System - <https://www.e-licitatie.ro/pub/notices/contract-notices/list/0/0>, last accessed 2023/12/01
3. European Central Bank – About – Education – Explaners, [https://www.ecb.europa.eu/ecb/educational/explaners/tell-me-more/html/what\\_is\\_inflation.en.html](https://www.ecb.europa.eu/ecb/educational/explaners/tell-me-more/html/what_is_inflation.en.html), last accessed 2023/09/01
4. Ahmed Yousry Akal, Inflation and Reinforced Concrete Materials: An Investigation of Economic and Environmental Effects, ISSN: 2071-1050 Sustainability 2023, 15, 7687.
5. VOB 2019 edition in English, German Construction Contract Procedures – Parts A, B is C, DIN Deutsches Institut für Normung e.V.
6. Statistisches Bundesamt - [https://www.destatis.de/DE/Home/\\_inhalt.html](https://www.destatis.de/DE/Home/_inhalt.html), last accessed 2023/10/01
7. L'Institut national de la statistique et des études économiques - l'INSEE - <https://www.insee.fr/fr/accueil>, last accessed 2023/10/20
8. Index du bâtiment - BT01 - Tous corps d'état - <https://www.insee.fr/fr/statistiques/serie/001710986#Tableau>, last accessed 2023/11/20
9. Indice de réactualisation des actifs matériels dans la construction (IM) - <https://www.insee.fr/fr/statistiques/serie/001711020#Tableau>, last accessed 2023/11/20
10. Office for National Statistics - <https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/interim-constructionoutputpriceindices>, last accessed 2023/09/20
11. National Institute of Statistics - <https://insse.ro/cms/ro/content/buletin-statistic-de-pre%C5%A3uri-nr62020>, last accessed 2023/12/10

However, a thorough understanding of costs requires a risk analysis, other comprehensive studies, and automated calculation programs.

The following actions are required :

- Analysis of existing formulas for the calculation of cost adjustment;
- Finding adjustment cost parameters applied to each type of project (civil constructions, hydro-technical constructions, monuments, road constructions)
- Cost impact depending on the execution duration and the type of project;