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Factors affecting the delay of urban development investment projects: A case of Vietnam

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Abstract

The project implementation schedule is an important plan for every construction project, to reduce and control project delays. The implementation of urban development investment projects is increasing in terms of both quality and quantity as urban areas are rapidly developing in cities. However, many construction projects are scheduled but they are late from due time. As the number of urban development investment projects increases, understanding the causes of project delays will help project managers and stakeholders limit these delays. This paper investigates all those factors which are causing a delay in the development of urban investment projects These factors are further developed through expert knowledge elicitation using the Delphi method. Lastly, as based on the issues identified were run to determine how they affected project delays. Finally, a survey based on the issues identified factors was conducted to assess how they affected project delays. The linear regression model is used to analyze the results from the survey. The results of the study indicate that there are six main factors that cause the delay in the implementation of urban development investment projects in Vietnam, including Policy, Design, Cooperation, Implementation, Financing and Objective factors. The study's findings indicate that there are six primary groups of elements, including Policy, Design, Collaboration, Implementation, Finance, and Objective factors, that contribute to the delay in the execution of urban development investment projects in Vietnam. The study offers a research model for the factors that contribute to delays in the execution of construction projects for urban development. This finding can serve as a foundation for ideas on how to deal with this issue in Vietnam as well as a guide for similar works.

Keywords: Affecting, Delay, Delphi, Factors, Urban development investment projects, Vietnam.

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1. Introduction

Delay is one of major problems that the construction industry is facing is in term of schedule. Delay in schedule can be defined as a situation in which a construction project is not completed within the planned time. Projects throughout the world frequently experience construction delays. Progress lags can happen at any point during the investment process. Yet the majority happens during the building stage [1]. The schedule is one of the main criteria when effectiveness of a construction project is evaluated [2]. In fact, a variety of circumstances, such as the effectiveness with which construction contractors operate, the resources at their disposal, the environment, the involvement of other parties, contractual relationships, etc., can cause delays in the execution of building projects. Due to these factors, construction projects may encounter issues that cause delays in progress [1].

Urban development investment projects are a new investing trend and are implemented in big cities in Vietnam. The rise of this type of project is rapidly accelerating urbanization. Urban development project execution, however, still has some drawbacks, especially a protracted implementation process. Therefore, this study considers factors affecting the delays in the implementation of construction projects. The research data used for analysis is collected through questionnaires for individuals and organizations involved in the development of this type of project. The research findings offer valuable resources that will help to assist relevant government agencies and developers in implementing measures to limit delays in urban development investment projects. The research's conclusions offer useful resources that will help relevant government organizations and developers put policies into place that will prevent delays in investment projects for urban development.

2. Overview of the Factors Affecting the Delays in the Implementation of Construction Projects

Many researchers have carried out studies regarding those factors which are generally affecting the delays in the implementation of construction investment projects.

Dayı [3] who carried out an analysis to determine the impact of construction delays on the total time of project completion and assigned responsibility among project participants for such delays, thereby pointed out that these delays were due to organizational shortcomings of the developer, local administrative apparatus, lack of detailed drawings in the process of applying for construction permits, contractors' experience is still limited, problems in the process of purchasing materials; unstable weather conditions and shortage of qualified personnel of subcontractors. Marzouk and El-Rasas [4] pointed out the causes of construction delays in Egypt through survey research and sent to developers, consultants, and contractors, thereby showing that the most important causes of delays are grouped into seven components: owners, consultants, contractors, supplies, labor, equipment, projects, external. Sweis, et al. [5] conducted a study that identified the top ten causes of delays in construction projects in Jordan. Bhatia and Apte [6], argued that the causes of delays in construction of residential projects are delays in decision-making, arising works, organizational conflicts, poor organization and planning of work, inaccuracy of cost estimates, changes in scope, design, drawings. Sambasivan and Soon [7] identified 10 important causes of delays including: inadequate planning, poor performance monitoring, weak experience, weak finances, problems with subcontractors, shortage of raw materials, shortage of labor supply, outdated and damaged equipment, lack of coordination between the parties and mistakes during the construction phase [4, 8-14].

The results of the study showed the causes of delays, the types of delays and the impact of delays on the overall progress of the project. Researchers found that the overall progress of the project was prolonged due to the progress of each phase, each step in the project implementation process, and each step in relation to the construction step. From the above studies, it is also shown that the causes of delays in progress can be classified into the following groups: Legal causes group, cause group related to planning work, group of causes of implementation organization, group of causes of implementation control, groups of causes of resources (human resources, resources, materials), groups of peripheral causes (design changes, environment, characteristics of the project, ...).

However, the causes of the above delay are the causes for construction investment projects in general. In addition to some of the aforementioned causes, it is important to research additional factors that are specific to this kind of project for urban development investment projects in Vietnam.

3. Presenting research models and factors that influence the implementation of construction investment projects in Vietnam

After conducting an overview study on the factors affecting the delays in the implementation of construction investment projects, a total of 50 factors affecting the delays were proposed by the research team, classified into 6 main groups, as follows:

- Policy: 7 factors
- Design: 6 factors
- Cooperation: 6 factors
- Implementation: 13 factors
- Financing: 8 factors
- Objective causes: 10 factors

Table 1 presents a comprehensive list of proposed factors.

3.1. Research Hypotheses

H_1: Limitations of the policy mechanism correlate in the same direction with the delay in the implementation of urban development investment projects.

H_2: Project design errors correlate in the same direction with delays in the implementation of urban development investment projects.

H_3: Limitations of cooperation among stakeholders in the project correlate in the same direction with delays in the implementation of urban development investment projects.

H_4: Speed and errors in Implementation correlate in the same direction with delays in the implementation of urban development investment projects.

H_5: Delay in Financing correlates in the same direction with delays in the implementation of urban development investment projects.

H_6: Objective causes correlated in the same direction with delays in the implementation of urban development investment projects.

Table 1.
Group of factors.

No	Group of factors	Factors	Sources
1	Policy	Inadequate resettlement compensation policy mechanism	[2]
		The legal document system is not synchronized	[7]
		Lack of regulations, standards, guidance documents	[2]
		Changes in government regulation and legislation	[8]
		Difficulties in obtaining construction licenses	[4, 9]
		Lack of guidance for the implementation of policies	[7]
		Slow permit by government	[2, 4, 10]
2	Design	Asynchronous design	[11, 12]
		The blueprints have many flaws	[8, 10]
		Design that does not match reality	[12, 13]
		The design capacity of the project is too large compared to the response of the infrastructure system	[13]
		Change the design by the investor during construction	[11]
		The investor is slow to approve the design	[4, 14]
3	Cooperation	Conflicts between construction contractors	[15]
		Conflict between the construction contractor and the supervisory consultant	[6]
		Conflict between the construction contractor and the design consultant	[6]
		Conflict in work implementation between the investor and the design consultant	[6]
		Conflict in work implementation between the investor and the supervisory consultant	[6]
		The process of exchanging information between project members is slow or inaccurate	[5, 10]
4	Implementation	Errors in geological survey works	[16]
		Labor accidents	[4, 10]
		Using outdated technology	[12, 15]
		Shortage in labor	[12]
		Safety rules and regulations are not followed in the contractor organization	[17]
		Many errors occur during construction	[5]
		Delays in handing over premises	[7]
		Delay in material delivery	[14, 18]
		The speed of application of new technologies in construction is slow.	[12]
		Labor dispute and strike	[2, 7]
		Inaccurate estimates	[6]
		Ineffective delay penalties	[4]
		Construction equipment is frequently damaged and repaired	[7]
5	Financing	The investor is late in paying the parties involved	[19]
		Delay in payment	[20]
		Shortage of capital from investors	[3]
		Shortage of funds from contractors	[10, 21]
		Untimely allocation of government budget	[22]
		Delays in acceptance	[6, 10]
		Late payment by subcontractors	[17]
		Prolonged verification and appraisal time	[18]
6	Objective	Act of God	[2, 3, 10]
		Civil disturbances	[2, 17]
		Extreme weather conditions at the construction site	[21]
		Environmental pollution	[16]
		Foreign currency exchange rate increase	[22]
		Disease	[9, 23]
		Price fluctuations	[2, 22]
		Inflation	[9]
		Rising interest rates	[22]
		Local culture and society	[16]

The proposed model for the study shown in Figure 1 shows the relationship between the group of factors and the delay in the implementation of development investment projects in Vietnam.

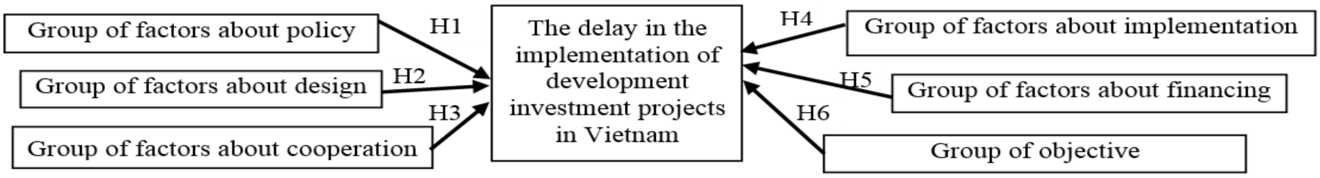

Figure 1.
Research model.

4. Research Methods and Sequence

4.1. Research Process

It aims to identify the factors affecting the delay of urban construction projects in Vietnam and assess the impact and verify the proposed research model, the implementation process has three main steps as follows.

The first step analyzes the rationale, develop a research model, and identify the group of factors affecting the delays in the implementation of urban projects.

The second step applies the Delphi technique then asks experts for their input after sending a summary table of the various factor groups.

In the third stage, the research team reconstructs the entire questionnaire according to the results from the second phase. The team conducts a poll of those directly involved in carrying out the urban development investment project to obtain the evaluation results. And finally, analyze the results from the last survey using linear regression to propose results.

4.2. Applying Delphi Method to Identify the Factors Affecting the Delays in the Implementation of Construction Investment Projects in Vietnam

4.2.1. Implementation Process

After studying the rationale, in the next step, the Delphi method is applied to help redefine the factors affecting the delays in the implementation of the construction project. A set of experts' forecasts will be compiled using this procedure in an organized, iterative fashion. The Delphi approach enables specialists to share their expertise and opinions in an anonymous manner to determine if their analysis of the problem agrees with that of others. It also allows them to modify their minds, if they so choose, after analyzing the material provided in the group. [23]. Thereby, the factors with high consensus from experts will be selected for the next survey step. The procedure consists of the following steps.

Step 1: Design of the Survey Questionnaire

Based on the researched rationale, a questionnaire based on chosen factors will be composed, accompanied by an evaluation system with two possible answers: "yes" or "no" regarding the delay in the execution of urban projects.

Step 2: Select Expert

The experts targeted by the research team are individuals working in state-owned agencies and organizations, investors or construction. They are contractors with experience in the implementation or management of urban development investment projects. In this study, 20 experts from different fields were selected to conduct the evaluation.

This phase involves sending the questionnaire directly to the experts for review. To gather the most logical analytical results, the submission of queries might be repeated in numerous cycles.

Step 4: Analyze Expert Reviews

After receiving the experts responses, synthesize and evaluate the findings using the (KAMET) method’s Knowledge Acquisition for Multiple Experts with Time scales (KAMET) concept [24]. According to the KAMET principle, each indication is given a critical grade at various phases based on a mix of statistical variables, including the median, quartile deviation, mean, and variance. These values will be compared with each other to decide whether to proceed with further rounds of interviews or to end the process.

Step 5: Adjust the Questionnaire Based on the Analysis Results of the Previous Round

After eliminating indicators or questions that did not follow the KAMET standards in the previous round, questionnaires are given to each expert to seek consensus and evaluate the consistency of members' responses

Step 6: Send the Questionnaire and Collect the Results

Do the same as step 3.

Step 7: Analyze the Next Round Answers

Similar to the previous step , after obtaining answers from experts, analysis was conducted based on KAMET principles [24] Statistical values include Median (Md_{qi}); Quartile deviation (Q_{qi}); The mean (M_{qi}) and Variance (V_{qi}) are recalculated in this step.

Step 8: Analyze and Synthesize the Final Result

Figure 2 describes the process of performing the work to get expert opinion based on the Delphi method.

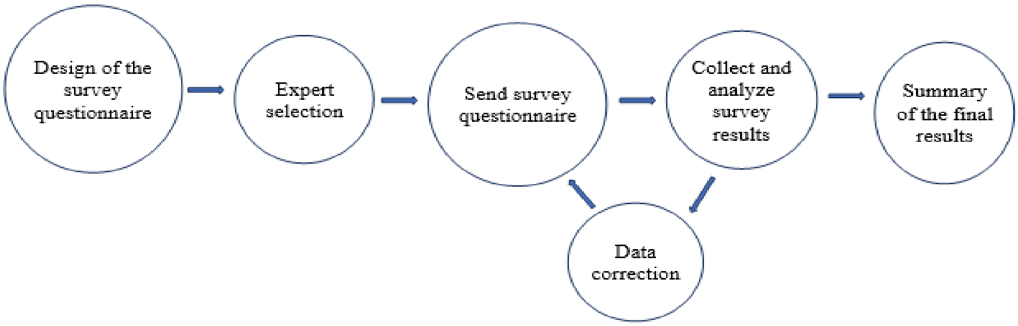

Figure 2.
Delphi process.

4.2.2. Aggregate Results

After 5 rounds of consulting experts according to the Delphi method, 40 factors reached a level of consensus in accordance with the KAMET rules and were selected for the next step of analysis. Table 2 presents factors and a set of them following five rounds of expert consultation using the Delphi method.

Table 2.
Group of factors after 5 rounds of consulting experts according to the Delphi method.

No	Group of factors	Factors
1	Policy	Inadequate resettlement compensation policy mechanism
		Changes in government regulation and legislation
		Lack of regulations and standards
		Difficulties in obtaining investment decisions
		Lack of guidance for the implementation of policies
		The legal document system is not synchronized
		Slow permit by government
2	Design	Asynchronous design
		The blueprints have many flaws
		Design that does not match reality
		The design capacity of the project is too large compared to the response of the infrastructure system
		Change the design by the investor during construction
		The investor is slow to approve the design
3	Cooperation	Conflicts between construction contractors
		Conflict between the construction contractor and the supervisory consultant
		Conflict between the construction contractor and the design consultant
		Conflict in work implementation between the investor and the design consultant
		Conflict in work implementation between the investor and the supervisory consultant
		The process of exchanging information between project members is slow or inaccurate
4	Implementation	Errors in geological survey works
		Labor accidents
		Shortage in labor
		Many errors occur during construction
		Delays in handing over premises
		Delay in material delivery
		The speed of application of new technologies in construction is slow
		Unreasonable construction planning and progress
		Inaccurate estimates
		Construction equipment is frequently damaged and repaired
5	Financing	The investor is late in paying the parties involved
		Shortage of capital from investors
		Shortage of funds from contractors
		Delays in acceptance
		Prolonged verification and appraisal time
6	Objective	Act of God
		Environmental pollution
		Disease
		Price fluctuations
		Inflation
		Local culture and society

4.3. Linear Regression Analysis of Factors Affecting the Delays in Urban Project Implementation in Vietnam

4.3.1. Implementation Process

With the aim of identifying the main factors affecting the delays in progress when implementing urban development investment projects, measuring the impact of the factors on the above situation, the multivariate linear regression analysis was chosen for application with the goal of finding the primary factors impacting the delays in progress when implementing urban development investment projects and quantifying the impact of the factors on the aforementioned situation. The implementation process entails creating survey questions, selecting survey subjects and the number of research samples, conducting surveys, collecting surveys, and analyzing results.

Step 1: Design the Survey Question

A questionnaire of 40 factors with the choice of evaluation on the Linkert scale with a level of 1 to 5 was applied based on the findings of the Delphi analysis from the preceding step and the chosen research model. The Linkert scale has five levels: 1 - No effect; 2 - Little influence; 3 - Influence; 4 - Great influence; 5 - Huge influence.

Step 2: Select the Survey Subject and the Number of Research Samples

The target audience here is individuals directly involved in the implementation and management of urban development investment projects in Vietnam, operating at organizations and units as Contractors, Investors, State Management Agencies, as well as related field organization and training units.

According to Hair Jr, et al. [25] the minimum sample size to use Exploratory Factor Analysis (EFA) method is 50, preferably 100 or more. The ratio of the number of observations to an analytical variable is 5:1 or 10:1. In the study, with a Linkert scale of 5 and a measurement variable of 40, the minimum number of samples required for EFA analysis was 50 x 4 = 200.

For regression sample sizes, the minimum sample size recommendation should be in a ratio of 5:1, which is equivalent to 5 observations for each independent variable. With the proposed study model, the number of independent variables is 6, which is equivalent to the required sample number of 5 x 6 = 30 [25].

Thus, the minimum number of samples required to conduct EFA, and regression analysis requires minimum 200 or more samples.

Step 3: Conduct a Survey and Collect a Survey

With a convenient random sampling method, using the Google Forms platform to create and submit surveys is selected for its popularity and ease of use for both surveyors and survey makers. A total of 264 questionnaires were submitted in the form of an online survey, the results of which included 218 votes, in accordance with the number of samples to be analyzed.

Step 4: Analyze the Results

For regression analysis, the team conducts data analysis through the following steps.

- Data review and encryption.
- Conducting inspections of Cronbach's Alpha.
- EFA discovery factor analysis.
- Multivariate regression analysis.

4.3.2. Analysis Results

4.3.2.1. Data Review and Encryption

Of the 218 votes collected, a total of 218 were valid, 0 invalid. The team coded the data according to Table 3, in which, six groups of factors are encoded, respectively: Policy – PL, Design – TK, Cooperation – HT, Implementation – TC, Financing – TT, Objective – KQ. CT stands for the dependent variable representing the progress delay. After encryption, the team entered and analyzed the data using SPSS 20 software.

Table 3.
Encryption of causes.

No	Group of factors	Content	Notation
1	Policy - PL	Inadequate resettlement compensation policy mechanism	PL1
		Changes in government regulation and legislation	PL2
		Lack of regulation standards	PL3
		Difficulties in obtaining investment decisions	PL4
		Lack of guidance for the implementation of policies	PL5
		The legal document system is not synchronized	PL6
		Slow permit by government	PL7
2	Design - TK	Asynchronous design	TK1
		The blueprints have many flaws	TK2
		Design that does not match reality	TK3
		The design capacity of the project is too large compared to the response of	TK4

No	Group of factors	Content	Notation
		the infrastructure system	
		Change the design by the investor during construction	TK5
		The investor is slow to approve the design	TK6
3	Cooperation - HT	Conflicts between construction contractors	HT1
		Conflict between the construction contractor and the supervisory consultant	HT2
		Conflict between the construction contractor and the design consultant	HT3
		Conflict in work implementation between the investor and the design consultant	HT4
		Conflict in work implementation between the investor and the supervisory consultant	HT5
		The process of exchanging information between project members is slow or inaccurate	HT6
4	Implementation - TC	Errors in geological survey works	TC1
		Labor accidents	TC2
		Shortage in labor	TC3
		Many errors occur during construction	TC4
		Delays in handing over premises	TC5
		Delay in material delivery	TC6
		The speed of application of new technologies in construction is slow	TC7
		Unreasonable construction planning and progress	TC8
		Inaccurate estimates	TC9
		Construction equipment is frequently damaged and repaired	TC10
5	Financing - TT	The investor is late in paying the parties involved	TT1
		Shortage of capital from investors	TT2
		Shortage of funds from contractors	TT3
		Delays in acceptance	TT4
		Prolonged verification and appraisal time	TT5
6	Objective - KQ	Act of God	KQ1
		Environmental pollution	KQ2
		Disease	KQ3
		Price fluctuations	KQ4
		Inflation	KQ5
		Local culture and society	KQ6

4.3.2.2. Cronbach's Alpha Scale Reliability Test Analysis Results

In Cronbach's Alpha test, the measurement variable is satisfied when there is a Total Corrected Item - Total Correlation ≥ 0.3, the measurement scale qualifies when the Cronbach's Alpha coefficient value level ≥ 0.6, and there is no case for removing any observed variable greater than Cronbach's Alpha of the scale. In the analysis of the study, the above values all satisfied the requirements, which proves that the scale reaches reliability, all observed variables are accepted and will be used in the influence factor analysis. Table 4 present the results of Cronbach's Alpha scale reliability test of six group factor.

Table 4.
Cronbach's Alpha scale reliability test results.

-	Cronbach's alpha coefficient	Scale average if this variable is removed	Scale variance if this variable is removed	Variable correlation - total correction	Cronbach alpha value if this variable is removed
Policy - PL	0.872	-	-	-	-
PL1	-	20.68	23.159	0.489	0.874
PL2	-	20.85	21.877	0.640	0.855
PL3	-	20.97	21.916	0.615	0.858
VT1	-	21.28	21.355	0.709	0.846
VT2	-	21.16	21.782	0.678	0.850
VT3	-	21.09	20.633	0.707	0.846
VT4	-	20.97	20.958	0.715	0.845
Design - TK	0.910	-	-	-	-
TK1	-	17.3	17.742	0.739	0.896
TK2	-	17.39	17.409	0.77	0.892
TK3	-	17.31	16.759	0.765	0.892
TK4	-	17.31	17.331	0.746	0.895
TK5	-	17.28	17.594	0.731	0.897
TK6	-	17.26	17.353	0.751	0.894

-	Cronbach's alpha coefficient	Scale average if this variable is removed	Scale variance if this variable is removed	Variable correlation - total correction	Cronbach alpha value if this variable is removed
Cooperation - HT	0.934	-	-	-	-
HT1	-	17.1	20.161	0.791	0.924
HT2	-	17.04	19.524	0.879	0.913
HT3	-	17.1	19.538	0.845	0.917
HT4	-	17.02	19.769	0.84	0.918
HT5	-	17.08	19.602	0.79	0.925
HT6	-	17	21.046	0.696	0.933
Implementation - TC	0.936	-	-	-	-
TC1	-	31.61	54.746	0.786	0.928
TC2	-	31.7	54.597	0.721	0.932
TC3	-	31.5	56.362	0.784	0.928
TC4	-	31.56	55.279	0.805	0.927
TC5	-	31.16	59.472	0.63	0.935
TC6	-	31.47	57.153	0.717	0.931
TC7	-	31.72	57.834	0.706	0.932
TC8	-	31.47	57.034	0.775	0.929
TC9	-	31.48	56.527	0.75	0.930
TC10	-	31.69	55.781	0.791	0.928
VT1	-	10.28	7.532	0.783	0.855
VT2	-	10.16	7.776	0.753	0.867
VT3	-	10.09	7.024	0.788	0.853
VT4	-	9.98	7.506	0.736	0.872
Financing - TT	0.888	-	-	-	-
TT1	-	15.71	9.838	0.736	0.862
TT2	-	15.46	10.075	0.736	0.862
TT3	-	15.59	9.939	0.754	0.858
TT4	-	15.65	10.34	0.748	0.860
TT5	-	15.51	10.629	0.67	0.877
Objective - KQ	0.891	-	-	-	-
KQ1	-	17.31	17.725	0.711	0.890
KQ2	-	17.72	17.961	0.796	0.876
KQ3	-	17.48	18.546	0.726	0.886
KQ4	-	17.3	18.949	0.73	0.886
KQ5	-	17.18	18.47	0.744	0.884
KQ6	-	17.75	19.155	0.705	0.890

4.3.2.3. EFA Discovery Factor Analysis Results

In EFA analysis, Kaiser-Meyer-Olkin (KMO) index and Barlett tests are used to assess suitability. The selected standard load factor is 0.5. The conditions required for a rotation matrix to be statistically significant include:

- KMO coefficient should be between 0.5 and 1[26].
- Barlett test has a sig value less than 0.05 [26].
- Eigenvalue greater than or equal to 1 [27].
- Total quoted variance greater than or equal to 50% [28].

After analyzing and eliminating inappropriate variables due to the failure to ensure the load factor or having a differential load factor of no more than 0.3, Barlett and KMO analysis produced results shown in Table 5 in accordance with the conditions for the rotation matrix to be statistically significant. Specifically, the KMO coefficient in the analysis reached 0.939 >0.5, the Sig value of the Barlett test was equal to 0.000 <0.05. Thus, the data is entirely appropriate, the variables included in the analysis are correlated with each other and satisfy the condition of factor analysis [25].

Table 5.
KMO and Barlett test.

KMO factor		0.939
Barlett accreditation	Approximate Chi squared value	5895.176
	Free tier	528
	Sig.	0.000

Conduct factor analysis according to the main components and Varimax rotation. The obtained value shows that the total quoted variance of the 6 independent variables is 72.013% > 50%, satisfactory. It can be concluded that the 6 factors included in the analysis explain 72.013% of the variability of the data. The Eigenvalue of all factors is greater than 1, of which the 6th factor has the lowest value of 1,094. Specific results are shown in Table 6.

Table 6.
Eigenvalues and quoted variance.

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	15.891	48.155	48.155	15.891	48.155	48.155	4.938	14.964	14.964
2	2.159	6.541	54.696	2.159	6.541	54.696	4.668	14.144	29.108
3	1.738	5.266	59.962	1.738	5.266	59.962	4.443	13.464	42.573
4	1.59	4.819	64.78	1.59	4.819	64.78	3.807	11.535	54.108
5	1.322	4.007	68.788	1.322	4.007	68.788	3.739	11.33	65.438
6	1.094	3.315	72.103	1.094	3.315	72.103	2.199	6.664	72.103
7	0.88	2.666	74.769	-	-	-	-	-	-
8	0.734	2.225	76.994	-	-	-	-	-	-
9	0.659	1.998	78.992	-	-	-	-	-	-
10	0.568	1.723	80.715	-	-	-	-	-	-
11	0.543	1.644	82.359	-	-	-	-	-	-
12	0.508	1.541	83.9	-	-	-	-	-	-
13	0.471	1.426	85.326	-	-	-	-	-	-
14	0.433	1.313	86.639	-	-	-	-	-	-
15	0.422	1.278	87.917	-	-	-	-	-	-
16	0.375	1.136	89.054	-	-	-	-	-	-
17	0.347	1.052	90.106	-	-	-	-	-	-
18	0.326	0.988	91.094	-	-	-	-	-	-
19	0.312	0.945	92.039	-	-	-	-	-	-
20	0.286	0.867	92.906	-	-	-	-	-	-
21	0.27	0.818	93.724	-	-	-	-	-	-
22	0.248	0.75	94.475	-	-	-	-	-	-
23	0.235	0.713	95.188	-	-	-	-	-	-
24	0.227	0.688	95.876	-	-	-	-	-	-
25	0.208	0.63	96.506	-	-	-	-	-	-
26	0.186	0.562	97.069	-	-	-	-	-	-
27	0.182	0.55	97.619	-	-	-	-	-	-
28	0.169	0.513	98.132	-	-	-	-	-	-
29	0.16	0.483	98.615	-	-	-	-	-	-
30	0.132	0.4	99.016	-	-	-	-	-	-
31	0.119	0.362	99.378	-	-	-	-	-	-
32	0.114	0.345	99.723	-	-	-	-	-	-
33	0.092	0.277	100	-	-	-	-	-	-

We have a rotation matrix table with six groups after using the Varimax rotation method; all of the factors have a big load factor of 0.5 and no variable has ever simultaneously uploaded two factors with a load factor that is almost identical to one another. The convergence of elements in the rotation matrix is displayed per group in Table 7.

Table 7.
Rotated component matrix[a].

-	Component					
	1	2	3	4	5	6
HT2	0.83	-	-	-	-	-
HT3	0.805	-	-	-	-	-
HT1	0.762	-	-	-	-	-
HT4	0.736	-	-	-	-	-
HT5	0.714	-	-	-	-	-
HT6	0.524	-	-	-	-	-
TK3	-	0.825	-	-	-	-
TK1	-	0.77	-	-	-	-
TK2	-	0.728	-	-	-	-
TK4	-	0.72	-	-	-	-

-	Component					
	1	2	3	4	5	6
TK5	-	0.616	-	-	-	-
TK6	-	0.59	-	-	-	-
TC6	-	-	0.745	-	-	-
TC5	-	-	0.699	-	-	-
TC3	-	-	0.691	-	-	-
TC7	-	-	0.647	-	-	-
TC8	-	-	0.585	-	-	-
TC9	-	-	0.58	-	-	-
TC4	-	-	0.558	-	-	-
TT2	-	-	-	0.742	-	-
TT1	-	-	-	0.715	-	-
TT3	-	-	-	0.693	-	-
TT4	-	-	-	0.65	-	-
TT5	-	-	-	0.646	-	-
KQ6	-	-	-	-	0.73	-
KQ2	-	-	-	-	0.716	-
KQ5	-	-	-	-	0.672	-
KQ4	-	-	-	-	0.658	-
KQ3	-	-	-	-	0.601	-
KQ1	-	-	-	-	0.578	-
PL1	-	-	-	-	-	0.819
PL2	-	-	-	-	-	0.759
PL3	-	-	-	-	-	0.587

Note: Mining method: Key component analysis.
Rotation method: Varimax with Kaiser normalization.
a. Rotation converges in 8 iterations.

4.3.2.4. Results of Multivariate Linear Regression Analysis

Finally, the multivariate linear regression analysis method is applied to analyze the factors that cause the delay in the progress of urban development investment projects. Proceed to identify the independent variables HT, TK, TC, TT, KQ, PL and the CT dependent variable by the method of obtaining the average values of the corresponding observed variables retained after EFA analysis. The outcomes are displayed in Table 8. An adjusted R2 value of 0.688 accurately indicates the model's fit for the whole dataset, and an adjusted R-factor of 0.829 shows that independent variables account for 82.9% of the change in the degree of association.

Table 8.
Model summary[b].

Model	R	R square	R2 adjustable	Standard error
1	0.829[a]	0.688	0.679	0.406

Note: a. Predictors: (Constant), KQ, PL, HT, TK, TT, TC.
b. Dependent Variable: CT.

Table 9 shows the results of analysis of variance (ANOVA), value F=77.563 and the statistical significance Sig. =0.000 are less than the critical index (0.05), which means that the regression model is consistent with the collected data and the variables included are all statistically significant with a significance level of 5%.α

Table 9.
Analysis of variance[a] (ANOVA).

Model		Sum of squares	df	Mean square	F	Significance level
1	Regression	76.957	6	12.826	77.563	0.000[b]
	Left	34.892	211	0.165	-	-
	Sum	111.849	217	-	-	-

Note: a. Dependent Variable: CT
b. Predictors: (Constant), KQ, PL, HT, TK, TT, TC

Table 10 shows that the factors all have a Beta value greater than 0, all Sig. values of the factors are less than the critical value (0.05) showing that all factors are statistically significant.

Table 10.
Coefficients[a] for regression equations.

Model	Unstandardized coefficients		Standardized coefficient	t	Sig.	95% Confidence interval for B		Collinearity Statistics	
	B	Standard error	Beta			Lower bound	Upper bound	Tolerance	Variance inflation factor (VIF)
(Constant)	0.551	0.155	-	3.558	0	0.246	0.857	-	-
PL	0.054	0.041	0.065	1.315	0.01	-0.027	0.136	0.605	1.653
TK	0.06	0.051	0.069	1.177	0.001	-0.04	0.16	0.432	1.317
HT	0.063	0.049	0.078	1.294	0.007	-0.033	0.159	0.409	1.445
TC	0.121	0.057	0.137	2.124	0.035	0.009	0.234	0.357	1.804
TT	0.264	0.055	0.289	4.802	0	0.156	0.373	0.407	1.455
KQ	0.283	0.053	0.336	5.354	0	0.179	0.387	0.376	1.658

Note: a. Dependent variable: CT.

The results of multivariate regression analysis showed that all independent variables were positively correlated with the dependent variable and that there was no multi-linear phenomenon between variables because the VIF (Variance Inflation Factor) index was less than 2.

The regression equation of factors affecting the delay in the implementation of urban development investment projects is expressed as follows:

$$CT = 0.551 + 0.054*PL + 0.060*TK + 0.063*HT + 0.121*TC + 0.264*TT + 0.283*KQ$$

The regression equation with a normalized regression coefficient is expressed as follows:

$$CT = 0.065*PL + 0.069*TK + 0.078*HT + 0.137*TC + 0.289*TT + 0.336*KQ$$

In particular, the Beta-normalized regression coefficient of the variables is greater than 0, so all 6 factors PL, TK, HT, TC, TT, KQ have a favorable influence on the delay in the implementation of urban development investment projects. Among the above factors, the Objective factors and Financing factors have the greatest impact on the delay in the implementation of urban development projects. Based on the results of the regression equation, it can be seen that the Objective (0.336) are the factors that have the greatest impact on the delay in the progress of urban development projects in Vietnam. This can be explained by complicated epidemic-related changes as well as significant swings in the domestic construction sector. This is the second most influential group of factors belongs to Financing (0.289). In particular, the main problem comes from the lack of capital, leading to the payment of contractors and subcontractors often delayed and longer than the original plan. This result is similar to the studies on delay in the global construction of Sanni-Anibire, et al. [10] with high ranking for causes related to financing and payment. The remaining groups of factors are ranked as Implementation, Collaboration, Design, and Policy, in that order, depending on how much of an impact they have.

In research and practice, these results have brought certain significance. It may form the basis for further studies related to construction delays. Based on 40 factors divided into 6 groups and the information from the regression model, more pertinent study can make comparisons and carry out additional investigations. In addition to using the criteria that have been identified and ranked, construction companies can conduct research to get ready and discover solutions to reduce risks when managing urban development projects in Vietnam.

5. Conclusions

In this study, 6 factors have been shown as affecting the delay in the implementation of urban development investment projects in Vietnam, including Policy, Design, Cooperation, Implementation, Financing and Objective factors. The group of causes of objective factors and financing is believed to have the greatest impact on project delays, according to a study that used Delphi analysis to identify groups of causes and regression analysis to evaluate correlations and rank the impact on project delays.

However, the study still has certain limitations. Firstly, due to limited resources and time, the collection of the number of samples is limited, although the number of samples needed for analysis is ensured, the generalization still has certain limitations. Secondly, the study is used with multivariate linear regression analysis to test the theoretical model but has not yet conducted a multidimensional relationship analysis between variables in a model.

By this study, the authors hope to add to the body of research on the factors that contribute to delays in the execution of construction projects for urban development and establish the groundwork for solutions to this problem.

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