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Analysis of investment stages along with a construction project management project for an investment task regarding the reconstruction and expansion of the locomotor system rehabilitation center Krzeszowice SPZOZ in Poland

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Abstract: The current geopolitical situation: the outbreak of war in Ukraine and the outbreak of the COVID-19 pandemic. This is related to the difficulties faced by construction projects, taking into account the problems at every stage of the investment project, from the beginning to the end. A specific investment case was adopted for the analysis, which is "Reconstruction and extension of the Rehabilitation Center of the Movement Organ in Krzeszowice". This is quite an intriguing case, because its course leads through these two difficult years for the construction industry. In the construction process, it can be noticed that the presented problems become everyday, which leads to the search for new ideas for solutions to the issues of pandemic and war. Numerous publications, articles and specialized books were used for comparison. The analysis of the literature on the subject allowed to notice that that the literature on the subject of this project is relatively small. The discussed issues are such a new experience that few authors have devoted their publications to this subject. Numerous articles and publications helped to prove and support the thesis in this field of economy.

Keywords: Construction company, construction investment management, investment process, participants in the investment process, construction investment planning.

1. Construction investment management

In the literature on the subject, you can find many definitions of investment project management. According to J. Sobieraj, according to CHARTERED INSTITUTE OF BUILDING, it is "comprehensive planning, coordination and control of the project from the conceptual phase, through preparation, implementation, to completion, the purpose of which is to meet the client's requirements for the creation of a functionally and financially feasible project, completed on time and in accordance with the requirements and quality standards" [1]. The author, B. Grzyl, believes that "an investment project covers a number of fundamental activities – e.g. planning and implementing the project and handing it over to the investor for use" [2]. A similar definition is provided in their work by E. Stokes and S. Akram, who state that that "investment project management is a professional discipline that separates the project management function from the design and execution functions. Management and project can be combined for smaller projects and may be performed by a project team leader, but for larger or more complex projects, the evolution of project management has resulted in the need to separate management" [3].

In numerous publications, the term "project" is used interchangeably with the term "undertaking", i.e. a complex action involving many other entities, which we carry out in accordance with the concept and plan. The term of the project can therefore be defined by such features as [4]: purpose, uniqueness, complexity and specificity.

The definition of the project is defined in national and international standards, i.e.:

- International standard ISO 10006 - "a single process consisting of a set of coordinated and controlled activities with a start and end date, undertaken to achieve a goal in accordance with specific requirements, including time constraints, costs and resources" [5];
- The German standard DIN 69901 – "investment project management is a full set of tasks, techniques and tools used in the course of project implementation" [6];
- British standard BS 6079.

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The definition of a project in construction reduces many meanings, e.g. construction design or detailed design, which facilitates nomenclature. The concept of a project can be limited by such parameters as [4]: scope, quality, costs, time, resources and risks [25]. Changing one of these parameters affects the possible change of at least one of the others [7], [8], [23]. [24]. [25], [26], [27].. The effects of the above sentence can be seen, for example, in by shortening the time of the project, caused by a deterioration in quality or an increase in costs (Fig. 1).

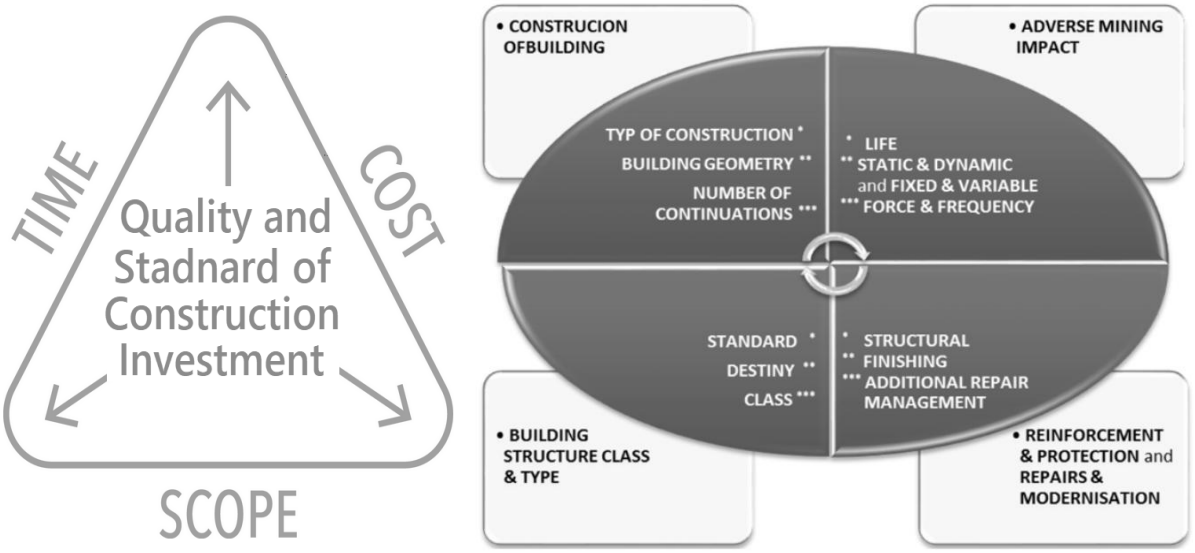

Fig.1. a). Project scope triangle [8] b) The scope of variables for a property in terms of investment risk for the project of erecting or renovation and modernisa-tion of existing buildings [25]

2. Phases of construction investment management

The implementation of the investment can be identified in terms of sixteen stages of the investment process, divided into individual phases:

- Conceptual phase – defines the conceptual stage and the initial feasibility study.
- Implementation planning phase – analyzes the feasibility of the investment and determines the final choice of the investment location (which at this stage is related to the fulfillment of legal requirements).
- Implementation preparation phase - it is divided into the stage of obtaining and financial security, as well as the preparation of construction documentation and a detailed map of investment management and arrangements.

Article [9] combines the phase of planning, preparation, pre-implementation and implementation of a construction investment. It begins its process with a building permit and ends with obtaining an occupancy permit. Between them there are a number of activities (construction works), including the preparation of detailed and as-built designs [9].

- Pre-implementation phase - is based on the preparation of detailed documentation and a tender aimed at selecting the general contractor for the project, as well as technical statements, bill of quantities and a list of settlement elements [10].
- Implementation phase - consists in handing over the construction site of the investment to the contractor (at the same time appointing the manager and investment supervision inspectors).
- Use phase - the stage of investment operation, related to the warranty period of the building.
- Project closing phase - based on the analysis of results immediately after the investment and after the end of the warranty period.

3. Construction project management processes

The area of operation of construction companies is very wide. It covers issues related to the design and construction of buildings. Processes that create value for customers are defined as core or essential processes, as well as those that support the core business. In accordance with the needs of the management system developed on the basis of the process method, an appropriate division of the implementation process is adopted (in construction companies, they are divided into main, auxiliary and management) [11], [23], [24]. [25]. The main implementation processes include processes that occur during the construction investment process. Due to its stage, these processes are divided into three groups:

- investment preparation process,
- investment design process,
- investment implementation process.

Auxiliary processes include procurement, testing and inspection activities. Management processes, on the other hand, concern: marketing activities, investor service, business management processes in the areas of general administration, human resources, finance, resources, and risk management.

A detailed classification of processes can be presented as follows:

- investment preparation process,
- investment design process,
- investment implementation process,
- the process of the supply sphere - applies to the purchase of e.g. materials, construction equipment, auxiliary materials, as well as delivery of material to the construction site,
- process of control and testing zone - includes geodetic measurements and technical tests of built-in building materials,
- financial management process - includes budgeting, obtaining funds, settlement, inventory of fixed assets and equipment, accounting, controlling revenues and costs, as well as reporting,
- resource management process - it is mainly the supervision of infrastructure, measuring devices, or machines and devices,
- company management process in the sphere of general administration,
- process related to marketing activities - includes obtaining orders, planning the company's annual resources, developing cost estimates, as well as purchasing services from external companies,
- personnel management process - includes personnel activities within the company, i.e. supervision, training, team building as well as medical, periodic and control examinations,
- risk management process – assesses risks and identifies environmental, technical and occupational health and safety hazards [11].

4. Participants in the investment process

The investment and construction process involves a greater number of participants in the investment process than provided for in the Construction Law. Each of the members remains in specific organizational and legal relations with each other, using (depending on their role) technical and working documentation as well as technical and organizational documentation (Fig. 2).

According to Art. 12.1 of the Construction Law in Poland - the main participants in the construction process, authorized to perform independent technical functions are:

- investor,
- investment supervision inspector,
- designer,
- construction manager or works manager.

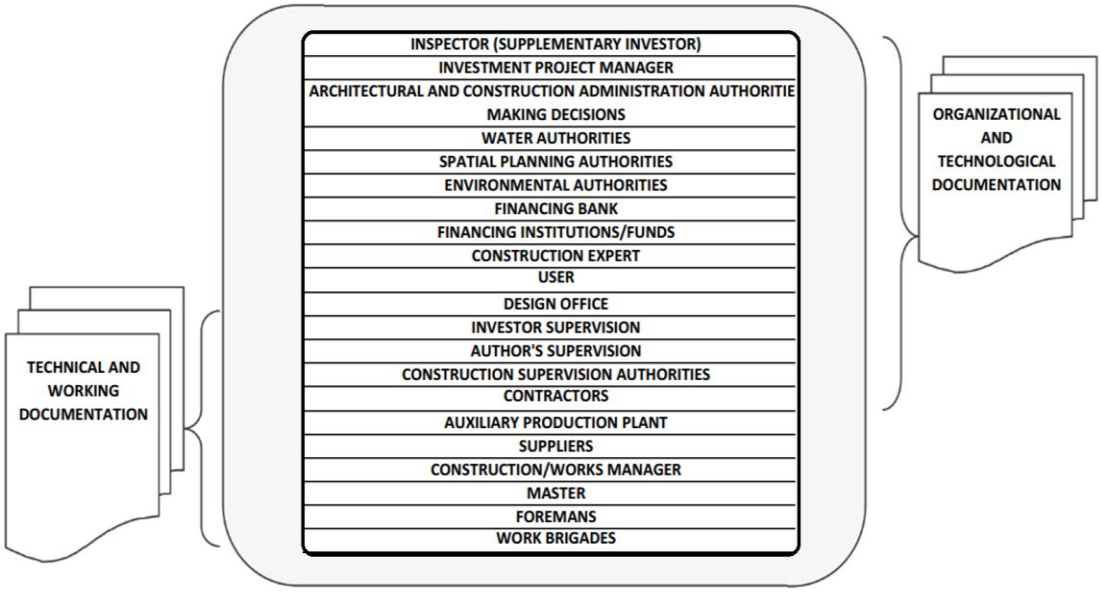

Fig. 2 Participants in the investment process [12]

Figure 3 shows an exemplary composition of a team of participants in a construction project.

Developing an effective specification strategy for your construction product is very important to create demand, to reduce the importance of price and transfer influence away. It is important to gain insight into the marketplace by industry forecasts. The fact gathering enables you to base your strategy on reality, answering real market demand. The construction of a building involves many people: Architects; Designers; Engineers; Contractors; Sub-Contractors all working together to meet the needs of the Client. These construction professionals are brought together for a specific construction project and then disbanded once construction is complete.

The Architect starts with the investor's needs in terms of how the building is to be used and of the building regulations and other performance aspirations, of which sustainability is often one. Analysis to specify a product is based on many factors, some of them conflicting. For architects, tools that help them to specify correctly are of importance, particularly since Grenfell. This is where the product manufacturer can provide BIM [28] objects, technical literature or specification documents. Management needs to find a way of getting the attention that analysis product ticks all of the boxes: functionality, reliability, sustainability, availability, aesthetics and value will be just some of their requirements.

Civil engineers must be responsible for foundations and general structures, with additional qualifications they become Structural Engineers who design the skeleton or structure of a building, that are safe, serviceable and perform well. Engineers have to sign-off the sub-contractor's installation, carrying the responsibility for any failure, so they should be very vigilant about product selections. The quantity surveyor has significant influence on the selection of building products. Early in the construction project QS should always give advice on costs, helping establish total spend for project completion to guide the architect and investor when it comes to product specification. Construction investment managers should look for value, either in Capital Cost or Operational Cost as well as issues like good availability. Some of the challenges facing the Quantity Surveyor are product availability, quantity and stock monitoring. The Quantity Surveyor will often be the starting point for a project, undertaking a feasibility study and defining a budget. Between 65% and 75% of a project's costs are decided at concept stage and if analysis product has not been included at this point it will be much harder to justify a price premium later, even if you can demonstrate superior value [27], [28]. [29] [30].

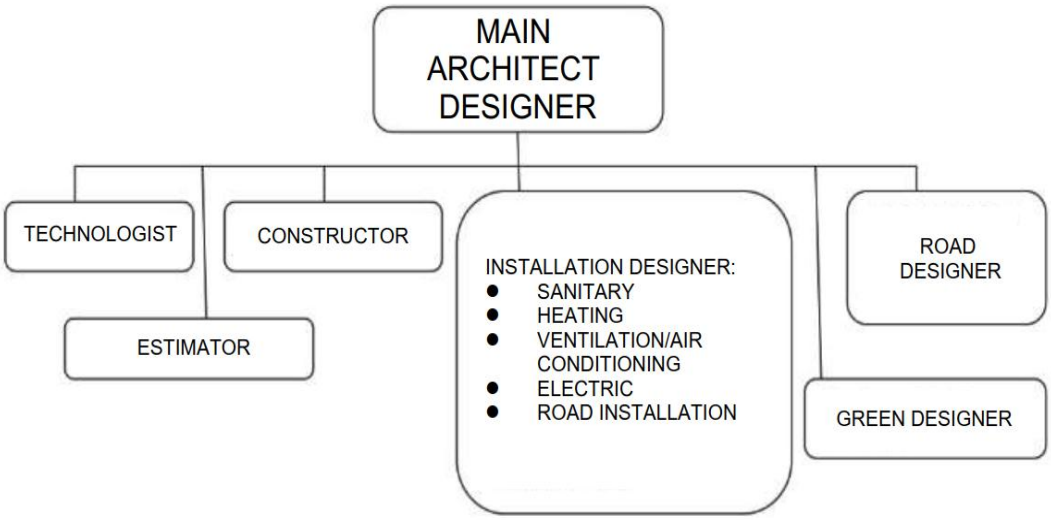

Fig. 3 An example of a team of participants in a construction project [12]

5. Planning of construction investments

When preparing an investment feasibility study, it is important to provide information necessary to identify investment opportunities and verify whether the project meets the needs of the intended beneficiaries. This analysis consists in conducting such technical, economic, strategic and market research that will allow to achieve the best parameters of the investment, and also create conditions for achieving the best economic or strategic result [13].

It is particularly important to implement such elements as:

- a list of goals and needs for the implementation of the investment, taking into account the market analysis; in the case of private sector investments, strategic analysis should be included in transport, wastewater treatment or other branches of the public sector;
- the potential of locating and placing the necessary building objects on them, while meeting the functional and utility requirements;
- environmental assessment of individual categories;
- a list of investment costs for individual variants, based on an indicator or comparative analysis;
- estimation of performance of individual variants, indicating the best one;
- strategic timetable for the most advantageous variant [14].

The most important task of the engineer is responsible technical analysis of the investment implementation. When determining the location of a construction object, the accessibility of a construction site, the proximity of a construction project or the impact of a construction object in the operation phase on other objects that may cause construction difficulties, the machine and ground conditions are primarily taken into account. In addition, it is necessary to analyze the possibilities of development and land development in accordance with the local plan, or at least study the conditions and direction of spatial development, or the conditions of development. It is also worth specifying the location of possible public purpose investments. This analysis also includes road system solutions, the number of above-ground and underground parking spaces, as well as the conditions for greenery development and tree felling. In order to select the best solution that meets the investor's requirements, a technical analysis is carried out. The Engineer should recommend the selected implementation variant. The environmental guideline is also important, constituting the information sheet of the project, according to which the environmental protection authority defines the scope of the report required to assess the impact of the project on the environment [15], [27], [28].

6. Current trends in the construction project

The current situation on the construction markets is quite changeable and dynamic. This is mainly due to the geopolitical crisis. The outbreak of the COVID-19 coronavirus pandemic in March 2020 provoked the construction industry to rapid price increases, both for building materials and labor. These circumstances shook all construction projects. None of the general contractors could predict sudden price increases before the pandemic. The tenders won before March 2020 were doomed to minus profits summing up the construction process.

The volatile prices of material and labor faced an additional problem - the outbreak of war in Ukraine in February 2022, which plunged the economy and the construction industry into even greater price increases. The increase in prices for raw materials, as well as for the lack of imports from Russia or Ukraine, caused a large increase in prices.

- **Valorization**

Construction projects, trying to save contracts, tried to index the prices of projects. Only larger construction companies with sufficient capital could afford such moves. Smaller companies were forced to leave the construction site and terminate their contracts.

The main tool to combat sudden increases in the prices of construction materials has been the indexation of remuneration in construction contracts. Currently, the Ministry has issued a new Journal of Laws of October 7, 2022, thanks to which the State regulates indexation acts and their assignment to individual subcontractors [16].

- **Polish construction sector and circular economy**

Many European countries (including Poland) face the challenge of closing the flow of natural resources in national economies. The concept of circular economy (CE Circular Economy), the overarching goal of which is to ensure the smooth flow of raw materials, energy, work and information in such a way as to enable the "reconstruction" of the involved human and environmental resources, has been indicated as a means of mitigating the effects economic, resulting from excessive exploitation of the natural environment. In the case of construction, which is one of the most absorbing sectors, the transition to BOZ requires a holistic approach involving all sectors of the supply chain at each stage of the product life cycle. The article by J. Tomaszewska [17] discusses selected issues,

- **Mediation in construction**

K. Kaczorek and M. Księga state in their article that "mediation is a voluntary, confidential, informal and out-of-court procedure in order to reach a consensus" [18], [26]. In the publication [19], [25], [27] you can also read that mediation is a method of dispute resolution in which a third party helps the parties to communicate with each other, identify interests and issues for discussion, and to reach mutual acceptance of the terms of the dispute.

Technical mediation is the fastest form of resolving conflicts in matters related to the performance of the contract, as well as the scope and quality of work. Mediation is one of the methods of voluntary conflict resolution in economic disputes, protecting the interests of both parties and enabling them to cooperate further.

7. Definition of the subject of the construction project

The construction project of the reconstruction and expansion of the Center for Rehabilitation of the Movement Organs was started with the announcement by the administrators of the center of order 2020/S 139-341009 of July 21, 2020. The aim of the project was to increase the availability and quality of medical services.

The reconstruction and extension was carried out in the "design and build" formula. It included the preparation of design and cost estimate documentation along with all necessary administrative decisions (e.g. building permit, conservation permit, as well as other required regulations and arrangements, including those with the Regional Directorate for Environmental Protection), necessary for the implementation of the investment, and then construction of a new hospital facility, depending on the solutions proposed in the design documentation.

The main goal of the company implementing the construction project was to prepare the planning process for its implementation in the future. In order to allow modeling, you need tools to analyze such processes. The currently available IT systems are programs supporting the management of the investment process. It is

important to use different graphical models of the entire investment process and its parts (schedule, dependency network). A project plan created with the use of graphics (schedule) and graphical analysis (methods), as well as a network of process planning tools, allows, among others, to evaluate the return on investment. A good solution is to use computer-aided planning, e.g. in the form of Microsoft Project.

The presented results of the schedule model include e.g. information about the oldest and newest date of occurrence, time reservation, as well as the course of the critical path for each event. Together with the agreed deadlines, this allows for accurate and comprehensive scheduling. In fact, schedules (e.g. general and detailed schedules) are a form of modeling and presentation [21], [23], [24], [25], [26].

Conclusions can be drawn on the basis of the problem article. This publication defines the importance of the impact of individual stages of the investment (its time and cost) on the timely completion of the investment (they are dependent on each other). The authors focused on the analysis of a selected construction investment process, financed from public funds. Problems encountered during the investment and their consequences are described here. It also presents the impact on the duration of the project, referring to the situation of preparing and designing public utility facilities, co-financed from government agencies or European Union funds. The author came to similar conclusions that were inferred from the presented schedules. The course of work depended on the applicable regulations and the time devoted to legal arrangements. A thorough analysis of the created schedules allows you to effectively eliminate all time constraints of the investment. Any investment changes during the project extend its completion date [22], [23], [24], [25], [27].

The problems of the construction project of extension and reconstruction of the Center for Rehabilitation and Organ Movement are not only a significant delay in implementation. The main problem of the General Contractor are the costs incurred, which are growing at an alarming rate from week to week.

The difficult times, as well as the increase in inflation, have been analyzed and regulated by the International Federation of Consulting Engineers FIDIC (Federation Internationale des Ingenieurs-Conseils). The goal of this organization is to unify the procedures for the implementation of global construction investments. The rules and regulations formulated by it are aimed at establishing a certain balance between the obligations and interests of all parties to the investment process, i.e. a fair sharing of risks, threats and responsibilities that arise between the contracting authority and the contractor. This group also helps to create a proposal for contracts for construction works, which define the framework for cooperation of participants in the construction process (in particular, sharing the risk between the participants of the process).

- contract agreement,
- general conditions,
- specific conditions.

These terms can be applied in almost any legal system in the world and therefore have a global scope. Typically, significant changes in contracts concluded on the basis of the Public Procurement Law require new public procurement procedures. This change takes place when it leads to a change in the general nature of the contract (modification of its subject or type - e.g. signing an annex).

8. The cost of improvements method

The calculation of the cost of improvements method should be always be comparable withto to new buildings which represent highest and best use development. If the subject property is new then it represents highest and best use development, the four classifications of cost (historic, current, replacement and reproduction) and is the initial given constituting the destination point of the construction investment because all will an ideal template for deserted costs of modernization or renovation, unless there has been a sudden and dramatic change in market conditions during the development period. When the building is not new that it becomes necessary to choose between the different standards of cost to which reference has been made. Three main methods of cost estimation include quantity survey, unit-in-place and unit-of-area or unit-of-volume.

Estimating costs by this method is undoubtedly the most accurate method. It is used by contractors in computing tender bids. It involves determining the quantity and quality of all of the component materials used, computing the amount of labour required and pricing these various individual components. In addition, items are included to cover the cost of the contractor's overhead and profit.

The unit-in-place method (best described as an element cost system) is a modification of the quantity survey method. It employs the cost of installed materials expressed in terms of a convenient module of measurement: such as foundation, roof, plumbing, wiring, heating, exterior walls, etc.

In estimating the installed costs of all of the materials, executive work, investment monitoring and project and administrative shapesin the bilding are estimated per square foot, and therefore the cost of the whole wall module of a building, can be readily determined, remembering that if the cost of overhead and profit is not included in the unit costs, these must be added as separate items. [23], [24], [25], [26], [27].

Once the costs of a sufficient range of units-in-place have been determined, it is a quicker way to estimate cost than the quantity survey method.

The method of estimating cost by unit-of-area or unit-of-volume involves taking the known total cost of a building (including contractor's overhead and profit) and dividing that by the total area or cubic capacity. The resultant cost per square foot or cubic foot is then applied in estimating the cost of buildings of similar construction. In principle, evidence of costs is collected and used in exactly the same way as evidence of value using the comparative method. For this reason, this way of cost estimating is sometimes known as the comparative method of cost estimating [28], [29], [30].

It will be apparent that the validity of such cost estimates depends on the degree of similarity between the subject property and the buildings used for the purpose of obtaining the unit costs. Similarity in this respect bears some relationship to similarity when using the comparative method of appraisal. In particular, it is important to recognize that differences in roof design, the shape of a building and ceiling heights will exercise a considerable influence on costs.

Since the amount of overhead expenses is a function of managerial ability, it follows that this item is subject to wide variations. It will be appreciated from the nature of the items included in the developer's overhead that it would be wildly optimistic to expect any great degree of accuracy in their estimation by an appraiser. The approximate nature of this estimate is one of the measurement weaknesses of the cost method. The experts is not working for the actual costs incurred in a particular case, but for those costs which might reasonably be expected by a developer of average efficiency.

The contractor's overhead listed above (for the purpose of comparison) and the contractor's profit will be included in the contractor's price. They do not, therefore, have to be computed separately. It is essential, however, to know the items which are covered by contractor's overhead in order to eliminate duplication. Reference to the quantity survey cost estimate will show if the contractor's overhead and profit have been included in total cost.

The developer's expected profit depends on his skill in anticipating market demand for the development undertaken and his ability to satisfy that demand at a price which buyers are prepared to pay. If the market value of the project on completion is less than had been expected and/or if the costs are higher than had been forecasted, the developer's profit will be reduced or perhaps eliminated. On average, the developer will make a profit which will be commensurate with his competence and risk. Keep in mind, however, that once the project is commenced, profit becomes strictly a residual amount after all other costs are paid. Developer's profits fluctuate violently with changes in economic conditions and any generalization as to their amount is extremely dangerous. The most common exception to the analysis of the costs of improvements arises in the case of development, especially the speculative construction of low-price. Depending on the scale of operations, such development may be carried out in a variety of ways.

In appraising property by the cost method, it would generally be incorrect to include in the cost of improvements a developer's profit and overhead (although some of the items contained in schedule of developer's overhead might have to be transferred to contractor's overhead; for example, disposal costs).

9. Conclusions

As a result of the discussions, the following conclusions were formulated:

- The course and method of carrying out a construction project depends on the applicable provisions of the construction law and on the financing of the project.
- The impact of the COVID-19 pandemic significantly affected the deadlines for the implementation of the construction project, due to such factors as: lack of direct contact with officials issuing significant decisions, isolation of people infected with COVID-19.
- The significant increase in prices is due to the unavailability of materials and human resources resulting from the COVID-19 pandemic.
- The outbreak of the war in Ukraine contributed to an increase in the prices of construction materials and labor.
- The lack of a valorization act causes bankruptcies of even the most prosperous construction companies.

- Lack of regulation of contracts prepared by FIDIC taking into account the increase in inflation,
- The construction industry and the financial sector should make efforts to build long-term relationships based on mutual trust and understanding, which will be the foundation of a successful business partnership independent of current market conditions.
- The use of environmentally-friendly building materials may have a more favorable impact on the duration of the construction project,
- Higher and longer financing of construction projects by general contractors caused by the extension of the implementation time, which involves the breakdown of the amount for a given stage over a longer period of time.

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