IOP Conference Series: Materials Science and Engineering

PAPER • **OPEN ACCESS**

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To cite this article: Magdalena Apollo *et al* 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **471** 112055

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Risk of Cost Overruns in Implementation of Building Investment in Urban Conditions in the Aspect of Historical Background of its Location

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Abstract. The article is a continuation of the authors' analyzes on the risk of delays in implementation of building investment in urban conditions in the aspect of historical background of its location. In case of construction investment located in the historic part of the city, the possible accumulation of many unfavourable factors, which in course of its implementation, may constitute a serious source of cost overruns and disruptions, should be taken into account at the preparation stage of the project. Therefore the aim of the article is to present the main factors that have a significant impact on the construction site located in the historic part of the city, i.e. they are the cause of risk in the course of works and, as a consequence, affect the cost of construction project. On the selected example of the facility located in the historic part of Gdańsk Old Town, the authors indicate the reasons for construction investment cost increase. The authors also analyze the scope of resulting cost overruns between planned and actual values. The aim of the analysis is to draw investors' attention to the need of taking into account cost contingency already at the preparation stage of construction investment, which results from the specific and unique nature of this type of projects.

1. Introduction

The main action undertaken by the investor and the contractor at various stages of the implementation of the construction investment (preparation, implementation, settlement and operation) is planning and cost control. Many examples coming from practice indicate that the vast majority of completed construction projects exceed the originally set budget.

It is possible to indicate numerous examples of construction projects for which the actual costs, determined after their implementation, were significantly different from planned. For example, [1] indicates the following cases:

- the cost of building a tunnel under the English Channel exceeded the planned budget by 80%,
- the cost of building the Jubilee underground line in London exceeded the planned expenditure by 67%, and the investment was delayed by two years,
- the construction of a bridge over the Great Belt Strait in the Baltic Sea exceeded the planned budget by 54%.

This tendency is also confirmed by research conducted under Flyvbjerg on a representative statistical sample of 258 buildings [2]. The research results show that the problem of underestimating the cost of planned investments is common and concerns almost 9 out of 10 projects under study.

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It was also found that the average exceeding of cost for the analyzed investments was 28% [3]. The quoted research results explicitly indicate that the monitoring of costs incurred in the course of investment implementation is an important and still valid issue[4]. It is also an important issue in the aspect of effective spending of public funds, including the EU budget. Therefore, methods are sought for effective control and reduction of expenses, through the development of advanced management and managerial accounting techniques, as well as the use of multifaceted analyzes conducted by the investor at the investment preparation stage. In Polish conditions, attention is paid to strong competition in the construction market, especially in the area of public procurement, in which the contracting authority is perceived as a "verified" (solvent) contractor.

The high interest in orders financed from the state budget means that in many cases construction companies propose unrealistically low prices in the offers. As stated in the Report of the President of the Public Procurement Office on the functioning of the public procurement system in the period from June 2016 (i.e. after the amendment of the Public Procurement Law), the price criterion may only represent 60% of the total assessment, and the most frequently used criteria are the date of completion and the warranty period. The selected criteria do not improve the situation - the price criterion is still significant (leading) in the evaluation of tenders. While in the case of non-public investors, it is possible to renegotiate the price of the contract in the course of works or after their completion (e.g. due to the increase in prices of production factors), in practice, in the vast majority of cases such action is not applicable to public procurers. A significant limitation in this respect is the provisions of the Public Procurement Law [5]. Despite the obligation for public procurers to apply differentiated criteria for the assessment and selection of the best offer, the large weight given to the price criterion means that often the lowest price determines the selection of a given contractor for construction works.

In the vast majority of cases, such action is the direct cause of the increase in the cost of investment, in extreme situations also leads to the company bankruptcy [6].

For the construction works contractor, a particularly severe solution is the lump-sum form imposed by the contracting authority and the lack of consent to increase the amount of remuneration in the event of unforeseen circumstances. In any case, a significant increase in the value of the contract adversely affects the image of the entities that implement it - weakens the creditor's credibility and undermines the reliability of the calculations, increases the cost of the contractor, worsens his position and good image on the construction market, it strains the opinion about his credibility and reliability [5,6].

An additional difficulty when estimating the cost of some construction projects is their location. Preparation and implementation of investments located in urban areas and in the areas of historical cities are highly risky activities of a different nature[9]. The direct effect of the occurrence of threats is usually the increase in the costs of the planned activities and the extension of the implementation time, which also in many cases has a financial dimension.

2. The subject of analysis

This article is a continuation of the analysis presented in the first part, i.e. in the article titled: *The risk of delays in implementation of building investment in urban conditions in the aspect of historical background of its location.*

The subject of the analysis is construction works, carried out in the period from December 2016 to March 2018 as part of the project entitled "*The improvement of the historic building of the Old Pharmacy from the 17th century with the Gateway Passage and defensive walls of the Main City in Gdańsk, by giving new cultural functions."* Its scope includes the revitalization and reconstruction of the historic building Wybrzeże Theater - 17th-century Old Pharmacy and the construction of a new scenes at the site of the former Gateway Passage, located in the area of the Main Town in Gdańsk.

The goal of the activities is the construction for the Wybrzeże Theater a new stage with a rehearsal room and an observation deck in the Gateway Passage and a foyer in the Old Pharmacy. According to the assumptions of the Investor, the building of the Old Pharmacy will be used as a communication and utility space for the new scene. It will allow to obtain a representative space in a historic building.

The project is implemented by Wybrzeże Theater with the co-financing from the Regional Operational Program of the Pomorskie Voivodeship for 2014-2020. The investment discussed in this article is a part of a wide range of activities including the modernization of the Malarnia scene, the construction of a new scene "Old Pharmacy", the modernization of the Large Stage and Teatralna Street, above which a glass connector will be constructed between the buildings. The end of the undertaking is planned for 2022, provided that the Investor obtains external sources of financing. The project is implemented in stages, and the work began in 2015. It includes earthworks and archaeological research, demolition works, conservation works of the front façade of the Old Pharmacy building and the construction of an underground technical building. Currently, thanks to co-financing from the EU and financial support of the Marshal of Pomorskie Voivodeship and the Mayor of Gdańsk, it is possible to complete the adaptation (reconstruction) of the Old Pharmacy and the scene in the former Gateway, as well as modernization of Teatralna Street. The next action will be the modernization of the Malarnia scene, followed by the construction of the Large Stage (Figure 1).

The division of the project into individual tasks is dictated primarily by the financial resources owned and acquired by the Investor. The division is as following:

- Task 1: the excavations and archaeological research
- Task 2: the conservation works of the front elevation of the Old Pharmacy
- Task 3: the construction of an underground technical building
- **Task 4: the reconstruction of the Old Pharmacy and construction of a new scene at the Gateway Passage:**
    - **Task 4.1: basic state**
    - Task 4.2: finishing works
    - Task 4.3: equipping facilities
- Task 5: modernization of the Malarnia scene building:
    - Task 5.1: basic state
    - Task 5.2: finishing works
    - Task 5.3: equipment
- Task 6: reconstruction of the main building.

The scope of the project, presented in the article, concerns the implementation of the basic state of objects from Task 4.1 – the reconstruction of the Old Pharmacy and the construction of a new stage in the former Gateway (Figure 2 and Figure 3). According to the Material and Financial Timetable prepared by the contract parties (the Employer - Contractor), the works have been divided into 5 stages (Figure 4):

- Stage 1: Old Pharmacy
- Stage 2: Gateway Passage, I.1-I.5 axes
- Stage 3: Gateway Passage, I.5-I.9 axes
- Stage 4: Connector
- Stage 5: Transformer station.

Figure 1. The visualization. The complex of Wybrzeże Theater buildings, top view. In the foreground, the Main Building, in the distance from the left: the Malarnia scene building, the Old Pharmacy and the Gateway Passage building (source: Author's Jacek Bułat Architectural Studio)

Figure 2. The visualization of buildings of Old Pharmacy and Gateway Passage (source: Author's Jacek Bułat Architectural Studio)

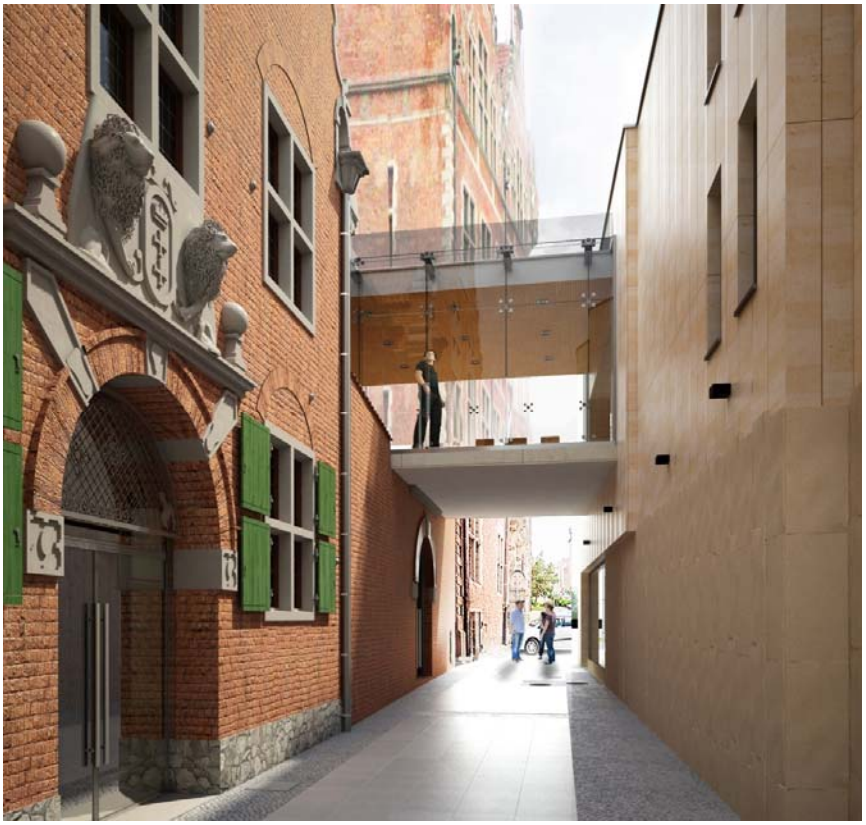

Figure 3. The Visualization of Teatralna street, view on Connector (source: Author's Jacek Bułat Architectural Studio)

The location of the new stage in the former Gateway Passage is planned between the existing buildings of the Old Pharmacy and the Great Armory. Both buildings are valuable for Gdansk because of their historical values. The conditions for conducting the works are difficult - the existing buildings are very compact and sensitive to noise and vibrations generated by working construction equipment - in the immediate vicinity there is an artistic public university, hotel and functioning theatre.

Detailed information related to the historical objects is presented in the article [*The risk of delays in implementation of building investment in urban conditions in the aspect of historical background of its location* - to be published].

3. The planned cost of investment

The analyzed case concerns the implementation of the basic state of the buildings of the Old Pharmacy and the Gateway Passage (Figure 4). In Table 1 is presented the amount estimated by the awarding entity and the contractor.

Six tenders were submitted in the procurement procedure. The value of networks proposed by the contractor selected in the tender procedure and entered into the content of the construction contract was lower by PLN 1 084 048, it is by 28% from the value determined by the Ordering Party in the investment cost estimate (Table 1). The arithmetic mean of prices from all submitted offers was 3 018 337.05 net PLN. It should be stated that the price of the selected - the most advantageous offer was the market price.

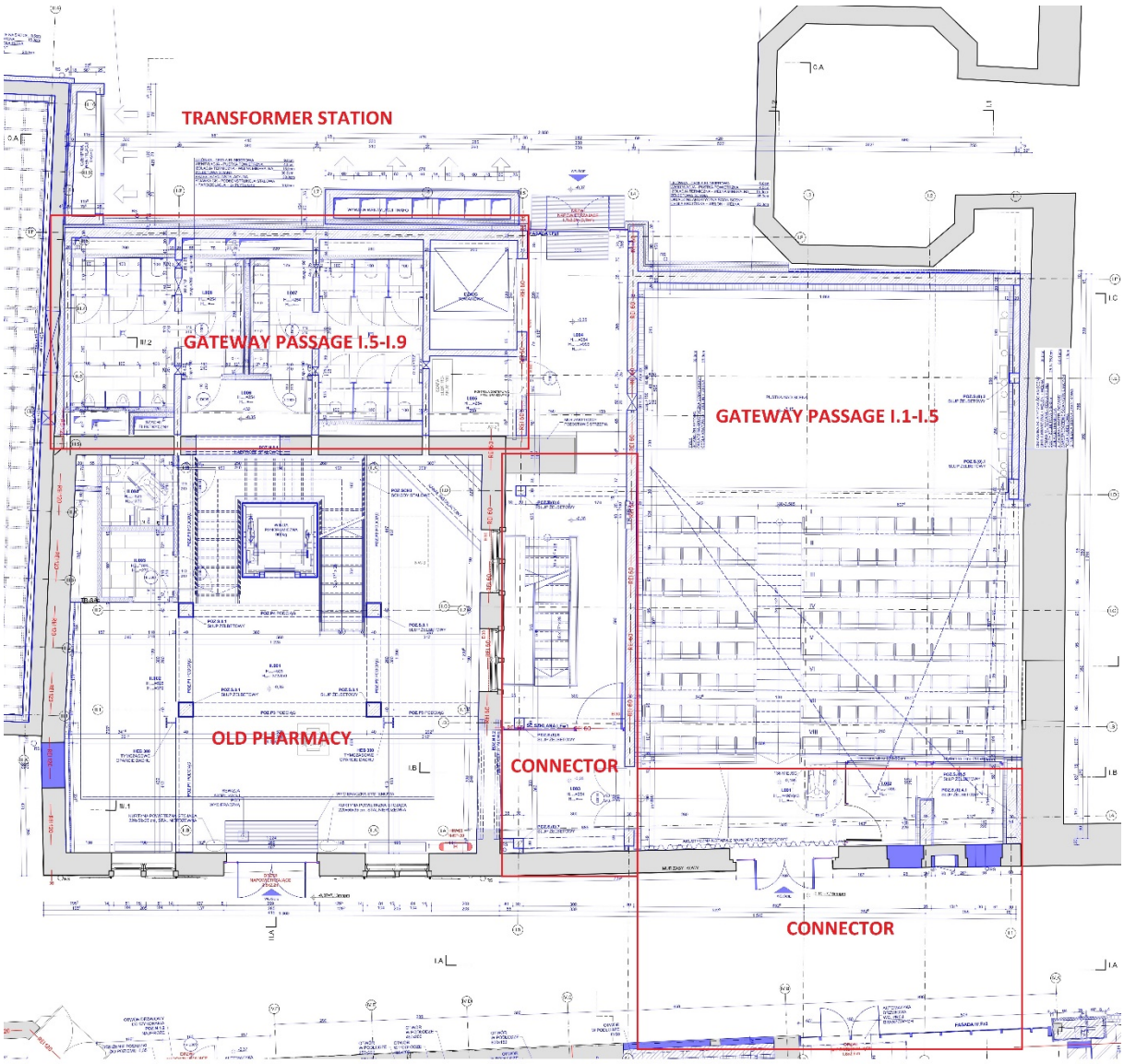

Figure 4. The graphical division into reconstruction stages of the Old Pharmacy and the construction of a new stage in the former Gateway Passage (own study based on the design of the Author's Jacek Bułat Architectural Studio)

Table 1. The list of investment costs estimated by the contracting authority and the contractor works at the stage of investment preparation

No	The estimated works value	The net works value [PLN]	The gross works value [PLN]
1	The value of works determined by the customer in the investment cost estimates	3 782 688.00	4 652 706.24
2	Value of works. proposed by the contractor selected in the tender procedure (unlimited tender) and entered into the Agreement for construction work	2 698 640.00	3 319 327.20
3	The value of works given by the awarding entity in the application for co-financing of the part 1implementation	3 152 240.00	3 877 255.20

[a] source: own study based on the co-financing agreement, the investment cost estimate and tender offer, made available by the Investor.

The parties divided the contract value into five stages, consistent with the work implementation order. In Table 2 is presented the division of the contract into stages along with the values of the individual stages approved by the Ordering Party and the Contractor.

Table 2. The division of the contract into stages with their values

No.	The stage of works	The value of works according to the Contract [PLN]
1	Old Pharmacy	824 617.63
2	Gateway Passage I.1-I.5	1 041 512.86
3	Gateway Passage I.5-I.9	401 105.64
4	Connector	124 839.87
5	Transformer station	306 564.00
	Total	**2 698 640.00**

[a] source: own study based on the material and financial schedule provided by the Investor

According to the construction contract signed by the parties in 2016, the value of the contract amounted to 2 698 640.00 net PLN, and the nature of the remuneration was defined as a flat rate, assuming the amount would remain constant throughout the contract's duration.

4. Disturbances in the course of works

After the Investor handed over the front of the works, the Contractor immediately proceeded with the demolition work. They ran without major complications, where during the earthworks, relics of brick architecture were found. The investor stopped works and notified the Pomeranian Voivodship Conservator of Monuments (PWKZ). He carried out the inspection and issued a decision ordering:

- further suspension of construction works,
- protection of the area and marking of the discovery site,
- carrying out archaeological research at the Investor's expense along with the implementation of conservation documentation.

A separate decision of the PWKZ was required to conduct archaeological research. In order to obtain it, the Investor was obliged to apply to the PWKZ for a research permit.

The application should indicate the head of the research team, therefore the Investor was obliged to conclude an agreement with the Archaeologist. The Archaeologist hired by the Investor prepared the Research Program, which was attached to the application for issuing a research permit.

The Archaeologist's tasks included:

- unveiling of all discovered architectural relics,
- archaeological and architectural documentation with description of discovered relics,
- conducting surveys in the place of trim of the area with the registration of archaeological layers visible in the profile,
- preparation of documentation from the course of archaeological research and preparation of these tests results.

Due to the unique nature of the finding, PWKZ did not allow to demolish the exposed walls. In the explanatory memorandum to the decision, it pointed out that the discovered walls constitute the gothic foundations of the medieval tower, demolished in the modern period under the Old Pharmacy, replaced by the building of the Old Pharmacy. It was found that the condition of the preserved walls makes possible to read their original function, it is possible to recreate the outline of the tower's foundations, and the relics have a scientific value, i.e. they constitute an original historic substance whose chronology dates back to XIV-XV centuries. The investor was obliged by the decision of the

PWKZ to adapt the discovered relics in the designed space. The need to adapt the walls resulted in a number of changes of utilitarian and constructional nature in the designed building. This involved the preparation of replacement designs that the designer - performing the author's supervision, performed for an additional remuneration.

During the archaeological research, historic foundations were completely uncovered, which is why the Investor, waiting for the design of a replacement structure, ordered a temporary support of historic foundations in the form of a steel grate, as recommended by PWKZ. His task was to protect the relics from possible destruction. This solution had to be approved by PWKZ. The support of the walls was made for additional remuneration.

The Investor's obligation was to conduct archaeological research. The order for their performance was related to the award of a public contract. The designer took part in the process of changing the project documentation, supervising the implementation of the project. The need to preserve the discovered relics and adapt them inside the building was associated with the introduction of a number of changes in the functional and constructional layout of the future facility. Major changes occurred at the level "-1"- the functional properties of the designed space significantly deteriorated, i.e. it was significantly limited. The size and location of the historic foundations collided with the corridor designed at level "-1", from which wardrobes and lavatories for artists need to be available. In addition to replacement of architectural solutions related to the new division of space, construction solutions have changed in terms of the positioning and support of the load-bearing walls. There was also a need to reduce the dimensions of the freight elevator. Changes introduced to the structure design resulted in additional costs related to previously prepared prefabricated made of reinforcing steel. The works contractor prepared steel prefabricated elements at the stage of joining demolition works, while construction changes introduced into the project during the ongoing works resulted in the inability to use some of the previously prepared elements.

5. The actual cost of the works – the cost deviations analysis

As a result of carried out at the request of PWKZ numerous activities (archaeological research, security and strengthening of foundations, introduction of changes to the project documentation), the Investor incurred an additional cost. The investor spent 178 861.14 net PLN (Table 3) on unveiling the discovered relics, unplanned at the stage of preparing the investment. Figure 5 presents the planned and actual costs of carrying out works in individual stages.

Table 3. The list of costs of additional works

No.	The scope of additional work	Works net value [PLN]
1.	Archaeological research	3 724.00
2.	Execution of the project replacement	40 000.00
3.	Implementation of temporary protection of uncovered foundations	92 186.27
4.	Development of the conservation works program	5 000.00
5.	Comprehensive restoration works of foundations	21 500.00
6.	Change of reinforcing steel elements	6 251.67
7.	Change of the location of the heating valves and construction of the technical ceiling	10 199.20
	Total:	**178 861,14**

[a] source: own study based on the material and financial schedule provided by the Investor

It should be noted that Stage 3 was originally to be completed for 401 105,64 net PLN, which accounted for 15% of the contract value. As a result of the discovery of historic foundations and the need to perform additional works, the value of works covered by Stage 3 (Gateway Passage I.5-I.9) increased by 178,861.14 PLN.

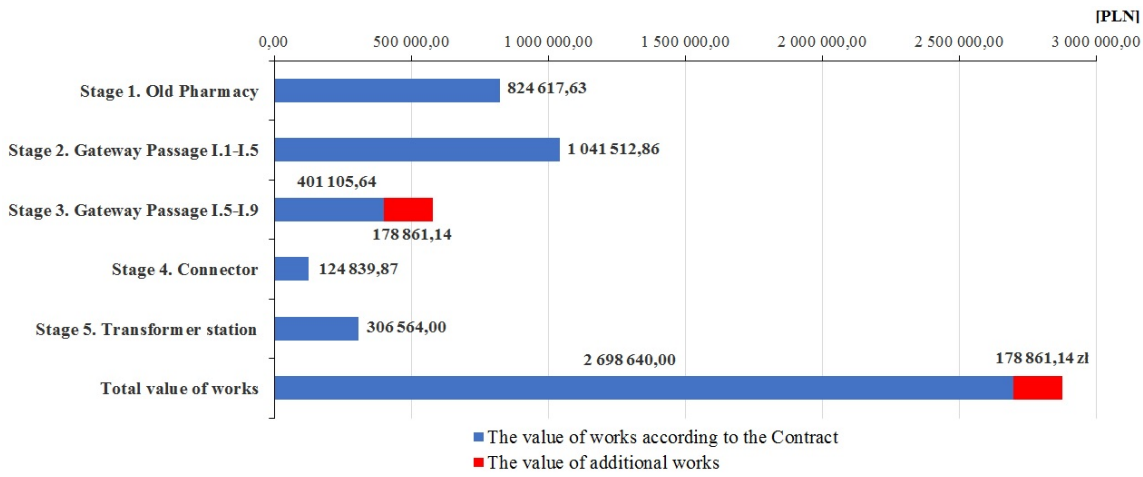

Figure 5. The summary of the basic works value and additional works (source: own study based on the original material and financial Timetable and its updates, made available by the Investor)

This means that the execution of Stage 3 in fact costed 579,966.78 net PLN. This resulted in an increase in the value of the contract by 31% in relation to the contractual amount determined by the parties at the stage of signing the contract.

It should be emphasized that due to the need to change the organization of works, the Contractor was obliged to perform a number of spare and additional works, which are not reflected in the cost statement. The replacement project concerned only the building and construction industry, the remaining industry projects concerning electrical installations, heating, ventilation and air conditioning, as well as hot and cold tap water were not updated. This in turn required a significant (not originally assumed) involvement of both investor's supervision and participation of works managers in the "on site" arrangements of the actual course of internal installations.

The costs that the ordering party had to incur in connection with the discovered relics do not increase the material value of the object and do not improve its functional properties. What's worse, the long process involved in issuing administrative decisions led to a significant moisture of walls, which for this period and in later works, were fully exposed, so vulnerable to weather conditions, including water and low temperature. In practice, these walls will give moisture into inside for many months, which will worsen the usable properties of the rooms.

The value of additional work amounted to 178 861.14 net PLN, which resulted in an increase in the value of the contract by 6.6%. However, the amount of additional expense does not reflect the actual workload of the Investor and the Contractor, related to obtaining relevant documents and carrying out works of a different nature in order to expose the historic relics.

6. Conclusions

The analysis of the literature on the subject and the chosen example justifies the formulation of the following conclusions and statements.

1) The initially planned cost of construction works for the case analyzed in the article was 2 698 640.00 net PLN. Due to the increase in the scope of activities and the caused delays, the investment cost increased by 178,861.14 net PLN. This resulted in an increase in the cost of implementation of the entire project by 6.6% in relation to the planned cost - determined at the stage of signing the contract. It should be noted that the additional expenditure that the Ordering party had to incur is at the same time the risk value associated with the implementation of this investment located in the historical part of the city of Gdańsk.

2) The example clearly shows that in the case of a building located in the historical part of the city, it is very difficult at the stage of preparing the investment, clearly determine the cost of its

implementation. For this reason, it is very important at this stage to comprehensively analyze the available historical documentation, as well as to take into account the financial and time reserve in relation to the potential increase in the scope of works, changes in project documentation and changes in the works technology.

3) It should be noted that in the case of archaeologically rich areas, the most probable reason for the suspension of works and the increase of the investment cost are historical discoveries. Their occurrence after the commencement of works usually results in the suspension of works in the area of discoveries. It is obvious, therefore, that in the case of such specific locations of construction investments, the possibility of increasing the cost and extending the duration of works should be taken into account already at the planning stage of the undertaking in the form of financial and time reserves. Despite the great difficulty in quantification, the risk analysis should be carried out in each case. In practice, a frequent reason for impeding the economical implementation of construction projects is the presence of numerous factors of a different nature: financial, administrative, legal and organizational. The diagnosing of potential threats, taking into account the possibility of their occurrence in cost estimates in the form of cost reserves (for unforeseen situations and expenses), in practice results in improving the quality and reliability of investment preparation, implementation and increasing the efficiency of spending funds. This is particularly important in relation to activities at historic buildings.

4) The implementation of works in the historical areas of some cities is a difficult issue. In many cases, due to the poor technical condition of monuments, they become a lost good, which is why actions aimed at protecting them are necessary. The most effective way is resettlement - adaptation. The introduction of new, currently desirable functions, can restore the monument to life, show its historical values, create a landscape of cultural urban space. The case presented in this article is a perfect example. A unique element of the presented project is the combination of a newly designed, reinforced concrete, contemporary theatre object with an existing historic building from XVII century. Due to the use of an unusual solution, a unique effect of interpenetrating usable space of a specific character was obtained and the historical and cultural values of found relics were emphasized.

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