Completion of the grounds for determining construction investment costs using State capital in Vietnam

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**Abstract.** Vietnam is in the performance of industrialization and modernization of the country. Along with the economic - cultural - social development, construction investment activities are growing in both scale and quality. The formulation and management of construction investment costs are always improved in terms of content as well as calculation methods in the direction of management and strict control of costs, but creating the right to be proactive, improve responsibility, power of the person deciding to invest and the investor. However, in fact, there are still many obstacles, lack of grounds for determining costs, incomplete construction price and norm system, "latency" compared to market movements; regulations on cost calculation is unreasonable, causing waste of investment capital, affecting project efficiency. The article aims to analyze the current situation of the grounds for determining construction investment costs, establish groups of factors affecting this work, and conduct linear regression analysis to determine the factors that have great influence on this work. This is the ground for proposing solutions to complete the grounds for determining construction investment costs using State budget capital in Vietnam.

**Keywords:** norm, construction price, price index, total investment amount, construction cost estimating.

1 Make a problem

The Covid-19 epidemic has comprehensively affected the economy of the world and Vietnam, including the construction industry. This is a field with large investment capital, accounting for a high proportion of the annual state budget. Therefore, the management of construction costs is always one of the contents of concern. Recently, the Government of Vietnam has made many efforts to improve the efficiency of State management of construction costs in investment projects. Such as approving the Project to complete the norm system and construction price; complete the research and complete 13 methods of building norm and determining construction price. However, due to negative impacts at home and abroad, volatile economy, financial difficulties, with requirements from very large-scale public investment projects, complicated management such as North-South Highway Project in the East in the period 2021-2025, there are shortcomings that cannot keep up and hinder practicality.

The production and supply chain of materials is constantly broken, the prices of energy, supplies, and raw materials have spiked and fluctuated unpredictably, which has increased the total investment amount and construction cost estimating, affected the medium-term public investment capital allocation plan. The system of regulations on norms and unit prices has many shortcomings and is not suitable for investment projects using State capital or large-scale public-private cooperation projects. The guidance on determining construction investment costs has a number of regulations that are not suitable for practice and difficult to apply.

In accordance with current regulations, construction investment costs (construction investment) is the total cost necessary for new construction, repair and renovation of construction works, expressed through the criteria of total investment (investment project formulation stage), construction estimate (construction phase), settlement value of investment capital. Construction investment costs are prepared according to each specific work, in accordance with the investment stage, design steps, capital used and regulations of the State [1].

In order to ensure that construction investment costs are properly and fully calculated for each project, work, in accordance with design requirements, the following grounds should be complied with:

Ground for determining construction investment costs

Total invest-ment

Construction estimate, construction bidding package price, construction contract price

Norms and construction prices, construction price indices

Cost of project management and construction investment consulting

Payment and settlement of construction contracts, payment and settlement of construction work investment capital

Rights and obligations of the person deciding to invest, investors and construction contractors

**Figure 1.** Ground for determining construction investment costs.

In there, for projects using State capital, the specific content and management decentralization are as follows:

+ *Total investment* is the entire construction investment cost of the project determined in accordance with the basic design and the contents of the Feasibility Study Report, which is the basis for managing the project's costs. For projects using State budget capital, the total approved investment is the maximum cost that the investor is allowed to use to implement the project.

+ *Construction cost estimate* is the necessary cost for the construction of the work, the performance of the bidding package, the construction work, which is determined on the basis of the calculated volume from the technical design, construction drawing design, work requirements to be performed and construction norms and prices. It is the basis for determining the price of the bidding package and negotiating and signing construction contracts.

+ *The norm system* is developed, promulgated and used by the Ministry of Construction for general throughout the country.

+ The Ministry of Construction shall guide the method of determining *work* *construction prices*, unit cost rate of construction investment and construction price indices. Province People's Committees shall announce the local work construction unit prices; decentralize and authorize the Department of Construction to announce information on construction prices and construction price indices in the province, serving as a basis for investors to make payment and settlement.

+ *Project management cost* is the maximum cost for project management, in accordance with the approved time and scope of work, determined on the basis of the norm of percentage (%) or equal to how to prepare an estimate

+ The settled investment capital must be within the limit of the total investment in construction approved or adjusted in accordance with the regulations of law. [1], [2]

Thus, the ground for determining construction investment costs includes many contents, which are closely related to each other. In this article, the authors focus on analyzing the shortcomings and inadequacies that greatly affect the cost management and investment performance in Vietnam, that is: *the norm system, construction prices, methods of determining construction investment costs.*

2 Overview of related researches

2.1 Domestic researches

- Some researches point out the inadequacies of the norm system, the construction price on different roles. As the State management agency and an investor with an article by author Thu Ky [3], the role of a contractor focused on the "Workshop to discuss difficulties in announcing prices of supplies and materials to the foot of the works” [4]. Ministry-level scientific research [5] deeply researches and perfects management costs in cost estimate for construction investment consulting.

- Researches on completing the State management of construction investment costs with projects using State capital on different aspects. State management aspect in general, author Le Manh Cuong researches on controlling construction investment costs [6]; author Ta Van Khoai researches on State management of construction investment projects from the State budget [7]; PhD. Nguyen Thi Binh delves into the sources of budgetcapital in the transportation industry [8]. Researching for specific localities, PhD. Can Quang Tuan mentioned solutions to improve the efficiency of using basic construction investment capital managed by Hanoi city [9].

- Delving the grounds for determining construction costs, author Phan Manh Cuong has established methods to establish general construction prices for road traffic works [10], the article [11] introduces international experience on the construction price formation system in the US, France, and the Russian Federation; Author Nguyen Quyet Thang proposes a number of methods to guide the setting of construction cost estimate [12].

The above researches help the author inherit some theoretical issues about construction investment costs, and also suggest the author to continue to research the grounds for forming construction investment costs in Vietnam.

2.2 Abroad researches

Researches on State management for construction investment using budget capital in general, cost management in construction in particular are mentioned quite a lot.

- Peter E.D.Love, Zahir Irani has completed the quality cost management information system in construction, analyzed the benefits and limitations [13]. P.E.D Love also believes that the loose management, lack of information is the cause leading to waste of time and costs [14].

- Renata.S-B, Marek.P analyzes the construction cost of energy-efficient wooden houses located in the South of Poland. In the construction cost estimate, statistics of the Central Statistics Office of Poland and market survey were used [15].

- Nadezhda.B, Andrey.I, Denis.K and Lyubov.P research on cost management of construction investment projects under conditions of risk and uncertainty. The authors have established the Cost Management Process Model, which includes the following stages: planning, determining, performance evaluation, analysis, and treatment [16].

- Article No. [17] analyzes the effects of time and cost on public works construction in Northeastern Nigeria, points out the factors that make time and cost variables become the big problems, adversely affecting the construction industry, mainly in terms of completing projects later than expected time and budget costs.

The research is quite in-depth about costs, but the legal regulations and measures applied to the environment are different from Vietnam.

3 Research Methods

- Qualitative research method: From the collected secondary data, the authors learn and evaluate the current status of regulations on cost management and the grounds for determining construction investment costs.

- Quantitative research method: analyzing survey results to identify and evaluate factors affecting the determination of construction investment costs. The steps are as follows:

|  |  |
| --- | --- |
| **Process** | **Contents** |
| Step 1: | Find out the results, research and interview some experts to understand the factors affecting the calculation of construction investment costs |
| Step 2:  | Build a questionnaire and consult experts to adjust the questionnaire |
| Step 3: | Direct interviews or send complete questionnaires to consult experts who are working as project managers, cost managers, contractors, investors, researchers in the field of construction.  |
| Step 4: | Collect questionnaires and process data using SPSS software. |

4 The current situation of grounds for determining construction investment costs using the State budget capital in Vietnam

4.1 System of norms, construction price and construction price indices

In the period of 2018 - 2022, the norm system and construction price has been reviewed, amended, abolished or newly promulgated being closer to reality, better complying with the laws on the market economy, especially for the investment projects from the State budget capital, contributing to creating a transparent and competitive construction market, preventing loss and waste in construction investment. Specifically:

**Table 1.** Summary of review, amendment, abolishment or new promulgation of construction norm[18]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No. | Implementation agencies | Total | Conduct a review | Rejection | Amendment | New construction |
| 1 | Ministry of Construction | 16,005 | 16,005 | 1,005 | 3,289 | 1,896 |
| 2 | Ministry of specialized construction management | 17,700 | 13,500 | 1.380 | 8.226 | 5.993 |

Regarding the construction price system, the Ministry of Construction has reviewed and amended 596 unit cost rate of investment and work construction structural parts prices; building the unit cost rate of investment for 1 km of highway. 61/63 provinces have issued a set of work construction unit prices to serve the management of construction investment costs in the locality; 63/63 provinces have surveyed and announced the price of materials and labor in the province; 58/63 provinces have issued machine shift prices.

The system of mechanisms, policies and laws on cost management has been amended, supplemented and perfected in the direction of strictly controlling costs but creating the right to be proactive, enhancing the roles, responsibilities and powers of the person deciding to invest, the investor, shorten the implementation period in order to bring the highest efficiency to the project. The Ministry of Construction has submitted to the Government for promulgation 3 decrees on management of construction investment costs. However, due to the rapid development of the construction market, when implementing new policies, difficulties and obstacles cannot be avoided.

* *Organize the determination and announcement of construction prices and construction price indices in the localities*

Price fluctuations and slippage are major obstacles in the implementation of projects. Prices of raw materials and construction materials fluctuate in an increasing direction, difficult to forecast (average 30 - 40%, even many types of materials increase by over 50%). The main materials (cement, iron, steel, sand) all increased strongly. For example, from the beginning of 2021 to the second quarter of 2022, the price of cement increased 3 times (30%), specifically: in January 2021 increased by VND 50,000/ton, in November 2021 continued to increase by VND 80,000 - VND 90,000/ton, March 2022 increased by VND 150,000/ton. In 2022, the price of terracotta bricks will increase by 15-18%, steel by 37%, diesel by 76%, gasoline by 97%. This has increased the total investment and construction cost estimate, affecting cost management.

- The determination and announcement of construction material prices monthly and quarterly is slow, not close to market prices, causing difficulties for investors in payment and settlement, affecting construction costs and construction progress:

+ The Law on Construction 2014 stipulates that the Province People's Committee are responsible for organizing the determination and announcement of work construction prices and local construction price indices, ensuring timely response to price fluctuations in the construction market. But there is no specific regulation on announcement time, currently only 44 localities announce monthly, there are still 19 localities quarterly (3 months), do not follow reality, causing a large difference between material prices in the announcement and market prices. For example, in Thanh Hoa province, in the first quarter of 2023, the market price of construction sand and plastering sand is VND 400,000/m3, but the price announced by the Department of Construction is VND 225,000/m3. In Binh Dinh province, the market price of land in road construction is VND 49,000/m3, but the price announced by the Department of Construction is VND 29,000/m3. [19]

+ The price of materials in the announcement of the Department of Construction is calculated on the basis of reference to the quotation of suppliers in the province without considering the supply-demand capacity of the market. When there are large projects or many projects are implemented at the same time, material suppliers take advantage of the situation of demand exceeding supply to speculate and increase prices. The price announcements of localities are only suitable for small-scale projects, with low technical requirements and construction for a long time in the locality, not suitable for highways with high and complicated technical requirements, constructed in a short time and often deployed simultaneously, such as the North - South highway component projects in the period of 2017 - 2020, 2021 - 2025.

+ The list of supplies and materials in the price announcement is lacking and limited in type (such as supplies for electromechanical systems), or has but unknown specifications, so it is not guaranteed to provide data to set up and manage costs.

- Construction price indices are targets that reflect the volatility of construction prices over time, but these indices are currently low and have not followed the market closely. In the first quarter of 2022, the price indices increased by an average of about 10% compared to the first quarter of 2020 (when there was no change), while the price of materials increased faster, causing difficulties for contract payment. For example, two North-South highway projects, section Mai Son - National Highway 45 and Phan Thiet - Dau Day, according to the price announcement and price indices of localities in 2021, the contract of these two projects is adjusted to increase from 5 - 7%, but calculated according to the actual slippage value, it must increase by 17-18%. [4]

- The method of determining the price indices when calculating the provision cost for the slippage factor according to the guidance of the Ministry of Construction is not very accurate. The calculation formula is as follows:

|  |  |
| --- | --- |
|  |  (1) |

In there:

+ IXDCTbq: Construction price index used when calculating provision for slippage factor;

+ T: number of years (the closest year compared to the time of calculation to determine IXDCTbq); T≥3;

+ In: selected construction price index year n;

+ In+1: construction price index year (n+1);

Thus, IXDCTbq is determined by averaging consecutive construction price indices of at least 3 most recent years compared to the time of calculation. Provision is calculated for the future, so the closer to the time of calculation, the more accurate the slippage will reflect the price movement. According to formula (1), the calculation of at least the last 3 years does not reflect the level of price fluctuations, it should be calculated on a monthly or quarterly basis. Currently, the construction price indices in localities has been announced quarterly and monthly, so to determine the IXDCTbq it is not necessary to calculate the continuous construction price index according to the calendar year but can be calculated according to the construction price index according to the project year. For projects with implementation time of less than 1 year, the above formula is still used.

* *Organize the formulation, promulgation and application of construction norms:*

In construction cost management, estimated norm and cost norm are tools to perform the State’s management function to publicize information to increase competition in construction investment.

*Estimated norm* is the necessary waste of materials, labor, construction machinery and equipment, determined in accordance with technical requirements, construction conditions and specific construction methods to complete a volume unit of construction work; used to prepare construction estimate.

*Cost norm* includes norm in percentage (%) and norm in value; is the basis for determining the work construction price, indirect costs, project management costs, construction investment consulting costs and a number of other costs.

Although the norm system has been adjusted and supplemented, there are still many inadequacies:

1. *Inadequacy of the estimated norm system are shown in Table 2:*

**Table 2.** Some shortcomings of the estimated norm system [18]

|  |  |  |
| --- | --- | --- |
| No. | Shortcomings of the estimated norm | Works |
| 1 | Norm development method | Methods of statistics, synthesis, comparison, empirical analysis and synthesis of the above 4 methods. These methods have not closely followed surveys and market surveys, and have not focused on construction regulations, standards, and project standards,  |
| 2 | Lack of updating modern construction technology, new materials | - Construction technology of aluminum formwork, high-strength concrete, high-strength steel, etc.- Fill the roadbed with new materials (filling the roadbed with static rollers), tiled using glue. |
| 3 | Many construction works still lack norms | Maintenance work of scaffolding, equipment; some stages of building basements, paving industrial floors, making ceilings; Construction work lacks some common brick sizes in the market |
| 4 | Many construction works do not have norms | - Producing and installing the hanging frame system when tiling stone- In the field of road traffic, there are about 32 construction works without norms such as the group of installation works of cable-stayed bridges, suspension bridges, processing and installation of steel arch bridges, drilling piles through casteur cave, pill out underground piles in the water. |
| 5 | Some norms are not suitable for the work (too high or too low, or the difference between works) | - (i) Too high compared to reality, for example, for reinforced concrete pile pressing, the pile depreciation norm is 3.7% for 1 time of driving, while in fact there are many types of presses with high speed, at a lower cost; the construction of bored piles, the norms of pile drilling, wall pipe lowering, concrete pouring are also higher than reality, etc.- (ii) Lower than reality, such as the norm of brick and stone tiling; paint ceilings and walls; or with Song Hau 1 thermal power plant project, the norm of steel structure installation work for turbine house only calculates steel structure level according to simple works, ordinary factories (using cranes 30 - 50 tons), while the thermal power plant is more complicated, it is necessary to mobilize a larger crane (200 - 300 tons) with higher cost.- (iii) suitability between works: for example, the steel tensile test is more complicated and takes longer than the concrete compression test, but the steel tensile norm is lower; Concrete waterproofing test has a longer implementation time than concrete compression, but the norm is lower. In addition, the bolt cutting and bolt pulling test have the same code and norm, although these two works have different properties. |

*(2) Inadequacy of the cost norm system*

Like estimated norm, the cost norm system also has many unreasonable norms or costs that are not specified. This makes it difficult to estimate as well as control costs. The inadequacies are summarized through the following contents:

- Project management cost norms are checked according to the size and type of construction works. Many construction works have cost scale outside the promulgated cost scale. Current regulations, in case of exceeding the frame, are calculated according to the estimate. However, at the stage of preparing Total Investment, there is not enough data to calculate.

- The norm of consulting costs is generally low compared to the nature of the work. The cost of pre-calculated taxable income (interest) has a norm of 6%, while consulting contracts are not applied interest rate if it is paid late (which often happens), so many consulting units do not take this work seriously.

- Cost norms for design consultancy: It is not clear whether there is a cost to design the idea (concept) or not? Not mentioning the research, training, application of science and technology or new ideas in the design, etc. resulting in not really good design products.

- Cost norms for verification consultancy: Not taking into account the scope of works to be verified.

- The cost of preparing an investment project, calculated according to the cost norm, but it is unreasonable with at least VND 10,000,000 [3] because there are construction works (such as repair and renovation construction works) with total investment of only about VND 30,000,000, the cost of preparing an investment project accounting for 30% is too high.

- Some consulting works have differences and are not suitable. As the current cost norm of making a feasibility study report (FS) is still much lower than the design cost, while the FS phase is very important, determining the quality, efficiency and creativity of project; or traffic works with the lowest design norms compared to the remaining 4 types of works (civil, industrial, agricultural and rural development and technical infrastructure). Even with the type of construction that requires 3-step design, traffic works are only about 50-60% compared to other works. This does not cover the characteristics of traffic works that have many complex types such as: Bridges, tunnels, roads, railways, aviation; especially works such as large-aperture bridges, tunnels, and traffic intersections with different levels. [2]

It can be seen that the current construction norm system has not kept up with reality, while this is an important ground for cost calculation and management.

4.2 Method of determining construction investment costs

*\* Determination of total investment:*

In the period of 2018 - 2022, many projects with inaccurate determination of the total investment had to be adjusted many times, with a large adjustment ratio, such as Tra Khuc River downstream dam project (Quang Ngai province) whose total investment was required to adjust twice from VND 60,648 billion to VND 1,498 billion, up to 25 times; the investment project on building Ho Sen - Cau Rao 2 road axis (Hai Phong province) whose total investment was required to ajust from VND 1,405.4 billion to VND 2,656.8 billion... Many costs of several projects have not obtained sufficient grounds for calculation, such as Project on Repairing Thang Long Bridge with VND 15,464 billion; Project on Upgrading and renovating Black water road and canal with VND 10,278 billion; Project on building Ong Nhieu Bridge with VND 21,108 billion; Project on Expanding and upgrading Provincial Road 8 with VND 14,904 billion; Project on Renovating and upgrading runways and taxiways at Tan San Nhat International Airport with VND 7,439 billion; Project on Renovating and upgrading runways and taxiways at Noi Bai International Airport with VND 28,895 billion; … This situation was resulted from many reasons, and the inadequate method of determining the total investment is one of the main reasons.

According to current regulations, there are 4 methods to determine the total investment: (1) from the construction volume, the calculation is made according to the basic design and other necessary requirements of a project; (2) according to the construction investment capital rate; (3) from cost data of similar projects and works finished; (4) Combination of the above three methods.

The method selection depends on the consulting unit and the investor, the accuracy of the total investment depends heavily on the selection of a determination method. Normally, the investment rate method is often used because it is very quick and simple for obtaining results. However, the construction of Unit cost rates of investment is still limited, only 20 indicators can be added per year, mainly adjusting and updating the existing contents, it is very difficult to make new additions due to lack of historical data. In the formula of unit cost rate of investment, the principle of efficiency and feasibility, and the labor productivity have not been determined, the science and technology innovation and creativity have not been encouraged. Concurrently, the conversion of costs to the present requires the use of price index, which is published slowly and has not kept up with market fluctuations. Therefore, this method has a large deviation and is difficult to determine the cost components of the total investment to facilitate the next steps of cost management...

*\* Determination of the construction cost estimate:*

- Construction costs in the estimate are determined by the method of detailed quantity take-off that cannot be reduced to the pay item, applying the set of construction unit prices announced by the locality and the set of norms promulgated by the Ministry of Construction. Such regulation is only suitable for small and simple projects and environments with less fluctuation in terms of legality and price.

- The price formation according to the normative works has many shortcomings such as failure to reflect the progress factor affecting the price of works. For works that require fast progress, the cost will be increased, but the use of norms cannot express such fact.

- It is not appropriate to calculate the project management cost by taking the value of construction and equipment multiplied by the cost norm due to the fact that the project management task involves the entire investment process, including consultation and site clearance as well as other tasks.

The above analysis shows that the grounds for determining construction investment costs are still inadequate, causing difficulties to prepare and control construction investment consulting costs, which is a big challenge for the Government of Vietnam.

5 Evaluation of grounds for determining construction investment costs

Analysis of the above current situation indicates that the process of determining construction investment costs is till inadequate, depends on many factors, making it difficult to resolve problems synchronously and concurrently, priority should be given to solving the factors (fields) with the most problems. In order to more objectively evaluate the current situation of such tasks, the authors have built 3 groups of factors: (1) Organizing the determination and announcement of construction prices in localities; (2) Organizing the formulation, promulgation and application of construction norms (3) Method of determining construction investment costs. In determining the extent of influence of the factors, the authors created a questionnaire, conducted a survey by in-depth interviews with experts, applied SPSS software to process data, thereby proposing practical and reasonable suggestions and solutions to perfect this task. The implementation process has been mentioned in item 3.

**Table 3**. Factors evaluating the grounds for determining construction costs

| **No.** | **Code** | **Title of criteria** |
| --- | --- | --- |
| *I* | *Organizing the determination and announcement of construction prices in localities* |
| 1 | GXD1 | The organization of determining construction prices and construction price indexes in localities is carried out scientifically and transparently |
| 2 | GXD2 | The publication of construction prices and construction price indexes in localities is made in a timely and public manner |
| 3 | GXD3 | Contents of construction prices and construction price indexes are complete and synchronous |
| 4 | GXD4 | Construction prices and construction price indexes are suitable and closely follow the market |
| 5 | GXD5 | The criteria on method to survey and announce construction prices are clear and consistent. |
| 6 | GXD6 | The assignment and decentralization for management of construction prices and price indexes is made in a clear manner with specific responsibilities |
| *II* | *Organizing the formulation, promulgation and application of construction norms* |
| 1 | DM1 | The organization and formulation of norms is carried out in a scientific and transparent manner |
| 2 | DM2 | The promulgation of norms is made in a clear and synchronous manner |
| 3 | DM3 | The system of norms is updated and reviewed regularly |
| 4 | DM4 | The norms are developed in a specific, detailed and convenient manner for application |
| 5 | DM5 | The system of norms satisfies the requirements of formulating and managing costs |
| 6 | DM6 | The method of determining norms is modern, suitable and easy to do |
| 7 | DM7 | The assignment and decentralization for management of the norm system is made in a clear manner with specific responsibilities |
| *III* | *Method of determining construction investment costs* |
| 1 | PP1 | The method of determining construction investment costs is consistent with the investment stage and the sources of capital used |
| 2 | PP2 | The method of determining construction investment costs is consistent with the design steps |
| 3 | PP3 | The method of determining total investment guarantee the correct and complete calculations for each project or work |
| 4 | PP4 | The method of determining construction cost estimates guarantee the correct and complete calculations for each project or work |
| 5 | PP5 | The method of calculating unit cost rates of investment has covered all the criteria |

The findings from the analysis of factors influencing the determination of construction costs are shown in Table 4.

**Table 4.** Descriptive statistical analysis of factors influencing the determination of construction costs

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No. | Influencing factors | Mean value | Number of samples (N) | Minimum value | Maximumvalue | Standard deviation |
| *I* | *Organizing the determination and announcement of construction prices in localities* |
| 1 | GXD1 | 3.54 | 178 | 1.00 | 5.00 | .779 |
| 2 | GXD2 | 2.87 | 178 | 1.00 | 5.00 | .790 |
| 3 | GXD3 | 3.43 | 178 | 2.00 | 5.00 | .698 |
| 4 | GXD4 | 2.96 | 178 | 2.00 | 5.00 | .708 |
| 5 | GXD5 | 3.03 | 178 | 2.00 | 5.00 | .759 |
| 6 | GXD6 | 3.79 | 178 | 2.00 | 5.00 | .779 |
| *II* | *Organizing the formulation, promulgation and application of construction norms* |
| 1 | DM1 | 3.46 | 178 | 2.00 | 5.00 | .852 |
| 2 | DM2 | 3.48 | 178 | 1.00 | 5.00 | .859 |
| 3 | DM3 | 3.02 | 178 | 2.00 | 5.00 | .770 |
| 4 | DM4 | 2.99 | 178 | 2.00 | 5.00 | .753 |
| 5 | DM5 | 3.10 | 178 | 1.00 | 5.00 | .865 |
| 6 | DM6 | 3.27 | 178 | 1.00 | 5.00 | .851 |
| 7 | DM7 | 3.68 | 178 | 1.00 | 5.00 | .808 |
| *III* | *Method of determining construction investment costs* |
| 1 | PP1 | 3.61 | 178 | 2.00 | 5.00 | .901 |
| 2 | PP2 | 3.52 | 178 | 1.00 | 5.00 | .910 |
| 3 | PP3 | 3.27 | 178 | 1.00 | 5.00 | .826 |
| 4 | PP4 | 3.02 | 178 | 2.00 | 5.00 | .790 |
| 5 | PP5 | 3.03 | 178 | 2.00 | 5.00 | .822 |

Reviews on the findings obtained:

- All 18 factors have a certain extent of influence on the determination of construction investment costs, the mean value is asymptotically close to the cumulative mean value of 3.32. The maximum mean value is 3.79, the minimum one is 2.87, showing that all factors have influence, not too biased towards one factor. This poses the problem that it is not easy to concurrently solve all the inadequacies, it is required to identify factors with many inadequacies, which directly influence the effectiveness of cost management.

- Each factor has a different extent of influence, *it is required to carefully consider factors with low influence (mean value <3.0) to take initiative in providing directions and solutions to overcome. Because they are factors that indicate limitations, inadequate matters which should be improved.*

- GXD2, GXD4 factors in the first group obtain a mean value of <3.00 which accurately indicates the current urgent situation, when the price of fuel, raw materials and supplies increases rapidly and is difficult to make predictions but the construction price and price index fail to keep up with the market, making it difficult for the investor to prepare and manage costs, for the contractor's payment and final settlement, pushing many contractors into debt, especially with bidding packages applying the form of lump-sum contracts or fixed unit price contracts.

- In the second group of factors, the DM4 criteria has a mean value of <3.0, while the DM3 criteria has a mean value of 3.02, showing that the system of norms has still been insufficient, outdated, and failed to satisfy the demands for construction investment, in the context that public investment capital is being promoted to recover the economy after the Covid pandemic.

- PP4, PP5 criteria in the third group of factors obtained low mean value, showing that there are many limitations in the estimation methods.

- The factors with high mean value such as GXD6, DM7, PP1, PP2 indicate that the current assignment, decentralization for management of the norm system, construction prices are clear with specific responsibilities. At the same time, regulations on methods of determining construction investment costs are suitable for the investment stage, capital source and design steps.

The above analysis and evaluation findings serve the basis for the author to offer practical solutions to perfect the grounds for determining construction investment costs.

6 Solutions to perfect the grounds for determining investment costs in constructing works using State owned capital in Vietnam

6.1 Perfecting the system of construction norms and prices to guarantee the correct and complete calculations, the synchronization, simplicity and transparency

* *Perfecting the system of prices and construction price indexes*

In order to obtain comprehensive and synchronous solutions in the context of the construction market with many fluctuations and unpredictable material prices, it is required to implement the following solutions:

The Ministry of Construction should provide more specific instructions for localities on method to survey and calculate the price of materials to the construction site as well as calculate the price index. It is required to establish criteria on method to survey and announce prices in order for the announcement of construction prices to be transparent, public and timely.

It is required to stipulate that localities should regularly review, update and supplement the main materials and popular construction equipment in the list of announcement. For materials with many fluctuations, it is required to organize the determination and announcement of prices on the monthly and weekly basis. At the same time, the quality of forecasts on supply and demand in the area should be improved.

The scope of application of construction price indexes should only serve for management and direction, not for adjustment to contracts. There should be policies to encourage investors to employ consulting entities to calculate the construction price index and then submit it to the Ministry of Construction for promulgation.

The Ministry of Construction is required to establish a Team to monitor market information on construction prices to promptly summarize and evaluate the price movement of building materials and to forecast scenarios in the case of price fluctuations to serve as a basis for advising the Government's operation.

* *Reviewing, amending and supplementing construction norms in a timely manner*

It will take time to perfect the system of norms to guarantee the correct and complete calculations, the synchronization, simplicity and transparency. In the short term, pay attention on correcting the inadequate norms which greatly influencing construction investment costs; giving priority to the development of new norms that are urgent and have not been sufficient in the system of norms, considering this as a regular and urgent task.

The Ministry of Construction should to step up the professional training task so that the entities (localities, investors, contractors) may master the contents of guidance on determining new cost estimates and adjusted cost estimates according to the method promulgated by the Ministry of Construction, in order to help entities take initiative in applying when participating in construction.

Approaching the method of determining norms by surveying the market, ensuring compliance with construction regulations and standards, project standards, engineering instructions, construction conditions.

6.2 Perfecting the method of determining construction investment costs

The correct and adequate calculation of the total investment and construction cost estimates is essential for state management, the management of investors and construction contractors with projects using state owned capital in general as well as other sources of capital.

* *Determination of Total Investment:*

- It is required to depend on specific conditions on the extent of design performance, engineering and technological requirements, time and related documents to choose a method of determining the total investment. The combination method is the best one, whereby:

For construction cost: it is possible to determine on the basis of the construction floor area or according to the specific volume of construction and take-off tasks under the design and experience.

For equipment cost, it is calculated according to the quantity and type of equipment suitable to the technological design, market price of equipment and other factors (if any).

The cost of compensation for site clearance and resettlement shall be calculated according to the compensation and resettlement volume of the project and relevant state regimes;

Other costs shall be determined by making estimates or temporarily calculated according to a percentage (%) of total construction and equipment costs;

- Perfecting the calculation of the contingency cost for the slippage factor (GDP2): According to regulations, GDP2 is determined on the basis of the length of the construction period according to the project implementation schedule and the average price fluctuation of at least the last 3 years, suitable to the type of work, by construction region, and the fluctuation trend of cost and price factors in the region and internationally should be considered. GDP2 is determined by the following formula:

|  |  |
| --- | --- |
|  |  (2) |

Of which:

- T: the length of time to implement the construction investment project, T>1 (year);

- t: corresponding period (in years) according to the project implementation schedule, t = 1÷T;

- Vt: investment capital before provision made in year t;

- LVayt: interest expense on investment capital in year t;

- IXDCTbq: The construction price index used to calculate the provision for price slippage, which is calculated in section 4.1.

+ ±ΔIXDCT: average volatility of cost and price factors, which is determined on the basis of forecasting fluctuation trends in cost factors in the region and internationally by expert experience.

Formula (2), ΔIXDCT is determined on the basis of forecasting fluctuation trends of cost factors in the region and internationally. However, there is no guidance on method to forecast or get forecast data from any agency, so it is difficult for investors in appraisal, payment and final settlement. Therefore, in order to quickly complete the procedure for calculating Total Investment, consulting contractors and investors often set ΔIXDCT = 0.

In order to improve the accuracy when calculating GDP2 and to simplify the calculation formula, the contingency cost due to GDP2 price slippage should be calculated according to the following formula:

 $G\_{DP2}=\sum\_{t=1}^{T}(V\_{t}-L\_{vt})x(I\_{XDCTbq}t-1)$ (3)

- Determining the unit cost rate of investment: when the data is summarized, cross-checking measure should be applied to check the information; it is required to convert to volume units, typical designs for reference and adjustment for each type of work. Priority should be given to the determination of unit cost rate of investment by a proactive data-driven approach, in combination with historical data and data from design documents as well as input cost factors to match reality.

* *Calculation of Construction Estimates:*

It is required to renovate the estimation method in the direction of approaching international practices, whereby the quantity take-off and unit price analysis by item and aggregate unit price are consistent with engineering instructions, convenient for the payment and final settlement.

With the analysis of unit prices for items on the basis of the standard norm system, good design documents, detailed engineering instructions, together with the specific conditions of each work, it is possible to calculate the appropriate estimated price, thereby creating a basis for considering bid prices and selecting contractors.

7 Conclusion

Currently, the economy is changing unpredictably and has not yet recovered from the Covid-19 epidemic, therefore the effective management and use of state budget capital are even more appreciated. It is required to calculate and determine construction costs on the basis of the following principles: Developing an accurate, transparent and regularly updated database; applying the method of determining construction costs suitable to each stage of project implementation; Ensuring benefits between parties when participating in construction investment. Therefore, the article has analyzed the grounds for determining construction investment costs, constituting 18 factors that influence this task. Thereby, practical solutions are proposed to perfect the grounds for determining construction investment costs using State owned capital in Vietnam.

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