



Cost Contingency Estimation in Public Projects in the Construction Digitalisation Era: A Case of Vietnam

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Abstract: Construction projects, in nature, are complex and dynamic, therefore, when estimating the project budget, there should be a budget set aside, called “contingency” for dealing with changes in the project internally and externally. This paper, used a case study of a public hospital in Vietnam, discussed the estimation of cost contingencies in the preliminary feasibility study and feasibility study stages. Cost contingencies estimation using the construction investment rates have low accuracy, therefore, have been adjusted and re-allocated through out the stages. Additional data is needed for improving the accuracy of the contingency estimation. This approach is facilitated in the construction digitalisation era, especially with the issuance of Circular 12/2019/TT-BXD guiding the development and management of the systems of databases on cost norms, prices and price indexes. Historical data can increase the accuracy of the estimation of costs for construction consultancy services, including BIM services, which are currently estimated by predefined rates based on construction and equipment costs.

Keywords: Construction cost, cost contingency, unexpected additional quantity of work, cost escalation, construction digitalisation.

1. Introduction

As construction projects, in nature, are complex and dynamic (Nieto-Morote and Ruz-Vila 2011), they often face a number of uncertainties and more severe risks (Xiang, Zhou et al. 2012). Therefore, solutions for preventing construction project risks are essential for the success of project management. In the project owner's point of view, there should be a budget set aside to deal with the risks (Touran 2003), or in other words, to perform the selected risk management strategi(es). This type of budget is called “contingency”. Though both cost and schedule may be assigned a contingency (Touran 2003), this research study only focuses on cost contingency, which has been the subject of research for years.

One of the most frequent approaches for budgeting for contingencies is to include in a percentage of the expected cost, which is estimated based on previous experience with similar projects. This approach is the approach to be used in public projects in Vietnam, as required by recent and current regulations (Government of Vietnam 2015, Government of Vietnam 2019, The Government of Vietnam 2021). A variant of this approach is to assign varying percent contingencies to various elements of the budget with riskier sections of the project getting a greater contingency percentage (Touran

2003). However, recent research studies on the topic have revealed that, in the aforementioned approaches, the project risks are not taken into consideration, or not considered sufficiently (Espinoza 2011), then the estimated cost contingency may not be enough. Therefore, globally, several new approaches have been proposed in order to estimate the contingencies for construction projects more accurately.

In Vietnam, according to the current regulations and laws guiding the implementation of public construction projects, contingencies in these projects include provision for additional quantity of works and contingency for cost escalation during the project execution. According to the guidelines, contingencies for unexpected quantity of work can be quantified as a percentage of other total amount of other components of the total construction investment cost with a maximum predefined percentages identified in the guidelines; contingency for cost escalation is calculated based on the duration of project execution, capital allocation plan, and annual construction price indexes that suit the type of the construction considering the domestic and international price fluctuation (Government of Vietnam 2019, Government of Vietnam 2021). Though some risks such as price fluctuation have been included in the contingencies, there are lots of risks whose costs may not be estimated very well. In order to supply historical data for estimating the contingencies, Ministry of Construction in Vietnam has issued Circular No. 12/2019/TT-BXD of December 26, 2019, guiding the development and management of the systems of databases on cost norms, prices and price indexes (Ministry of Construction 2019). Building up such databases is one of the job that the construction industry of the country must do in the digitalisation era, as required by the Decision 1004/QĐ-BXD on Digitalisation Plan for the Construction Industry between 2020–2025, with vision to 2030 (Minister of Construction 2020).

This paper discusses the practice of cost contingency estimation in public construction projects in Vietnam. A case study of a public large hospital project was used for illustration. Background such as the international approaches of cost contingency estimation in construction projects, the practice of cost contingency estimation in public construction projects in Vietnam were discussed along with the policy change of the industry in the digitalisation area.

2. Background

2.1 Cost Contingency Estimation in Construction Projects: International Approaches

Cost contingency/contingencies (G_{DP}) in construction projects can be viewed from both perspectives of the project owners or the contractors. In public projects, since the real owners are the governments, for budgeting the contingencies, the governments may issue guidelines or suggest relevant standards issued by a professional body.

According to the Association for the Advancement of Cost Engineering (AACE), contingency is a component of the project budget, other components are base cost and escalation allowance. Base cost of a project is defined as the costs that will be used to physically delivered the project with a given scope (Bakhshi and Touran 2014). Base cost includes the project allowances, which is the estimates or “plug numbers” that the estimators assign to a project component that is hard to estimate due to incomplete design or insufficient information supplied; this type of allowances are not contingencies (Bakhshi and Touran 2014).

From the owner’s perspective, contingency is the budget that “is set aside to cope with uncertainties during construction” (Touran 2003). According to AACE (AACE International 2020), contingency costs can be calculated to offset the cost of errors or omissions in planning and estimating, for small changes in price, for detailed design or for design changes but still within the scope of the project, and changes in market or environmental conditions. However contingency does not include additional costs due to changes in the product of the project, such as changes in specifications, features, capacity, project size, project location, or unusual events such as natural disasters, strikes, price spikes or exchange rate effects (AACE International 2020).

Except for the traditional approach of contingency estimation based on a percentage of the project budget, more approaches have been developed and applied. According to Baccarini (Baccarini 2005), there are about 12 popular methods for calculating this type of cost, including the traditional method (Table 1).

Table 1 - Selected methods for estimating contingencies in construction projects

No	Methods
1	Deterministic Methods
1.1	Predefined Percentages (Fixed/Line items)
1.2	Expert Judgement
2	Probabilistic Methods
2.1	Method of Moments (first-order second-moment methods, second-order method)
2.2	Individual risks – expected value
2.3	PERT
2.4	Parametric Estimating (Regression Analysis)
2.5	Analytical Hierarchy Process
2.6	Monte Carlo Simulation/Range Estimating
2.7	Integrated Models of Costs and Schedules

No	Methods
3	Modern mathematic methods
3.1	Artificial Neural Networks
3.2	Fuzzy Sets/Fuzzy Techniques

Source: (Baccarini 2005, Bakhshi and Touran 2014)

2.2 Cost Contingency Estimation in Public Construction Projects in Vietnam

In Vietnam, contingency costs are considered a part of construction investment costs. This is one out of 7 component cost items of the total construction investment of the project, is an item in 6 cost items of the construction estimate and is also a component in the estimated budget for procurement purposes. The concepts of contingencies in Vietnam in Vietnam are not defined in terms of connotations and extrinsic as in some countries but is considered in terms of component costs mentioned in the legal provisions on cost management in construction investment projects.

In the total construction investment or construction estimate, contingencies are separated from other cost items such as land acquisition, construction costs, equipment costs, project management expenses, consultancy costs and other costs. However, when developing the budget for procuring work packages, including construction work or equipment and also consultancy services, contingencies must be included in the budget (Ministry of Construction 2019, Government of Vietnam 2021).

In public construction projects in Vietnam, contingencies should be estimated following the guidelines issued by the Ministry of Construction. According to Circular 09/2019/TT-BXD (Ministry of Construction 2019), total contingencies G_{DP} can be estimated using the following formula:

$$G_{DP} = G_{DP1} + G_{DP2} \tag{1}$$

Where, G_{DP1} is the contingency for unexpected additional quantity of work
 G_{DP2} is the contingency for cost escalation.

$$G_{DP1} = (G_{BT,TDC} + G_{XD} + G_{TB} + G_{QLDA} + G_{TV} + G_K) \times kps \tag{2}$$

Where, $G_{BT,TDC}$: land acquisition costs, which include expenses for asset compensation, support and resettlement for concerned residents

G_{XD} : construction costs

G_{TB} : equipment cost, including building equipment and technology equipment

G_{QLDA} : project management costs

G_{TV} : construction consultancy costs

G_K : other costs

kps: the rate for this contingency, $kps \leq 10\%$. For simple projects, $kps \leq 5\%$.

G_{DP2} is also estimated as a percentage of the total costs of the items above, but this percentage is calculated based on the duration of the construction project, budget allocation during the project duration and relevant price indexes for the relevant type of construction projects, considering the price escalation:

$$G_{DP2} = \sum_{t=1}^T (V_t - L_{V_{ayt}}) \left[(I_{XDCTbq} \pm \Delta I_{XDCT})^t - 1 \right] \tag{3}$$

Where, T: the duration of the project implementation, $T > 1$ (year);

t: the order of the year to allocate funding according to the project plan, $t = 1 \div T$;

V_t : investment capital (exclusive of cost escalation contingency) in year t, according to the project plan

$L_{V_{ayt}}$: interest expense on the planned investment capital in year t.

I_{XDCTbq} : the construction price index used for estimating cost escalation contingency, determined as the averaged number of the consecutive construction price indexes by type of work for at least the last recent 3 years (not taking into account the unusual fluctuations in the prices of raw materials, fuel and construction materials).

$\pm \Delta I_{XDCT}$: the average fluctuation of the construction price indexes by year of construction comparing with the average price escalation of the year calculated and determined on the basis of forecasting the trend of fluctuations in cost and price factors regionally and internationally by expert experience.

3. Materials and Methods

This study uses a 1000-bed hospital project in Vietnam using public funding as a case study. This project consists of several items such as the main building, the convention building, guesthouse and staff dormitory and funeral home, also the hospital infrastructure including auxiliary buildings such as pump house, power substation, carpark building and roads, drainage and water supply systems, fences etc. (Table 2). The construction investment duration is 5 years. Due to the confidentiality of the cost data, the name of the project is kept anonymous. The project was at its technical design stage at the time the paper was written.

Table 2 - The project items

No	Items	No of floors	Floor Areas (m ²)
1	Main Hospital Building	8	63,300
2	Convention Building	2	12,375
3	Guesthouse and Staff Dormitory	7	8,190
4	Funeral Home	1	477
5	The hospital infrastructure (including auxiliary buildings)		

The total investment cost of the project was estimated twice: at the pre-feasibility study and the feasibility study stages. At the pre-feasibility study stage, it is called “preliminary total construction investment” and is named “total construction investment” in the feasibility study stage, according to current Vietnamese regulations (Government of Vietnam 2015). As the rule in managing construction investment projects in Vietnam, the figure of preliminary total construction investment, which is 1,259 VND billions (approximately USD 29 millions), is considered the initial budget for the project. This figure is the ceiling amount that the total project costs cannot exceed. Only when are there special cases defined in the laws and regulations, can the total project costs be larger than that initial amount, but the project must undergo another reviewing and appraisal process before the new budget can be approved and used for funding as well as cost management purposes (Vietnam National Assembly 2014).

The estimated amount of the preliminary total construction investment is presented in Table 3. Construction and building equipment costs for each of the buildings and for the infrastructure were calculated collectively based on the adjusted investment rates issued with the Decision 44/QD-BXD in January 2020 (replaced by 65/QD-BXD in January 2021) and the floor areas of the buildings or the infrastructure spaces (Ministry of Construction 2021). The investment rates published were determined for new construction works which are common in nature, using medium-advanced construction technology. The investment rates are presented at three types of figures, the total rate, the rate for construction works and the rate for equipment. The total rate covers costs for construction works and for equipment, project management costs, construction consultancy costs as well as costs under the category of other costs. The total rates are VAT inclusive but do not cover any individual or special requirements of the projects, such as land acquisition costs, loan interest, initial working capital (if any), contingencies, some other special costs including environmental impact assessment and treatment of the project's impacts on the environment; international quality registration, building deformation monitoring; cost of work quality inspection; special reinforcement of the building foundation; expenses for hiring foreign consultants etc. (Ministry of Construction 2021).

Due to the fact that there is not a completely compatible investment rate for this hospital project, the investment rates used are the rates developed for buildings with similar structures. Since the investment rates are inclusive of construction and conventional building equipment costs, the total investment amount of construction and building equipment of the project was presented as compound figures, not separating these costs. With a hospital project, there are some special finishing work and equipment such as finishing work for operation room and the central medical gas supply system or the medical sample transport system, these should be added as separate items from the conventional costs. The special building equipment and medical equipment costs were estimated based on the market prices.

Though at the preliminary study stage, lots of details cannot be identified very clearly, the contingency for this stage, with unexpected additional quantity of works and cost escalation inclusive, was fixed at the rate of 10% (the allowable maximum rate according to Circular 09/2019/TT-BXD (Ministry of Construction 2019) and Circular 11/2021/TT-BXD (Ministry of Construction 2021)), since the investment decision maker perceived little expected changes and risks for the project.

Table 3 - The preliminary total construction investment for the project

No	Cost Items	Amount (VND) (VAT included)
1	Construction and Building Equipment Costs	979,551,430,240
1.1	Main Hospital Building	664,650,000,000
1.2	Convention Building	100,237,500,000
1.3	Guesthouse and Staff Dormitory	71,115,408,000
1.4	Funeral Home	3,318,832,440
1.5	The Hospital Infrastructure (including auxiliary buildings)	98,429,689,800
1.6	Operation Room Finishing Work	19,800,000,000
1.7	Special Building Equipment	22,000,000,000
2	Medical Equipment Costs	165,000,000,000
2.1	Cyclotron Radioisotope Production System	99,000,000,000
2.2	Pet-CT equipment	66,000,000,000
3	Total Costs (1+2)	1,144,551,430,240
4	Contingency (10%)	114,455,143,024
5	Grand Total (3+4)	1,259,006,573,264
	Rounded	1,259,000,000,000

Note: VND 1,000,000 = USD 43.3153 as of 31/3/2021 (<https://www.exchange-rates.org/Rate/USD/VND/3-31-2021>)

With a basic design developed, the project came to its feasibility study stage where project items are designed and described with more details. After reviewing the function and capacity of the buildings in the project with considerations on keeping the project building density (or the Floor Space Ratio - FSR) not greater than the allowed ratio, the project items' areas have been adjusted. Table 4 shows the revised areas of the project items.

Table 4 - The revised areas of project items

No	Items	No of floors	Floor Areas (m ²)
1	Main Hospital Building	8	72,450
2	Convention Building	2	4,534
3	Guesthouse and Staff Dormitory	7	7,130
4	Funeral Home	1	550
5	The hospital infrastructure (including auxiliary buildings)		

As required by the current regulations, the total construction investment must be broken down into 7 cost items, including: land acquisition cost (if any), construction costs; equipment costs; project management costs; construction consultancy costs; other costs, and cost contingency (Government of Vietnam 2015, Government of Vietnam 2019, Government of Vietnam 2021). In this project, since the land was cleared before, there is no land acquisition cost. Due to the requirements of detailing the consultancy and other costs, the construction costs and equipment costs are calculated separately. In addition, additional costs must be estimated for the items that have not been covered in the construction investment rates, leading to some increment in both construction and equipment costs. These items were considered to be included in the project design since they had been found in similar projects.

Consultancy and other costs were then estimated based on the values of construction costs and equipment costs, considering the schedules of rates predefined for each type of consultancy services (Ministry of Construction 2019, Ministry of Construction 2021). The Ministry of Construction issues the schedules for using in managing construction investment costs in public projects. The cost contingencies are calculated separately to show separate figures for unexpected additional quantity of works and cost escalation.

The summary of the total construction investment is illustrated in Table 5.

Table 5 - Total construction investment of the project

No	Cost Items	Amount (VAT included) (VND)
1	Land Acquisition Costs ($G_{BT,TDC}$)	0
2	Construction Costs (G_{XD})	901,703,948,461
3	Equipment Costs (G_{TB})	432,435,519,557
4	Project Management Cost (G_{QLDA})	15,039,390,367
5	Construction Consultancy Costs (G_{TV})	51,777,184,688
6	Other Costs (G_K)	4,519,088,504
7	Contingencies (G_{DP})	184,262,885,949

No	Cost Items	Amount (VAT included) (VND)
	- <i>unexpected additional quantity of work (G_{DP1})</i>	140,547,513,158
	- <i>cost escalation (G_{DP2})</i>	43,715,372,791
8	Total	1,589,738,017,527

Since the total costs of the first six cost items in Table 5 is VND 1,405,475,131,578, the estimated contingency for unexpected additional quantity of work is VND 140,547,513,158 (at the maximum rate of 10%). The total construction investment capital to be used to estimate the contingency for cost escalation is VND 1,546,022,644,736. Table 6 details the estimation of contingency for cost escalation based on the amount of capital allocated for each year in the construction investment duration and the yearly price indexes. The total contingency for cost escalation, therefore, is VND 43,715,372,791, resulting in the total contingencies for the project as (shown in Table 5):

$$G_{DP} = G_{DP1} + G_{DP2} = 140,547,513,158 + 43,715,372,791 = 184,262,885,949 \text{ (VND)}$$

Table 6 - Contingency for cost escalation

Year	Allocated capital for each year (VND)	Contingency for cost escalation (VND)
1	220,000,000,000	1,980,000,000
2	300,000,000,000	5,424,300,000
3	350,000,000,000	9,535,305,150
4	450,000,000,000	16,420,015,152
5	226,022,644,736	10,355,752,488
Total	1,546,022,644,736	43,715,372,791

4. Results and Discussions

When including the costs for additional items as described in the basic design, which have not been covered in the construction investment rates, and their derived increased costs, there is a rise in the total construction investment of VND 330,700,000,000 comparing to the preliminary total construction investment amount. This increased amount is for the additional costs in construction work, especially high-class finishing works, the modern building systems (building equipment inclusive) which are not included in the construction investment rates but appeared in similar projects that have been built previously. This increment leads to the increase in the derived costs, including project management, construction consultancy costs due to that these costs are estimated based on the construction and equipment costs and the rates that can be interpolated from the predefined ranges of norms, as instructed in the current guidelines (Ministry of Construction 2019, Ministry of Construction 2021). Some consultancy costs that cannot be determined based on the current systems of norms were estimated using analogous cost estimating and bottom-up estimating techniques. Considering the country’s policy of applying modern technology, especially digitalisation technology for complex construction projects of the country, Building Information Modelling (BIM) was selected to be used in this project, therefore, additional costs for BIM application needs to be included in the total project budget. According to the current guidelines, costs for BIM can be estimated at up to 50% of the total costs for the design services (Ministry of Construction 2021). In this project, with the BIM application from the technical design stage, the total design service costs to be used for calculating BIM costs include the BIM cost for technical design and the BIM cost for detailed design, which is estimated at VND 19,566,975,682 (VAT inclusive). BIM cost, estimated with the rate of 40%, therefore, is VND 7,826,790,273 (VAT inclusive).

The new total construction investment amount was summed up as VND 1,589,700,000,000, with the maximum allowable amount of contingencies for unexpected additional quantity of work (10%) and the contingency for cost escalation determined using the recent price indexes. Even when all of the contingencies were used up for other cost items, the total amount was VND 1,405,475,131,578. However, the investment decision maker cannot mobilise such amounts for the project, the total budget can be allocated is only VND 1,259,000,000,000. Therefore, considerations need to be carried out in order to cut off the cost while keeping the functions and capacity of the project the same. The high-class finishing materials and modern building systems have been downgraded or removed, replaced with cheaper solutions. Contingency for unexpected additional quantity of work was reduced, not using the maximum allowable rate. The calculated rate for this type of contingency was set at only 5.567%, leading to the amount of VND 64,590,867,336. The cost items of the total construction investment of the project with the adjusted values are presented in Table 7.

Table 7 - Adjusted total construction investment of the project

No	Cost Items	Amount (VAT included) (VND)
1	Land Acquisition Costs ($G_{BT,TDC}$)	0
2	Construction Costs (G_{XD})	747,251,068,804
3	Equipment Costs (G_{TB})	351,633,417,149
4	Project Management Cost (G_{QLDA})	12,387,425,114
5	Construction Consultancy Costs (G_{TV})	44,665,274,207
6	Other Costs (G_K)	4,280,529,011
7	Contingencies (G_{DP})	98,782,285,715
	- unexpected additional quantity of work (G_{DP1})	64,590,867,336
	- cost escalation (G_{DP2})	34,191,418,379
8	Total	1,259,000,000,000
	Rounded	1,259,000,000,000

With the revised total construction investment amount, the contingency for cost escalation was re-calculated (Table 8). With another plan to allocate funding for each year in the duration, an amount of VND 34,191,418,379 was estimated for this contingency, making up the total contingencies of VND 98,782,285,715. Noted that the total construction investment amount allocated for each year in the project duration is exclusive of contingency for cost escalation but inclusive of contingency for unexpected additional quantity of work.

Table 8 - Revised contingency for cost escalation

Year	Allocated capital for each year (VND)	Contingency for cost escalation (VND)
1	200,000,000,000	1,800,000,000
2	250,000,000,000	4,520,250,000
3	250,000,000,000	6,810,932,250
4	320,000,000,000	11,676,455,220
5	204,808,581,621	9,383,780,909
Total	1,224,808,581,621	34,191,418,379

Table 9 shows the differences between the initial total construction investment and the adjusted figures. Due to the changes in the finishing works and building systems applied, the construction and equipment costs reduced about 154 and 81 VND billions and 17.13% and 18.69% respectively. The reduction rates of these cost items are approximately equal to the general difference of the total amount (20.80%). Being calculated based on these costs, the project management and construction consultancy costs see the reduction of 17.63% and 13.74%. Costs of selected consultancy services were estimated using detailed estimation; therefore, they can be fixed and are not dependable on the changes of construction and equipment costs. Since most of the item of "other costs" were estimated using analogous cost estimating and bottom-up estimating techniques, their reduction rate is relatively smaller than that of other cost items (only 5.28%). But the contingencies observe a huge reduction rate, with a compound rate of 46.39%; most of the reduction is by the decrease in contingency for unexpected additional quantity of work (54.04% less). It is noted that the contingency for unexpected additional quantity is kept at 5.567% for the risks of cost increase in the technical design stage, when more details can be defined for the finishing works and also building systems. Contingency for cost escalation was estimated using price indexes and fully included in the amount, due to that the project duration is 5 years, then changes in the market prices have a high possibility.

Table 9 - Comparison of the initial and adjusted total construction investment amounts of the project

No	Cost Items	Initial Amount (VND)	Adjusted Amount (VND)	Differences (VND)	Reduction (%)
1	Land Acquisition Costs	0	0	0	
2	Construction Costs	901,703,948,461	747,251,068,804	154,452,879,657	17.13%
3	Equipment Costs	432,435,519,557	351,633,417,149	80,802,102,408	18.69%
4	Project Management Cost	15,039,390,367	12,387,425,114	2,651,965,252	17.63%
5	Construction Consultancy Costs	51,777,184,688	44,665,274,207	7,111,910,482	13.74%
6	Other Costs	4,519,088,504	4,280,529,011	238,559,493	5.28%
7	Total Costs excluded	1,405,475,131,578	1,160,217,714,285	245,257,417,293	17.45%
8	Contingencies	184,262,885,949	98,782,285,715	85,480,600,234	46.39%

No	Cost Items	Initial Amount (VND)	Adjusted Amount (VND)	Differences (VND)	Reduction (%)
	- unexpected additional quantity of work	140,547,513,158 (10%)	64,590,867,336 (5.567%)	75,956,645,822	54.04%
	- cost escalation	43,715,372,791	34,191,418,379	9,523,954,412	21.79%
9	Total	1,589,738,017,527	1,259,000,000,000	330,738,017,527	20.80%

Regarding BIM costs, with the rate based on design services fees kept the same, its reduction is VND 1,340,650,995 and 17.13%, while the decrease in total design costs for technical design and detailed design is VND 3,351,627,489 and also 17.13%. This reduction is relatively similar to the general reduction rate for the total amount. However, the scope of the BIM job in the project is still almost the same. This is a shortcoming of the cost estimation approach which is based on the relative rates.

Comparing the preliminary total construction investment with the adjusted figures (Table 10), we can see the reallocation of the total amount among the cost items. It is observed that the changes in the revised alternative of the basic design influence most on the contingencies, especially contingency for unexpected additional quantity of work. About VND 15,6 billion was extracted from the contingencies to be added to the main costs. That is to say, with more detailed design, contingencies have been released for to cover the shortage in other cost items of the total construction investment. At this basic design, some contingencies also need to be estimated for the next design stage since more changes are expected for this large and complicated hospital project. However, for such large and complicated project, the contingency of 5.567% allocated for the unexpected additional quantity of work is low, which will set strict constraints for this technical design stage.

Table 10 - Comparison of the preliminary and adjusted total construction investment amounts

Cost Items	Initial Amount (VND)	Adjusted Amount (VND)	Differences (VND)	Differences (%)
Total cost excluded contingencies	1,144,551,430,240	1,160,217,714,285	-15,666,284,045	-1.37%
Contingencies	114,455,143,024	98,782,285,715	15,672,857,309	13.69%

In order to improve the quality of the estimation job for preliminary total construction investment and total construction investment, more information is needed at these early stages of the project. Construction investment rates can provide some initial information, but due to their general level, the accuracy is low. Estimators need to find other sources of data for improving the quality of the costs estimated.

Though each construction project has its own uniqueness, in principle, historical data can be referred to when estimating. Previously, historical data were not collected and managed systematically, only some cost consultancy firms were seriously conscious about this. Not enough data were collected and managed for the purpose of cost estimation, therefore, some estimation depended on relative rates; this shows low accuracy when there was a change in the unit prices of the finishing work or building systems which lead to no or very little change in the consultancy services, but their costs were adjusted.

Due to that there was no proper way to collect, process, clean the data, firms found it difficult and unreliable to use historical data in estimation. However, in this digitalisation era, when the construction industry well perceives the importance of data and the development of information technology, especially the application in processing and managing big data, historical data can be managed more efficiently and effectively for the purpose of cost estimation in future projects. The issuance of Circular 12/2019/TT-BXD also promotes and facilitates the use of historical data for construction estimation, including contingencies budgeting. The estimation of construction consultancy services, including BIM services, therefore, can be improved in terms of accuracy due to that information from similar jobs and previous projects can be extracted from the databases, then other type of estimation methods can be applied.

However, it needs time for developing the databases systems and tools (information technology) need to be programmed for exploiting and managing the databases before they can be used efficiently and effectively for the contingencies estimation.

5. Conclusion

This paper, using a case study of a large and complicated hospital project in Vietnam, discussed the estimation and use of contingencies in the preliminary feasibility and feasibility stages. Two types of contingencies, which are contingency for unexpected additional quantity of work and contingency for cost escalation were considered and estimated in the two stages, showing that they were released to cover increased costs for the cost items along the project life cycle.

The paper pointed out the shortcomings of using only construction investment rates and the predefined rates of consultancy services. Though the scope of work of selected consultancy services, such as BIM, does not change, the budget estimated for them adjusted when other cost items changed, though the change did not lead to any alter in the consultancy services.

The development of cost database systems may resolve this issue. However, since the Circular 12/2019/TT-BXD was just released in 2019, it needs time to be put into practice. Also, solution providers must join for developing information and communication software to facilitate the database system development and management. Future research studies should address these issues.

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