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越南交通建設專案進度落後的潛在因素衝擊程度

Impact levels of potential factors causing schedule overruns in transportation construction projects in Vietnam

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本論文係　阮英秀 (R10521728)　在國立臺灣大學土木工程學系營建工程與管理組

完成之碩士學位論文，於民國113年01月22日承下列考試委員審查通過及口試

及格，特此證明。

The undersigned, appointed by the Department of Civil Engineering (Construction Engineering and Management Division) on January 22nd ,2024 have examined a Master's Thesis entitled above presented by Nguyen Anh Tu (R10521728) candidate and hereby certify that it is worthy of acceptance.

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Abstract

Transportation infrastructure plays a crucial role in propelling the economic and social development of a nation, especially in a developing country like Vietnam. Despite the dedicated attention from the government and city authorities, numerous transportation construction projects, including key ones, face various issues. One persistent and prominent problem observed in both large and small transportation construction projects in Vietnam is the lack of schedule control and its consequential negative impacts. Many completed projects have experienced delays, resulting in substantial financial losses amounting to billions of Vietnamese dong. While various documents and guidelines aim to tightly control the construction process, project schedule overruns persist without signs of improvement. Therefore, conducting research to elucidate the current situation of the construction industry concerning project schedule overruns is imperative. Additionally, identifying and consolidating the factors that contribute to project schedule overruns is crucial for proposing solutions that can mitigate or eliminate negative impacts on construction schedules. The research has identified 39 potential factors contributing to project schedule overruns in transportation construction projects in Vietnam, categorized into seven groups. The author then created a questionnaire survey for respondents to evaluate the impact level of each factor on a scale from 1 to 5. A total of 68 responses were collected from individuals with experience in the construction industry in Vietnam. The collected data were analyzed using two methods. The first method involved evaluating the impact of each factor using a one-sample Sign Test. The results indicated that almost only one factor, “Contractor encountering financial difficulties during construction progress”, has a significant impact on project schedule overruns in transportation projects in Vietnam. Except for “Accidents occurring at the construction

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site" and "War, conflict," have an impact level less than moderate, all of these other factors have a moderate impact on project schedule overruns. The second method involved ranking the factors using the Relative Importance Index. A list of the top 10 factors impacting project schedule overruns in transportation construction projects was identified based on the opinions of individuals with over 5 years of experience in transportation construction projects. The research also observed different views on the top factors among different groups of respondents. After a test with Spearman correlation coefficient, four groups—contractors, project management and supervision consultants, design consultants, and government agencies—showed a certain level of agreement, ranging from medium to high. However, the owner group did not demonstrate agreement with the other four groups. Based on these findings, the research provides recommendations to mitigate the adverse effects of project delays in construction works in Vietnam.

Keywords: Project schedule overruns, Transportation construction project, Relative Importance Index, One-sample Sign Test.

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Chapter 1. Introduction

1.1 Research background

Vietnam is a rapidly developing country and one of the shining stars in Southeast Asia region. The country has achieved significant economic milestones recently, maintaining a high annual GDP growth rate averaging 6% to 7%.(Anh, 2023) Transportation infrastructure is crucial in driving the nation's economic and social development. With the government's strong commitment and support from the international community, Vietnam's transportation infrastructure has undergone significant breakthroughs. The road network, railways, seaports, and aviation have been developing and expanding, creating a solid infrastructure foundation to support economic development and enhance international integration. However, despite the utmost attention from the government and city authorities, many transportation construction projects, including key ones, still encounter various issues. One of the persistent and prominent issues frequently seen in both large and small transportation construction projects in Vietnam is the lack of schedule control and its negative impacts. Many completed projects have been affected by delays, resulting in significant financial losses amounting to billions of Vietnams dong. Notable examples include the Nhat Tan Bridge project, a crucial infrastructure project in Hanoi, Vietnam's capital. The project reported a delay of 4 years, 14 months in the design phase and 34 months in the construction phase (Minh, 2014). Another major project is the Hanoi Metro Line 2A. The project started construction in 2011 with the expected completion and operation in 2015. However, it was not completed until the end of 2020 and put into operation in 2021. The project experienced a cost escalation from 8,789 billion dong to over 18,000 billion dong (Long, 2022). There are still other ongoing transportation construction projects undergoing multiple

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adjustments and extended completion deadlines, such as the Hanoi Metro Line 3 (Nam, 2023). These flagship projects impose a tremendous burden not only on the nation but also on the associated businesses.

To assess the project implementation progress, a group of experts from the World Bank conducted a study evaluating 66 tender packages funded by the World Bank. Among them, 16 packages were completed ahead of schedule, 22 packages were completed on time, and the remaining 28 packages experienced delayed construction, with some being delayed by up to 17 months. The overall analysis of projects utilizing state budget funding revealed that a staggering 85% of contracts experienced delays. (Tien, 2016)

Numerous documents and guidelines aim to control the construction process tightly, but project schedule overruns persist without signs of improvement, causing significant adverse effects. Contractors, consultants, and project managers all acknowledge the impact of these project schedule overruns; however, the extent to which project schedule overruns occur and the impact of influential factors causing project schedule overruns have not been fully grasped. Therefore, conducting research to clarify the current situation of the construction industry regarding project delays is crucial. Additionally, identifying and consolidating the factors that cause project schedule overruns is essential to propose solutions that can mitigate or eliminate negative impacts on construction schedule.

1.2 Research Objectives

This thesis aims to examine the current status of transportation construction projects in Vietnam. It identifies the potential factors causing project schedule overruns, evaluates their impact level and ranks them based on the opinions of experienced professionals in the construction industry. It then proposes measures to mitigate the adverse effects of project delays in construction works in Vietnam.

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1.3 Thesis Structure

In addition to the general introduction in section 1, section 2 provides an overview of related research studies conducted in the past. Section 3 presents the methodology of this research. Section 4 shows the analyzed results from collected data and provides some discussion. Finally, section 5 concludes the research.

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Chapter 2. Literature Review

2.1 Project schedule overruns in the construction project

Delay can be defined as the extra time required to finish a given construction project beyond its original (planned) duration, whether compensated for or not (Alkhathami, 2004). Another study defined schedule overrun as the time overrun either beyond the completion date specified in a contract, or beyond the date that the parties agreed upon for the delivery of a project. It is basically a project slipping over its planned schedule and is considered a common problem in construction projects worldwide(Assaf & Al-Hejji, 2006).

A study on the actual status of construction projects in Malaysia (Intan Rohani Endut, 2009) examined 359 projects from 1994 to 2005, including public and private projects. The study revealed an average cost deviation of 2.08% compared to an average time deviation of 49.71%, indicating that project schedule overruns is a more critical issue in Malaysia's construction projects. A more detailed analysis showed that 79.5% of public sector projects and 66.7% of private sector projects experienced time overruns exceeding 10%. Besides, no specific procurement method, implementation method, or project type consistently had projects with significantly higher schedule overruns than others.

In 2015, a study on the slow progress of road construction projects in Jordan was conducted (Al-Hazim & Abusalem, 2015). The author used data verified and archived at the Jordan Ministry of Rural and Public Works to analyze projects conducted during the period 2000-2008. Through recorded reports and documents, the author found that the delay time in road construction projects in Jordan in that period ranged from 125% to 455%, averaging about 226%. In addition, 19 causes of slow progress at road projects in

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Jordan have been listed and the two most common causes are Terrain and Weather conditions.

In the study of Senouci et al., , the authors present the current status of public construction projects conducted between 2000 and 2013 in Qatar (Senouci et al., 2016). The study found that these projects experienced a 54% cost overrun and a 72%-time delay. Similarly, maintenance projects during the same period also encountered 50% cost overruns and time delays.

A research in 2018 of Johnson and Babu synthesized previous studies on the current state of the construction industry in the UAE (Johnson & Babu, 2018). One of these previous studies found that approximately 50% of analyzed projects in the UAE experienced time and cost overruns due to delays in approvals, client decision-making, and poor initial planning (Motaleb & Kishk, 2010). Another study conducted by The Chartered Institute of Building (CIOB) identified the Dubai metro as the third most troublesome project, experiencing a 5-year delay compared to the estimated(Wilks, 2015). Furthermore, another study highlighted that 70% of projects in Dubai experience time overruns due to monetary resources, contractual differences, approvals, and licensing issues (Maceda, 2016). These previous studies shed light on the severity of the issue and emphasize the need to identify the underlying causes leading to time and cost overruns in the UAE construction industry.

These studies above have provided valuable insights into the current state of construction projects in general and transportation construction projects in particular across different countries. These investigations have shed light on the persistent issue of project schedule overruns, indicating that it remains a prevalent and unresolved challenge in the construction industry. Recognizing the significance of project schedule overruns,

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researchers have conducted numerous studies in various countries, examining primary factors that significantly influence project timelines and providing recommendations for improved project management and execution.

In 2009, a study of delays in road construction projects in Zambia was set out to identify the causes of delays (Kaliba et al., 2009). They found that financial factors such as delayed payment, financial processes or financial difficulties are the main causes of slow progress in this small country.

In another research (Hamzah et al., 2011), developed a theoretical framework for understanding the causes of construction delays in public higher education institutions in Malaysia. After doing a literature review, the authors categorized the causes of delay in the theoretical framework into non-excusable and excusable delays. Non-excusable delays refer to delays caused by the contractor or its suppliers, without any fault on the part of the owner. Excusable delays are divided into two subcategories: compensable and non-compensable. Compensable delays are caused by the owner or the owner's agents, and the contractor may be entitled to compensation for these delays. On the other hand, non-compensable delays are caused by third parties or incidents beyond the control of both the owner and the contractor. These delays are often called "acts of God" because they are not attributable to any specific party's responsibility or fault.

(Gündüz et al., 2013) listed a total of 83 factors that contribute to project schedule overruns in the Turkish construction industry. These 83 factors were categorized into major groups: owner-related factors, contractor-related factors, consultant-related factors, design-related factors, equipment-related factors, labor-related factors, material-related factors, externality-related factors, and project-related factors. Based on the Relative Importance Index (RII) method, the top three factors influencing project delays were:

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inadequate contractor experience, ineffective project planning and scheduling, and poor site management and supervision. On the other hand, the three factors with the least impact on project schedule overruns were: slow mobilization of labor, escalation of material prices, and absenteeism.

Another study in 2023 in India was also conducted to evaluate the factors causing delay in road construction projects (Madhu & Sree Lakshmi, 2023). The findings show that contractors, consultant, and engineer have different evaluation of the impact of project schedule overruns factors, except for factors of, delay in land acquisition, which is rated seriously in all three perspectives.

Aftab Hameed Memon researched the situation in Malaysia and showed project schedule overruns factors such as design and document issues, finance resource management, project management, and contract administration (Memon et al., 2012). Similarly, Serdar Durdyev conducted a study in Cambodia and identified the following results: inaccurate estimate, rework, and delays (Durdyev et al., 2017).

Researchers also have conducted several studies to examine the causes of time and cost overruns in the context of construction projects in Vietnam. Long Le Hoai focused on large-scale construction projects and collected data to identify and rank the causes. Through surveys, direct interviews, and correspondence with experts, they found 21 factors contributing to these overruns. The top three causes identified were poor site management and supervision, poor project management assistance, and financial difficulties faced by the project owner (Le-Hoai et al., 2008).

The literature review above shows inconsistency among studies about the top factors causing project schedule overruns. Long Le Hoai's study, also highlights this disparity when comparing their findings with other studies conducted in Malaysia, Hong

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Kong and Korea. The author indicates that while there are common factors that are widely agreed upon as having a significant impact on project duration, such as the management capabilities of the involved parties, financial aspects, and weather conditions, the extent and prominence of these factors vary across different countries, project scales, and types.

Hence, research on project schedule overruns with a completely different scope than previous studies remain crucial. Each study provides valuable insights into the unique circumstances and dynamics of the construction industry in a particular country. By understanding the specific factors influencing project schedule overruns in different contexts with unique circumstances and dynamics, researchers and industry professionals can develop targeted strategies and interventions to address these challenges effectively. Therefore, conducting a more detailed research and considering diverse contexts and project types is necessary to understand the factors contributing to schedule overruns in transportation construction project in Vietnam. Such studies can provide valuable insights into the dynamics of the construction industry and help stakeholders make informed decisions, develop effective project management practices, and enhance transportation construction project's overall performance and success.

2.2 Factors causing schedule overruns in transportation construction projects

Based on the studies mentioned above and other related studies, this research has formed a list of potential factors that can cause projects schedule overruns in transportation construction projects. Next, the author tried to adjust the list by eliminated factors share the same meaning, or merged factors have overlapped meaning. Then, after some interviews and discussions with experts in the construction industry in Vietnam, especially ones who have experience with transportation construction projects, along with

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public data about delayed transportation construction projects in Vietnam, the list of factors was modified again by add or eliminate factors according to the actual situation in Vietnam. A notable factor was added to the list is "Delays in processes with state management agencies", which have not been shown in other research. And finally the list settled down to 39 factors and divided into seven groups including (1) factors related to project owners, (2) factors related to construction contractors, (3) factors related to construction supervision consultants, (4) factors related to design consultants, (5) factors related to state management agencies, (6) factors related to multiple project stakeholders, (7) factors related to external conditions of projects as described in the Table 1. The background of the interviewee is shown in Appendix A

Table 1. List of potential factors causing project schedule overruns in transportation construction projects in Vietnam

No.	Factors causing project schedule overruns	Symbol
I	**Project owners-related factors**	
1	The owner is behind schedule in selecting the contractors and awarding the contracts	O1
2	The owner is behind schedule in project appraisal and approval	O2
3	The owner is behind schedule in handing over the site to the contractor.	O3
4	The owner has difficulty securing the funding for the project	O4
5	The owner is behind schedule in making agreed payments for construction	O5
6	The owner changes the requirements during the project execution process.	O6
II	**Construction contractors-related factors**	
7	Contractors lack experience.	CC1

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No.	Factors causing project schedule overruns	Symbol
8	Contractors encounter financial difficulties during the construction process	CC2
9	The construction method is not suitable	CC3
10	Poor construction planning and management	CC4
11	The contractor's internal construction site management and supervision are not good	CC5
12	The mobilization of construction machinery and equipment to the construction site is behind schedule	CC6
13	The quality of construction machinery and equipment is poor	CC7
14	Low labor productivity	CC8
15	Labor shortage	CC9
16	The contractor's materials supply logistics are not good	CC10
17	Construction rework due to mistakes or errors.	CC11
18	Accidents occurred at the construction site	CC12
19	Subcontractors lack competency	CC13
III	**Construction supervision-related factors**	
20	Construction supervision consultants lack experience	SC1
21	Construction supervision consultants do not properly inspect or supervise the construction works	SC2
22	Construction supervision consultants are behind schedule in accepting contractors' construction work	SC3
23	Construction supervision consultants do not allocate enough human resources when supervising project construction	SC4
IV	**Design consultant-related factors**	
24	Designers lack experience	DS1

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No.	Factors causing project schedule overruns	Symbol
25	The design consultant does not thoroughly survey and collect data before designing	DS2
26	The design is unclear, lacking details, or has errors.	DS3
V	**State management agencies-related factors**	
27	Changes in government regulations and laws	SA1
28	Delays in processes with state management agencies such as fire prevention and fighting issues, environmental impact assessment, land use rights, design approval, project approval	SA2
VI	**Project stakeholders-related factors**	
29	Poor communication between project stakeholders	PS1
30	Conflicts between project stakeholders	PS2
31	Contract-related issues: lack of consistency between contract parts, not mentioning necessary standards, specifications...	PS3
VII	**External context-related factors**	
32	Unfavorable weather, geological, hydrological and tidal conditions	E1
33	Natural disaster	E2
34	General market conditions are not favorable: for example, rising steel prices, shortage of construction sand mines...	E3
35	Global or regional economic crisis/recession	E4
36	The project location has unfavorable economic/political/cultural conditions)	E5
37	Wars, conflicts	E6
38	Diseases pandemic	E7
39	Influence from neighboring projects	E8

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Chapter 3. Methodology

3.1 Research methodology map

After identifying a list of potential factors causing project schedule overruns, this research built a questionnaire survey to collect opinions from experts who had work or are working in the construction field in Vietnam about the impact of these listed factors on project schedule overruns in transportation construction in Vietnam. The collected data was then analyzed using the Sign Test to evaluate the impact levels of these factors, then the factors were weighted and ranked based on the Relative Importance Index method. The research methodology map is shown in Figure 1.

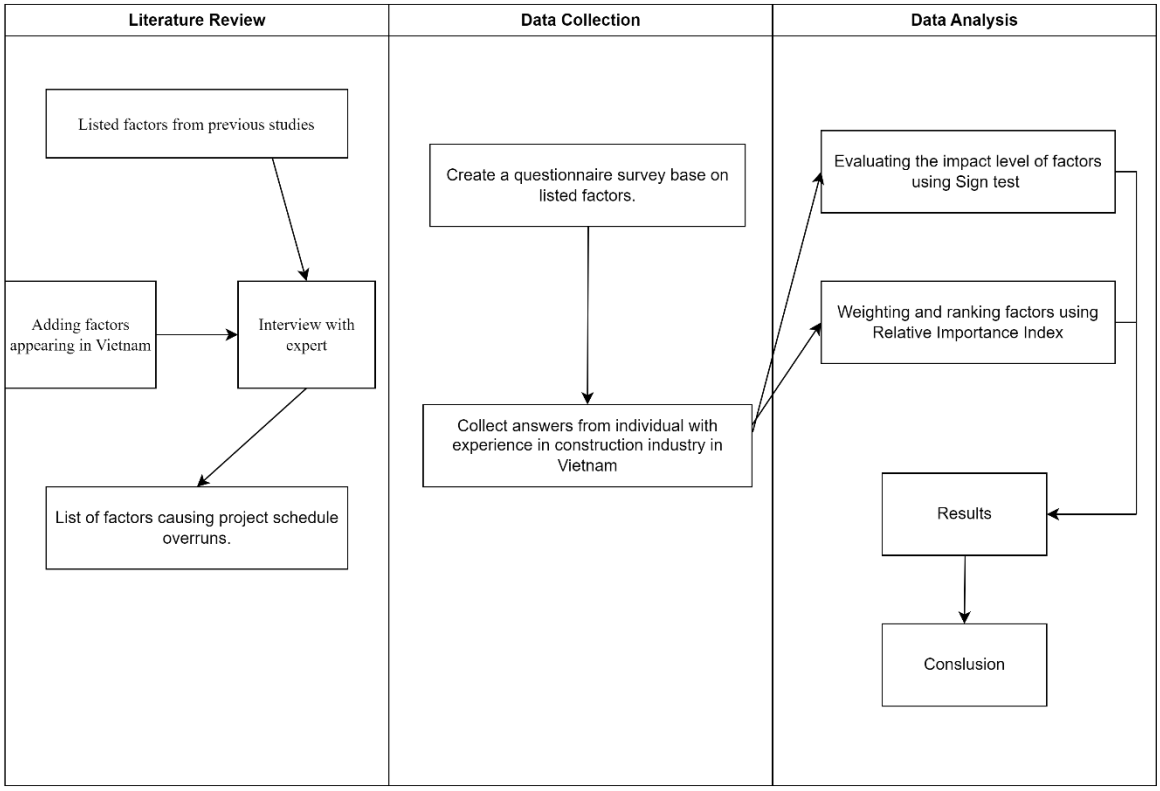

Figure 1. Research methodology.

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3.2 Data collection

In order to collect data to specify and evaluate the influence of factors potentially causing project schedule overruns in transportation construction projects, the study employed a survey method. The survey's targeted audience is experts with working experience in transportation construction projects in Vietnam. They can be project owners, construction contractors, construction supervision consultants, design consultants and state agencies related to the construction field.

The survey form was designed to convey the purpose and implementation method that the survey is aiming for. The survey has three parts:

- Part 1 asks for general information about survey respondents. Participants are asked to provide information about their background, such as current organization and position, general seniority in the construction profession, and experience participating in transportation construction projects. Participants must also indicate whether they have participated in any transportation construction project behind schedule. If they have participated, they will continue answering in part 2; otherwise, they will move directly to part 3.
- In part 2, participants are asked to provide some information related to delayed transportation construction projects that they have participated in, such as capital source, type of transportation construction projects, and project location. Participants can choose multiple answer options for each question.In part 3, participants are asked to take advantage of their own experience to evaluate the impact level of factors potentially causing project schedule overruns in transportation construction projects, following six options: 1 - Not at all; 2 - Slight; 3 - Moderate; 4 - Significant; 5 - Extreme; and 6 - I don't know.

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Survey respondents are asked to evaluate based on their experience with transportation construction. For each factor, participants were asked to evaluate the impacting level following six options: 1 - Not at all; 2 - Slight; 3 - Moderate; 4 -Significant; 5 - Extreme; 6 - I don't know.

3.3 Data analysis

3.3.1 Evaluating the impact levels of factors using the one sample Sign Test method

In order to assess the impact level that the listed factors may have on the project schedule overrun in transportation construction projects in Vietnam—whether it be "3-Moderate", "4-Significant", or "5-Extreme"—this study conducted a hypothesis testing. Hypothesis testing is a statistical method used to determine if there is enough evidence in sample data to draw conclusions about a population. It involves formulating two competing hypotheses, the null hypothesis (H0) and the alternative hypothesis (Ha), and then collecting data to assess the evidence. To conduct the hypothesis testing, the study chose to perform either a one-sample T-test or a one-sample Sign Test. Both methods can be used to test hypotheses. The difference between the two methods is described in their definition as follows:

A one-sample T-test is a statistical hypothesis test used to determine whether the mean of a single sample significantly differs from a known or hypothesized population mean. It is commonly employed when working with continuous data and assumes that the data follows a normal distribution (University, 2023).

On the other hand, the Sign Test is a non-parametric statistical test used to determine whether the median of a set of observations differs significantly from a hypothetical median. It is a distribution-free test, meaning that it makes no assumptions about the distribution of the underlying population and is applicable when the data may

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not follow a normal distribution (Shier, 2004). Therefore, the choice between these two methods depends on whether the data collected from the questionnaire follows a normal distribution or not.In order to test whether the data is distributed normally, the research conducted a Shapiro-Wilk test, utilizing the Jamovi software. The Shapiro-Wilk test is a statistical test used to assess whether a given sample of data comes from a normally distributed population. It is particularly useful when dealing with smaller sample sizes, as other normality tests may be less reliable in such cases. To conduct the test, we set a null hypothesis and an alternative about the distribution of data as follows:

H0: the data is distributed normally,

Ha: the data is not distributed normally.

At the significant level at 5%, if the P-value of the Shapiro-Wilk is smaller than 0.05, we can reject the null hypothesis and accept the alternative hypothesis. On the other hand, if the P-value is greater than 0.05, it fails to reject the null hypothesis. An example of the Shapiro-Wilk test is shown in Table 2

Table 2: Example of the Shapiro-Wilk test

	O1
N	68
Missing	0
Mean	2.57
Median	3
Standard deviation	0.997
Minimum	1
Maximum	5
Shapiro-Wilk W	0.9

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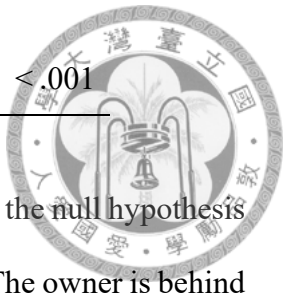
Shapiro-Wilk p	< .001



The Shapiro-Wilk p-value is smaller than 0.001. We can reject the null hypothesis and accept the alternative hypothesis. In this case, the data in factor "The owner is behind schedule in selecting the contractors and awarding the contracts" (O1) is not distributed normally. All other factors are shared with the same result. The full Shapiro-Wilk test results of the table will be shown in Appendix B.

After utilizing the Shapiro-Wilk test, the author observed that the data obtained regarding the factors impacting project schedule overruns did not follow a normal distribution. Hence, the Sign Test method was employed. The Sign Test uses Binomial Distribution and looks at the probability of success of a trial as 50%. In this research, each trial means each time the survey respondents evaluate the impact level of the concern factor. The trial will be regarded as "success" if the factor is considered as greater than 2 (or 3 or 4, depending on which value we want to test the median of the factor impact level against). For the evaluation process, the researchers formulated the null hypothesis and alternative hypothesis for each factor potentially causing project schedule overruns as follows:

$$H0: \text{Median of the impact level} \leq X,$$

$$Ha: \text{Median of the factors impact level} > X.$$

Here, X took on values of 2, (or 3, or 4), aligning with the impact levels of Slight (or Moderate, or Significant), as stipulated in the survey questionnaire scoring criteria.

The test statistic for the one-sample Sign Test is S, where S represents the number of values greater than X. The sample size of the one-sample Sign Test is n, which is the total number of values greater than X and values smaller than X.

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The p-value for the tests was computed using the formula (1):

$$\mathrm{p-value} = \mathrm{P}(\mathrm{x} \geq \mathrm{S}) = 1 - \mathrm{P}(\mathrm{x} \leq \mathrm{S} - 1) \quad (1)$$

At a significance level of 95%, if the p-value is below 0.05, the null hypothesis is rejected in favor of the alternative hypothesis. Conversely, if the p-value exceeds 0.05, we fail to reject the null hypothesis. This approach provides a robust statistical framework for the assessment, ensuring meaningful conclusions about the impact level of various factors on transportation construction project schedule overruns.

3.3.2 Ranking factors based on Relative Importance Index method

This research ranks the factors potentially causing transportation construction project schedule overruns by employing the Relative Importance Index (RII) method. The RII is a method to determine the index for sets of objects based on the value points assigned to each answer and its formula was introduced into Microsoft Excel 2016 to determine the index for sets of objects (Ajao, 2023). In this study, scores were assigned from 1 to 5 on an ascending scale based on the level of impact of the factor on the project schedule overruns with 1 being no impact at all and 5 being a extreme impact. Each factor will have its own Relative Importance Index and will be used to determine its impact rank. These values will be calculated in the formula (2)

$$RII = \frac{\sum W}{A * N} \quad (2)$$

Where:

W: Weighting given to each factor by a survey responder.

A: The highest weight (5 in this research)

N: Number of survey responders.

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Chapter 4. Research findings and results

4.1 Information about respondent

There are a total of 68 recorded answers. The respondents come from groups such as Owner, Contractor (Construction contractor; Design and construction contractor; Engineering, Procurement, and Construction (EPC) Contractor), Project management and Supervision consultant, Design consultant, and Construction-related government agency. The design consultant lies in a different group from the consultant group because, in Vietnam, they usually work as a designer, giving a different view than other consultants. The percentage of respondents based on groups is as in Figure 2.

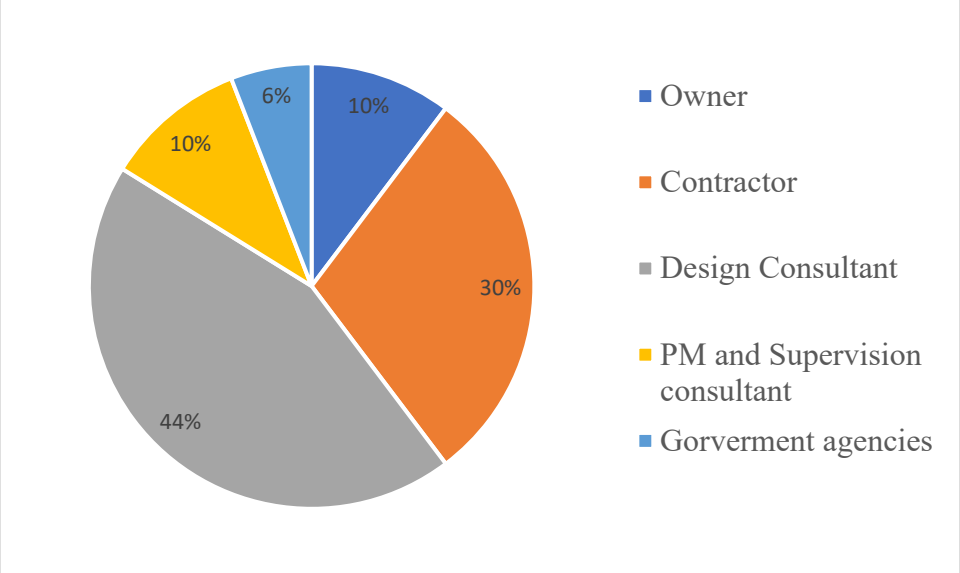

Figure 2. Percentage of respondents based on organization

Respondents also provided information about their years of experience in the field of transportation construction. Of the 68 survey participants, half of them responded that they had 5 years of experience participating in traffic construction projects. The allocation rate is shown in Figure 3.

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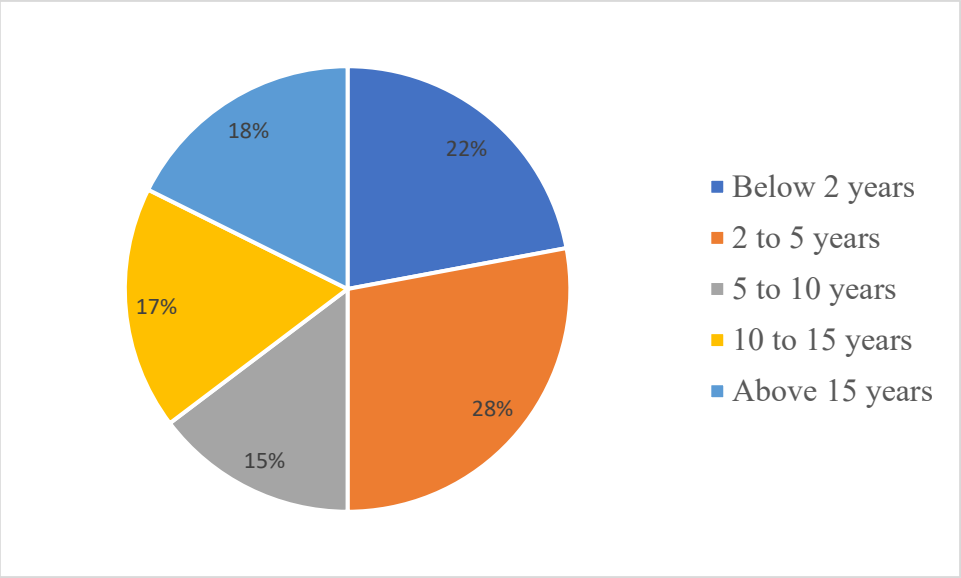

Figure 3. Percentage of respondents based on years of experience

Furthermore, participants were also asked to respond to the rate of delayed projects in which they had participated. The responses collected show that the vast majority of respondents have been involved in projects that are behind schedule. The number of people with projects from 5 to 30% accounts for the majority, but the number of people participating in over 30% of projects is also very significant. Detailed rates are presented in Figure 4. And to have a clearer view of the current status of transportation construction projects in Vietnam, they were also asked to answer about the capital sources of those projects. It can be seen that nearly half of respondents encountered this problem in projects with public funding. Detailed proportions are presented in Figure 5.

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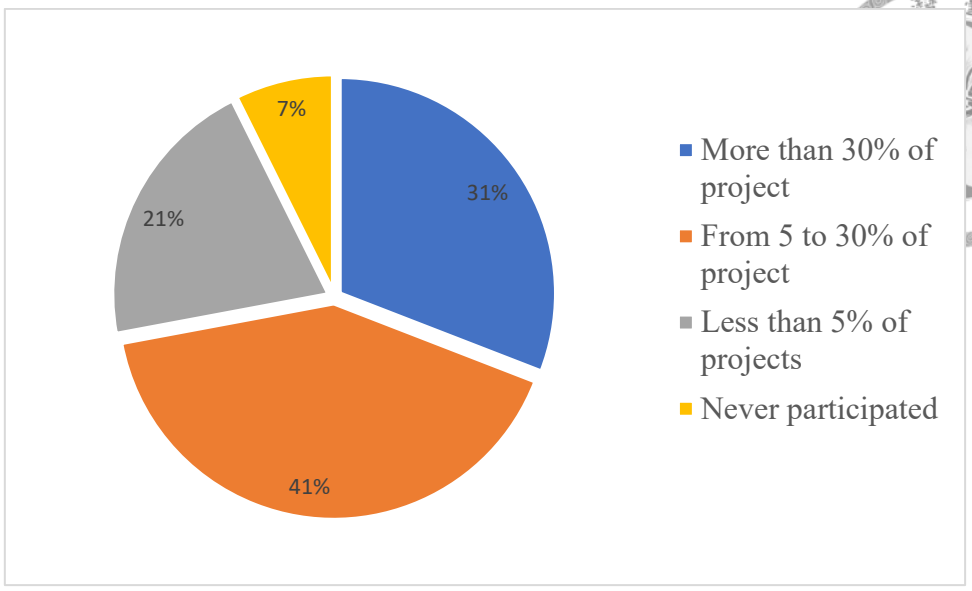

Figure 4. Frequency level of schedule overrun project that respondents have participated in

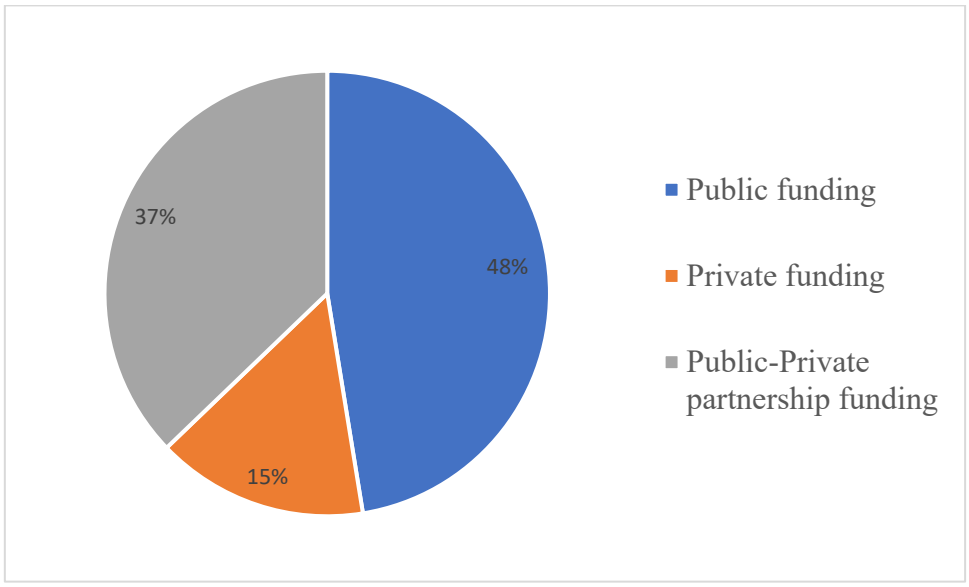

Figure 5. Proportion of projects schedule overruns by capital source

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4.2 Data analysis result

4.2.1 Results of Evaluating the Impact Levels of Each Factor Using the Sign Test Method

Table 3. One-sample Sign-test result with X=2

Factors	Number of values > 2 (positive sign)	Number of values < 2 (negative sign)	Sample size (n) = Total of positive sign and negative sign	p-value = P(X >= s) = 1 - P(X <= s - 1)	Decision
O1	35	7	42	0.0000	Support Median > 2
O2	40	8	48	0.0000	Support Median > 2
O3	46	2	48	0.0000	Support Median > 2
O4	49	4	53	0.0000	Support Median > 2
O5	49	5	54	0.0000	Support Median > 2
O6	42	6	48	0.0000	Support Median > 2
CC1	43	6	49	0.0000	Support Median > 2
CC2	52	4	56	0.0000	Support Median > 2
CC3	35	9	44	0.0001	Support Median > 2
CC4	39	7	46	0.0000	Support Median > 2
CC5	39	7	46	0.0000	Support Median > 2
CC6	42	7	49	0.0000	Support Median > 2
CC7	37	8	45	0.0000	Support Median > 2
CC8	41	8	49	0.0000	Support Median > 2
CC9	39	8	47	0.0000	Support Median > 2

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CC10	38	9	47	0.0000	Support Median > 2
CC11	30	9	39	0.0005	Support Median > 2
CC12	19	10	29	0.0680	Do not support Median > 2
CC13	33	8	41	0.0001	Support Median > 2
SC1	33	8	41	0.0001	Support Median > 2
SC2	36	6	42	0.0000	Support Median > 2
SC3	38	7	45	0.0000	Support Median > 2
SC4	39	6	45	0.0000	Support Median > 2
DS1	32	6	38	0.0000	Support Median > 2
DS2	35	6	41	0.0000	Support Median > 2
DS3	33	6	39	0.0000	Support Median > 2
SA1	39	3	42	0.0000	Support Median > 2
SA2	47	3	50	0.0000	Support Median > 2
PS1	33	6	39	0.0000	Support Median > 2
PS2	32	3	35	0.0000	Support Median > 2
PS3	36	4	40	0.0000	Support Median > 2
E1	44	3	47	0.0000	Support Median > 2
E2	29	6	35	0.0001	Support Median > 2
E3	49	3	52	0.0000	Support Median > 2
E4	45	4	49	0.0000	Support Median > 2
E5	30	5	35	0.0000	Support Median > 2
E6	26	18	44	0.1456	Do not support Median > 2
E7	36	6	42	0.0000	Support Median > 2
E8	25	9	34	0.0045	Support Median > 2

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At the testing level X = 2 shown in Table 3, with a significance level of 95%, most factors exhibit P-values less than 0.05. This implies that we reject the null hypothesis (H0) and accept the alternative hypothesis (Ha). In this context, the alternative hypothesis suggests that the factor has a moderate impact on project schedule overrun in transportation construction in Vietnam. Only two factors, "Accidents occurred at the construction site" (CC12) and "Wars, conflicts" (E6), have P-values greater than 0.05. This indicates that we cannot assert with confidence that these two factors have a moderate impact on project schedule overruns.

Table 4. One- sample Sign test result with X=3

Factors	Number of values > 3 (positive sign)	Number of values < 3 (negative sign)	Sample size (n) = Total of positive sign and negative sign	p-value = P(X >= s) = 1 - P(X <= s - 1)	Decision
O1	13	33	46	0.9992	Do not support Median >3
O2	17	28	45	0.9638	Do not support Median >3
O3	29	22	51	0.2005	Do not support Median >3
O4	27	19	46	0.1510	Do not support Median >3
O5	28	19	47	0.1215	Do not support Median >3
O6	19	26	45	0.8837	Do not support Median >3
CC1	19	25	44	0.8544	Do not support Median >3
CC2	32	16	48	0.0147	Support Median > 3
CC3	18	32	50	0.9836	Do not support Median >3
CC4	20	29	49	0.9238	Do not support Median >3

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CC5	16	29	45	0.9822	Do not support Median >3
CC6	17	26	43	0.9369	Do not support Median >3
CC7	13	31	44	0.9982	Do not support Median >3
CC8	18	27	45	0.9324	Do not support Median >3
CC9	18	29	47	0.9605	Do not support Median >3
CC10	19	30	49	0.9573	Do not support Median >3
CC11	14	38	52	0.9998	Do not support Median >3
CC12	13	49	62	1.0000	Do not support Median >3
CC13	17	35	52	0.9961	Do not support Median >3
SC1	13	35	48	0.9996	Do not support Median >3
SC2	10	32	42	0.9999	Do not support Median >3
SC3	17	30	47	0.9800	Do not support Median >3
SC4	16	29	45	0.9822	Do not support Median >3
DS1	16	36	52	0.9984	Do not support Median >3
DS2	16	33	49	0.9953	Do not support Median >3
DS3	16	35	51	0.9977	Do not support Median >3
SA1	17	28	45	0.9638	Do not support Median >3
SA2	32	21	53	0.0845	Do not support Median >3
PS1	8	35	43	1.0000	Do not support Median >3
PS2	16	36	52	0.9984	Do not support Median >3
PS3	17	32	49	0.9894	Do not support Median >3
E1	18	24	42	0.8600	Do not support Median >3
E2	16	39	55	0.9995	Do not support Median >3
E3	18	19	37	0.6286	Do not support Median >3
E4	18	23	41	0.8256	Do not support Median >3

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E5	13	38	51	0.9999	Do not support Median >3
E6	19	42	61	0.9991	Do not support Median >3
E7	26	32	58	0.8209	Do not support Median >3
E8	6	43	49	1.0000	Do not support Median >3

At the significance level X = 3 shown in Table 4, with a significance level of 95%, only one factor, "Contractors encounter financial difficulties during the construction process" (CC2), has a P-value less than 0.05. In this case, the alternative hypothesis (Ha) implies that this factor has a significant impact on project schedule overrun in transportation construction projects in Vietnam. The remaining factors have P-values greater than 0.05, indicating that we cannot assert that these factors have a significant impact on project schedule overruns.

Table 5: One-sample Sign test result with X=4

Factors	Number of values > 4 (positive sign)	Number of values < 4 (negative sign)	Sample size (n) = Total of positive sign and negative sign	p-value = P(X >= s) = 1 - P(X <= s -1)	Decision
O1	1	55	56	1.0000	Do not support Median > 4
O2	1	51	52	1.0000	Do not support Median > 4
O3	7	39	46	1.0000	Do not support Median > 4
O4	7	41	48	1.0000	Do not support Median > 4
O5	7	40	47	1.0000	Do not support Median > 4

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O6	1	49	50	1.0000	Do not support Median > 4
CC1	7	49	56	1.0000	Do not support Median > 4
CC2	8	36	44	1.0000	Do not support Median > 4
CC3	2	49	51	1.0000	Do not support Median > 4
CC4	2	48	50	1.0000	Do not support Median > 4
CC5	2	52	54	1.0000	Do not support Median > 4
CC6	2	51	53	1.0000	Do not support Median > 4
CC7	4	55	59	1.0000	Do not support Median > 4
CC8	4	50	54	1.0000	Do not support Median > 4
CC9	5	50	55	1.0000	Do not support Median > 4
CC10	2	49	51	1.0000	Do not support Median > 4
CC11	7	54	61	1.0000	Do not support Median > 4
CC12	7	55	62	1.0000	Do not support Median > 4
CC13	3	51	54	1.0000	Do not support Median > 4
SC1	3	55	58	1.0000	Do not support Median > 4
SC2	2	58	60	1.0000	Do not support Median > 4
SC3	3	51	54	1.0000	Do not support Median > 4
SC4	0	52	52	N/A	Do not support Median > 4
DS1	4	52	56	1.0000	Do not support Median > 4
DS2	5	52	57	1.0000	Do not support Median > 4
DS3	5	52	57	1.0000	Do not support Median > 4
SA1	4	50	54	1.0000	Do not support Median > 4
SA2	7	36	43	1.0000	Do not support Median > 4
PS1	0	60	60	N/A	Do not support Median > 4
PS2	6	52	58	1.0000	Do not support Median > 4

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PS3	5	51	56	1.0000	Do not support Median > 4
E1	1	50	51	1.0000	Do not support Median > 4
E2	8	52	60	1.0000	Do not support Median > 4
E3	7	50	57	1.0000	Do not support Median > 4
E4	6	50	56	1.0000	Do not support Median > 4
E5	3	55	58	1.0000	Do not support Median > 4
E6	9	49	58	1.0000	Do not support Median > 4
E7	9	42	51	1.0000	Do not support Median > 4
E8	0	62	62	N/A	Do not support Median > 4

At the testing level X = 4 shown in Table 5, with a significance level of 95%, no hypothesis testing has a P-value less than 0.05. This implies that for each factor, we can support the null hypothesis (H0), meaning there is insufficient evidence to demonstrate these factors have an extreme impact on project schedule overruns in transportation construction projects in Vietnam.

The results of the three tests indicate that, for the majority of the listed factors, excluding “Accidents occurred at the construction site” and “Wars, conflicts” respondents generally assessed these factors as having at least a moderate impact on project schedule overruns in transportation construction projects. Furthermore, the factor "Contractors encounter financial difficulties during the construction process” was evaluated to have more than a significant impact. However, none of the listed factors received evaluations suggesting an extreme impact on project schedule overruns.

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4.2.2 Result of ranking factors based on Relative Importance Index method

After performing the calculation, the scores of the factors are presented as the Table 6

Table 6. Relative importance Index of potential factors causing project schedule overruns

No.	Factors causing project schedule overruns	Symbol	RII
I	**Project owners-related factors**		
1	The owner is behind schedule in selecting the contractors and awarding the contracts	O1	0.515
2	The owner is behind schedule in project appraisal and approval	O2	0.538
3	The owner is behind schedule in handing over the site to the contractor.	O3	0.632
4	The owner has difficulty securing the funding for the project	O4	0.626
5	The owner is behind schedule in making agreed payments for construction	O5	0.621
6	The owner changes the requirements during project the execution process.	O6	0.556
II	**Construction contractors-related factors**		
7	Contractors lack experience.	CC1	0.579
8	Contractors encounter financial difficulties during the construction process	CC2	0.659
9	The construction method is not suitable	CC3	0.534
10	Poor construction planning and management	CC4	0.550
11	The contractor’s internal construction site management and supervision are not good	CC5	0.538

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12	The mobilization of construction machinery and equipment to the construction site is behind schedule	CC6	0.556
13	The quality of construction machinery and equipment is poor	CC7	0.535
14	Low labor productivity	CC8	0.559
15	Labor shortage	CC9	0.562
16	The contractor's materials supply logistics are not good	CC10	0.544
17	Construction rework due to mistakes or errors.	CC11	0.518
18	Accidents occurred at the construction site	CC12	0.471
19	Subcontractors lack competency	CC13	0.529
III	**Construction supervision-related factors**		
20	Construction supervision consultants lack experience	SC1	0.512
21	Construction supervision consultants do not properly inspect or supervise the construction works	SC2	0.515
22	Construction supervision consultants are behind schedule in accepting contractors' construction work	SC3	0.541
23	Construction supervision consultants do not allocate enough human resources when supervising project construction	SC4	0.532
IV	**Design consultant-related factors**		
24	Designers lack experience	DS1	0.529
25	The design consultant does not thoroughly survey and collect data before designing	DS2	0.541
26	The design is unclear, lacking details, or has errors.	DS3	0.535
V	**State management agencies-related factors**		
27	Changes in government regulations and laws	SA1	0.564

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28	Delays in processes with state management agencies such as fire prevention and fighting issues, environmental impact assessment, land use rights, design approval, project approval	SA2	0.638
VI	**Multiple project stakeholders-related factors**		
29	Poor communication between project stakeholders	PS1	0.497
30	Conflicts between project stakeholders	PS2	0.544
31	Contract-related issues: lack of consistency between contract parts, not mentioning necessary standards, specifications...	PS3	0.550
VII	**External context-related factors**		
32	Unfavorable weather, geological, hydrological and tidal conditions	E1	0.576
33	Natural disaster	E2	0.529
34	General market conditions are not favorable: for example, rising steel prices, shortage of construction sand mines...	E3	0.609
35	Global or regional economic crisis/recession	E4	0.588
36	The project location has unfavorable economic/political/cultural conditions)	E5	0.515
37	Wars, conflicts	E6	0.485
38	Diseases pandemic	E7	0.585
39	Influence from neighboring projects	E8	0.462

The study also calculated the score for each group by calculating the average score of each factor within the groups. The result is shown in Table 6. The group with the highest score is the one related to State Management Agencies (0.601). In this group, the factor with the highest influence is “Delays in processes with state management agencies

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such as fire prevention and fighting issues, environmental impact assessment, land use rights, design approval, project approval" with an RII of 0.638.

The second-highest scoring group is related to Project Owners (0.581). In this group, the factor with the highest influence is "The owner is behind schedule in handing over the site to the contractor" with an RII of 0.632.

The third-highest scoring group is related to Contractors (0.549). The factor with the greatest influence in this group is "Contractors encounter financial difficulties during the construction process" with an RII of 0.659.

The next ranked group is the group of factors related to external parties (0.544). The factor with the greatest influence in this group is "General market conditions are not favorable" with an RII of 0.609.

Following that is the group of factors related to Design Consultants (0.535). In this group, the factor with the greatest influence is "The design consultant does not fully survey and collect data before designing" with an RII of 0.541.

The sixth-highest scoring group is related to Project Stakeholders (0.53). The factor with the greatest influence in this group is "Contract-related issues like a lack of consistency between contract parts, not mentioning necessary standards, specifications..." with an RII of 0.55.

The lowest-scoring group in this study is the group related to Construction Supervision Consultants. The factor with the greatest influence in this group is "Construction supervision consultants are behind schedule in accepting contractors' construction work" with an RII of 0.541.

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Table 7. Group ranking

Group	RII	Ranking
Government related factors	0.6012	1
Owner related factors	0.5814	2
Contractor related factors	0.5488	3
External related factors	0.5438	4
Design consultant related factors	0.5353	5
Stake holders related factors	0.5304	6
Supervisor consultant related factors	0.5250	7

Based on the Relative Importance Index (RII) for each factor, the table listing the top 10 factors that impact project schedule overruns in transportation construction projects in Vietnam has been determined. The results are shown in Table 8

Table 8. Top 10 factors causing project schedule overruns in transportation project in Vietnam

Rank.	Top 10 factors causing project schedule overruns	Symbol	Group	RII
1	Contractors encounter financial difficulties during the construction process	CC2	Construction contractors	0.659
2	Delays in processes with state management agencies such as fire prevention and fighting issues, environmental impact assessment, land use rights, design approval, project approval	SA2	State management agencies	0.638

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3	The owner is behind schedule in handing over the site to the contractor.	O3	Project owners	0.632
4	The owner has difficulty securing the funding for the project	O4	Project owners	0.626
5	The owner is behind schedule in making agreed payments in construction	O5	Project owners	0.621
6	General market conditions are not favorable	E3	External	0.609
7	Global or regional economic crisis/recession	E4	External	0.588
8	Diseases pandemic	E7	External	0.585
9	Contractors lack experience.	CC1	Construction contractors	0.579
10	Unfavorable weather, geological, hydrological, and tidal conditions	E1	External	0.576

However, based on the answers received from people with 5 years or more of experience in the construction industry in general and the field of traffic construction in particular (accounting for 50% of the answers), the top 10 factors impact construction schedule overruns which is shown in Table 9 have some changes compared to the overall results in Table 8

Table 9. Top 10 factors impacting project schedule overruns in transportation construction projects in Vietnam as evaluated by experts having at least 5 years of experience in the construction industry in Vietnam

Rank.	Top 10 factors impacting project schedule overruns as evaluated by expert having at least 5 years of experience in the construction industry in Vietnam	Symbol	Group	RII

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1	General market conditions are not favorable	E3	External	0.682
2	Contractors encounter financial difficulties during the construction process	CC2	Project owners	0.659
3	The owner is behind schedule in handing over the site to the contractor.	O3	Project owners	0,653
4	Delays in processes with state management agencies such as fire prevention and fighting issues, environmental impact assessment, land use rights, design approval, project approval	SA2	State management agencies	0.647
5	Global or regional economic crisis/recession	E4	External	0.629
6	The owner has difficulty securing the funding for the project	O4	Project owners	0.617
7	Contractors lack experience.	CC1	Construction contractors	0.606
8	Unfavorable weather, geological, hydrological, and tidal conditions	E1	External	0.606
9	Diseases pandemic	E7	External	0.594
10	The contractor's materials supply logistic is not good	CC10	Construction contractors	0.588

The results reveal minimal divergence in the list of top factors influencing project schedule overrun, with the notable exception of the factor "The owner is behind schedule in making agreed payments in construction" which is replaced by "The contractor's

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materials supply logistics is not good." This suggests that these factors are prominent and easily recognizable and are consistently observed in transportation construction projects in Vietnam.

However, the noteworthy aspect lies in reordering the factors between the two lists. Although most factors experience slight shifts in ranking or remain stable, one factor undergoes significant change: "General market conditions are not favorable" moving from the 6th position in the overall opinion to the top position in the experienced individuals' perspective.

This evaluation may be grounded in the actual state of the construction industry in Vietnam during the 2021-2022 period, characterized by the post-COVID economic recovery. Construction projects were redeployed simultaneously, leading to a scarcity of materials and a surge in material prices, particularly steel. Many transportation construction projects in Vietnam encountered difficulties sourcing materials, resulting in project schedule overruns. This could explain why this factor is assessed more critically by experienced individuals who can perceive its substantial impact on project schedule overruns.

As a result, the study recognizes that the factor ranking based on experienced individuals' opinions holds higher accuracy, providing a more precise understanding of the factors that impact project schedule overruns in transportation construction projects in Vietnam.

The study reveals that the identified top factors bear similarities with those found in previous research. Financial-related factors, such as contractors facing difficulties in capital maintenance and owners encountering challenges in sustaining funding, have also been identified in(Kaliba et al., 2009). However, in studies from other countries like

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Turkey(Gündüz et al., 2013), top reasons often revolve around planning, management, and supervision, which do not feature prominently in this research. Additionally, external factors such as pandemics, market conditions, and material issues, typically not highly prioritized in other studies, receive high rankings in this research. This can be explained by the differences in Vietnam's conditions compared to the countries in other studies. As a developing country with limited financial resources, financial-related factors are consistently prioritized in Vietnam, unlike in more developed countries. Moreover, the issues and aftermath of the recovery process after Covid, as mentioned earlier, also influence the respondents' perspectives. This may elucidate why reasons such as pandemics or issues related to material scarcity and increased material prices are rated higher compared to studies conducted in the past. In essence, the unique socio-economic conditions of Vietnam, being a developing nation with financial constraints, contribute to the emphasis on financial factors. Additionally, the recent challenges and implications of the post-Covid recovery period have shaped respondents' viewpoints, further explaining the higher rankings given to factors like pandemics or material-related issues compared to previous studies.

Moreover, during the analysis of the results, the study also observed that the perspectives of the survey participants from different organizational groups would yield very different viewpoints, especially regarding factors related to their own organization and factors unrelated to their organization. Therefore, the study calculated the RII of the ranking based on the perspectives of five respondent groups: Owner, Contractor, Design consultant, Project management and Supervision Consultant, and Government agencies. Table 10 shows the top 5 factors causing project schedule overrun based on different perspectives.

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Table 10. Top 5 factors impacting project schedule overruns in transportation construction projects in Vietnam as evaluated by each group of respondents

Rank	Owner	Contractor	PM and S Consultant	Design Consultant	Government agencies
1	Poor construction planning and management	The owner is behind schedule in handing over the site to the contractor.	General market conditions are not favorable	Contractors encounter financial difficulties during the construction process	Contractors encounter financial difficulties during the construction process
2	Contractors lack experience.	Contractors encounter financial difficulties during the construction process	Global or regional economic crisis/recession	The owner is behind schedule in making agreed payments in construction	The owner is behind schedule in making agreed payments in construction
3	The design consultant does not fully survey and collect	The owner has difficulty securing the	Contractors encounter financial difficulties during the	The owner has difficulty securing the	Global or regional economic crisis/recession

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	data before designing	funding for the project	construction process	funding for the project	
4	Delays in processes with state management agencies	The owner is behind schedule in making agreed payments in construction	Unfavorable weather, geological, hydrological and tidal conditions	Delays in processes with state management agencies	Diseases pandemic
5	Unfavorable weather, geological, hydrological and tidal conditions	Delays in processes with state management agencies	Delays in processes with state management agencies	The owner is behind schedule in handing over the site to the contractor.	The owner is behind schedule in handing over the site to the contractor.

Table 10 delineates notable distinctions in pinpointing the primary factors contributing to project schedule overruns in transportation construction projects, as viewed through the lens of five distinct groups. The author observes that within the four groups—contractors, project management and supervision consultants, design consultants, and government agencies—the top factors for each group encompass 3 to 4 elements that are also prevalent in the assessments of the other groups. A noteworthy trend emerges with the factor “Contractors encounter financial difficulties during the

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construction process" consistently securing a position in the top 3 for these four groups. However, the author discerns a distinctive pattern within the owner group, where the top 3 factors evaluated by this group diverge from those identified by the other four groups. Only the remaining two factors, "Delays in processes with state management agencies" and "Unfavorable weather, geological, hydrological, and tidal conditions" exhibit similarities with the assessments of the other groups.

Consequently, the study proceeds to conduct a more in-depth examination to gauge the extent of agreement among these groups. The agreement among the groups was tested using the Spearman's method for each pair, utilizing the SPSS software. The degree of agreement between groups was assessed on a scale from -1 to 1, with a value of -1 meaning a total negative linear correlation, 0 being no correlation, and + 1 meaning a total positive correlation. The strength of the relationship between two groups is small medium, or large when the correlation coefficient is from 0.10 to 0.29, 0.30 to 0.49, or from 0.50 to 1, respectively. If the 2-tailed p-value of the test is smaller than 0.05, there is a statistically significant correlation between the 2 groups. If the 2-tailed p-value of the test is greater than 0.05, there is no statistically significant correlation between the 2 groups. The result of this test is shown in Appendix C.

The results indicated that the opinions of the owner group did not align with those of the other groups. The correlation coefficient values for contractor, consultant, Design consultant, and government agencies were 0.185, 0.166, 0.07, and 0.19, respectively. However, the 2-tailed p-value in these tests with owner group are greater than 0.05, so there is a no statistically significant correlation between the owner and other groups.

The contractor group showed a higher level of agreement with the other groups, with coefficients of 0.324 with consultant, 0.325 with Design consultant, and the highest

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with government agencies at 0.471. However, with the Design consultant, the 2-tailed p-value of the test is 0.059, which indicates that there is no statistically significant correlation between the contractor and the Design consultant groups. Two other pairs have a 2-tailed p-value smaller than 0.05, showing a medium correlation level between these pairs.

The consultant group demonstrated a high correlation level with the government agencies at 0.525 with 2-tailed p-value of 0.00 and nearly agreed with the Design consultant group, as the correlation coefficient for this pair was 0.942 with s2-tailed p-value of 0.001. The result of this test is shown in Table 11.

Lastly, the correlation coefficient between the Design consultant and government agencies pair was 0.493, a medium level of correlation with 2-tailed significance of 0.001.

Table 11. Spearman's test between Project management and Supervision consultant group and Design consultant group

Correlations

			PM and S Consultant	Design consultant
Spearman's rho	PM and S Consultant	Correlation Coefficient	1.000	.942**
		Sig. (2-tailed)	.	.000
		N	39	39
	Design consultant	Correlation Coefficient	.942**	1.000
		Sig. (2-tailed)	.000	.
		N	39	39

** *Correlation is significant at the 0.01 level (2-tailed).*

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Hence, while the owner's viewpoint may differ, a notable consensus exists among the other groups, demonstrating a strength of agreement ranging from medium to large. The difference of the owner group can be caused by the lack of experience in the construction field compared to the other groups. The remaining groups all have more direct and frequent involvement compared to the owners, who do not have much specialized experience in the construction industry. The other four groups are all experienced individuals directly participating in construction projects. This alignment is further emphasized by the shared identification of the top 5 influencing factors by contractors, consultants, design professionals, and government officials. The convergence of opinions among these groups is also reflected in the inclusion of these factors within the overarching list of the top 10 factors that impact project schedule overruns in transportation construction projects in Vietnam. However, the study also acknowledges the limitations of analyzing solely from the perspective of each group, as inherent biases may exist within each group's evaluation. With the exception of an anomaly in the contractor group, where a factor related to themselves is rated as one of the top causes, the other groups tend to undervalue factors associated with their own responsibilities. This becomes evident during the analysis, where in each group, relevant factors do not consistently receive high rankings. Notably, a factor such as "Delays in processes with state management agencies" is identified in all four groups but is conspicuously absent in the group responsible for it—government agencies.

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Chapter 5. Conclusion

5.1 Conclusion

The research has identified 39 potential factors contributing to project schedule overruns, categorized into 7 groups: (1) factors related to project owners, (2) factors related to construction contractors, (3) factors related to construction supervision consultants, (4) factors related to design consultants, (5) factors related to state management agencies, (6) factors related to multiple project stakeholders, and (7) factors related to external context project conditions.

A one-sample Sign Test was conducted for these factors at the 2, 3, and 4 impact levels, corresponding to Slight impact, Moderate impact, and Significant impact, to evaluate their influence on project schedule overrun in transportation construction projects in Vietnam. Most factors, except for "Accidents occurred at the construction site" and "Wars, conflicts," were assessed to have a moderate impact on project schedule overruns. Additionally, only one factor, "Contractors encounter financial difficulties during the construction process." was evaluated to impact on project schedule overruns significantly. However, none of the factors were perceived as having an extreme impact on project schedule overruns.

Subsequently, the study utilized scoring and ranking based on the Relative Importance Index (RII). After calculation and ranking, the top 10 factors were identified based on the evaluations of individuals with at least five years of experience in transportation construction projects in Vietnam. These factors were ranked as follows: "General market conditions are not favorable"; "Contractors encounter financial difficulties during the construction process"; "The owner is behind schedule in handing

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over the site to the contractor"; "Delays in processes with state management agencies"; "Global or regional economic crisis/recession"; "The owner has difficulty securing funding"; "Contractors lack experience"; "Unfavorable weather, geological, hydrological, and tidal conditions"; "Diseases pandemic" and "The contractor's materials supply logistics is not good".

Furthermore, the study identified the top 5 factors influencing project schedule overrun in transportation construction projects in Vietnam, following the perceptive of each group of project owners, contractors, consultant, Design consultant and government agencies. The Spearman's correlation coefficient was used to assess the level of agreement between pairs of groups. The results indicated that the owner's group opinion did not align with those of any other group, and the contractor's group did not align with the Design consultant's group. However, the remaining pairs showed moderate to high levels of agreement. This was also reflected in the top 5 factors evaluated by each group, where, except for the owner's group, there was a inevitable overlap in the factors, and these factors were the ones with the highest RII in the overall list. Therefore, except for the owner's perspective, the other groups demonstrated a certain level of consensus regarding the top factors influencing project schedule overruns in transportation construction projects in Vietnam.

5.2 Contribution

The issue of project delays remains a persistent and unresolved challenge, particularly in the context of construction projects in Vietnam. Despite being a prevalent concern in construction projects overall and specifically in transportation construction projects, there has been limited research on this matter in Vietnam. Therefore, this study

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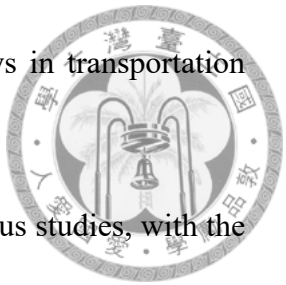

serves as a reference to shed light on the causes of schedule delays in transportation construction projects in Vietnam.

The factors identified in this research are derived from previous studies, with the author further refining and consolidating the list by eliminating redundancies. Additionally, specific factors unique to Vietnam, not covered in other research, have been integrated. Notably, the factor “Delays in processes with state management agencies, such as fire prevention and fighting issues, environmental impact assessment, land use rights, design approval, project approval” has emerged prominently, acknowledged as a primary contributor to schedule delays in Vietnam's transportation construction projects, providing novel insights to the discourse.

Moreover, through the implementation of a Sign test, the study can assess the impact of identified factors on schedule delays, which is not often done in other research. The results indicate that the majority of factors identified exert a moderate impact, with “Contractors encounter financial difficulties during the construction process” standing out with a significant impact. Evaluating the impact levels of these factors provides industry participants with a comprehensive understanding of potential triggers for schedule overrun.

Furthermore, by identifying the top 10 factors impact project schedule overrun in transportation construction project in Vietnam, key stakeholders, including the government, owners, supervisors, or contractors, can realize factor need more attention in Vietnam. Factors related to financial issues, or material sources or administrative procedures need to be focused on, so that they can formulate proactive strategies and detailed plans accurately for condition in Vietnam to prevent or minimize the occurrence of these factors and mitigate their potential consequences.

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5.3 Recommendation

Having identified the top 10 cause project schedule overruns in transportation construction projects in Vietnam, the author finds that these are the factors that need to be focused on. So, based on those top 10 factors, the author proposes a set of actionable recommendations to effectively address or mitigate their impact on transportation construction projects in Vietnam:

Project Owners:

- Ensure continuous funding to avoid project interruptions;
- Plan and execute accurate land clearance before handing over to the contractor to prevent delays in the construction process;
- Implement stringent contractor selection procedures, thoroughly assessing their experience, construction capabilities, and financial stability.

Construction Contractors:

- Only accept projects within their technical and financial capacities;
- Ensure a stable supply of construction materials and have contingency plans in place in case of material supply issues.

State Management Agencies:

- Enforce policies for strict monitoring and evaluation of the bidding and awarding process;
- Simplify and expedite funding and payment procedures for state-funded projects to prevent interruptions;
- Facilitate and expedite the inspection process for various project-related approvals.

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- Maintain rigorous procedures for fire prevention, environmental impact assessment, land use rights, design approval, and project approval, while speeding up the inspection process for each project;
- Introduce policies to monitor and support the construction sector during global or regional economic crises or recessions;
- Provide economic support and incentives to balance and mitigate the effects of material shortages and rising prices.

By implementing these recommendations, stakeholders can contribute to the effective management and successful completion of transportation construction projects in Vietnam, mitigating the impact of identified factors leading to project schedule overruns.

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Chapter 6. Limitations and future research

The evaluation of a small number of participants limits the study, as such, the results from the questionnaire may not accurately reflect the precise impact of the identified factors on project schedule overruns. The factors were determined based on those listed in previous foreign studies, and subsequently adjusted based on the author's and interviewees' opinions. Therefore, there might be additional factors specific to Vietnam that were not included in the study. Nevertheless, the research still provides results that can serve as a reference for future studies.

Subsequent studies could be conducted on a larger scale, involving a more extensive participant pool from various locations across Vietnam to obtain a more comprehensive perspective on the actual situations of transportation construction projects in Vietnam. Alternatively, a more detailed study could focus on a specific city or a particular type of transportation construction project. Moreover, future research could increase the number of participants from each organization to provide a more objective comparison of perspectives among different groups.

All these research directions would offer a detailed insight into project schedule overruns in transportation construction projects in Vietnam. This approach can help identify factors that require special attention and seek solutions to prevent the occurrence of these factors.

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Appendices

Appendix A: Interviewee's background

Interviewee	A	B
Current organization	Contractor	Contractor
Position	Director	Manager
Year of experience in construction industry	35 years	19 years
Number of transportation construction project participated	13	8
Type of transportation construction project participated	Road, bridge, tunnel	Road, bridge
Number of projects expecting schedule overruns	5	4

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Appendix B: Shapiro-Wilk test result

	O1	O2	O3	O4	O5	O6	CC1	CC2	CC3
N	68	68	68	68	68	68	68	68	67
Missing	0	0	0	0	0	0	0	0	1
Mean	2.57	2.69	3.16	3.13	3.1	2.78	2.9	3.29	2.67
Median	3	3	3	3	3	3	3	3	3
Standard deviation	0.997	1.05	1.09	1.12	1.19	1.03	1.15	1.08	1.09
Minimum	1	1	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5	5
Shapiro-Wilk W	0.9	0.895	0.901	0.914	0.903	0.893	0.915	0.906	0.901
Shapiro-Wilk p	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001

CC4	CC5	CC6	CC7	CC8	CC9	CC10	CC11	CC12	C13
68	68	68	68	68	68	68	68	68	68
0	0	0	0	0	0	0	0	0	0
2.75	2.69	2.78	2.68	2.79	2.81	2.72	2.59	2.35	2.65
3	3	3	3	3	3	3	2	2	2
1.1	1.05	1.02	1.04	1.1	1.1	1.09	1.19	1.22	1.09
1	1	1	1	1	1	1	1	1	1
5	5	5	5	5	5	5	5	5	5
0.901	0.908	0.907	0.903	0.915	0.911	0.903	0.877	0.804	0.898
< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001

SC1	SC2	SC3	SC4	DS1	DS2	DS3	SA1	SA2	PS1
68	68	68	68	68	68	68	67	68	68
0	0	0	0	0	0	0	1	0	0
2.56	2.57	2.71	2.66	2.65	2.71	2.68	2.82	3.19	2.49

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2	3	3	3	2	3	2	3	3	2
1.07	0.967	1.09	1	1.09	1.11	1.11	1.03	1.14	0.855
1	1	1	1	1	1	1	1	1	1
5	5	5	4	5	5	5	5	5	4
0.904	0.899	0.912	0.875	0.89	0.901	0.893	0.905	0.899	0.874
< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001

PS2	**PS3**	**E1**	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	**E8**
68	68	68	68	68	68	68	68	68	68
0	0	0	0	0	0	0	0	0	0
2.72	2.75	2.88	2.65	3.04	2.94	2.57	2.43	2.93	2.31
2	3	3	2	3	3	2	2	3	2
1.09	1.1	0.89	1.21	0.999	1.05	1.01	1.45	1.27	0.833
1	1	1	1	1	1	1	1	1	1
5	5	5	5	5	5	5	5	5	4
0.862	0.902	0.885	0.861	0.893	0.909	0.876	0.828	0.888	0.86
< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001

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Appendix C: Correlation coefficient test results

Correlations

			Owner	Contractor
Spearman's rho	Owner	Correlation Coefficient	1.000	.185
		Sig. (2-tailed)	.	.260
		N	39	39
	Contractor	Correlation Coefficient	.185	1.000
		Sig. (2-tailed)	.260	.
		N	39	39

Correlations

			Owner	PM and S Consultant
Spearman's rho	Owner	Correlation Coefficient	1.000	.166
		Sig. (2-tailed)	.	.313
		N	39	39
	PM and S Consultant	Correlation Coefficient	.166	1.000
		Sig. (2-tailed)	.313	.
		N	39	39

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Correlations

			Owner	Government agency
Spearman's rho	Owner	Correlation Coefficient	1.000	.019
		Sig. (2-tailed)	.	.907
		N	39	39
	Government agency	Correlation Coefficient	.019	1.000
		Sig. (2-tailed)	.907	.
		N	39	39

Correlations

			Owner	Design consultant
Spearman's rho	Owner	Correlation Coefficient	1.000	.007
		Sig. (2-tailed)	.	.967
		N	39	39
	Design consultant	Correlation Coefficient	.007	1.000
		Sig. (2-tailed)	.967	.
		N	39	39

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Correlations

			Contractor	PM and S Consultant
Spearman's rho	Contractor	Correlation Coefficient	1.000	.324*
		Sig. (2-tailed)	.	.044
		N	39	39
	PM and S Consultant	Correlation Coefficient	.324*	1.000
		Sig. (2-tailed)	.044	.
		N	39	39

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

			Contractor	Design consultant
Spearman's rho	Contractor	Correlation Coefficient	1.000	.305
		Sig. (2-tailed)	.	.059
		N	39	39
	Design consultant	Correlation Coefficient	.305	1.000
		Sig. (2-tailed)	.059	.
		N	39	39

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Correlations

			Contractor	Government agency
Spearman's rho	Contractor	Correlation Coefficient	1.000	.471**
		Sig. (2-tailed)	.	.002
		N	39	39
	Government agency	Correlation Coefficient	.471**	1.000
		Sig. (2-tailed)	.002	.
		N	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			Consultant	Design consultant
Spearman's rho	Consultant	Correlation Coefficient	1.000	.942**
		Sig. (2-tailed)	.	.000
		N	39	39
	Design consultant	Correlation Coefficient	.942**	1.000
		Sig. (2-tailed)	.000	.
		N	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

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Correlations

			PM and S Consultant	Government agency
Spearman's rho	PM and S Consultant	Correlation Coefficient	1.000	.525**
		Sig. (2-tailed)	.	.001
		N	39	39
	Government agency	Correlation Coefficient	.525**	1.000
		Sig. (2-tailed)	.001	.
		N	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			Government agency	Design consultant
Spearman's rho	Government agency	Correlation Coefficient	1.000	.493**
		Sig. (2-tailed)	.	.001
		N	39	39
	Design consultant	Correlation Coefficient	.493**	1.000
		Sig. (2-tailed)	.001	.
		N	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

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Appendix D: Relative importance index of each factor based on individuals have above 5 years of experience

No.	Factors causing project schedule overruns	Symbol	RII
I	**Project owners-related factors**		
1	The owner is behind schedule in selecting the contractors and awarding the contracts	O1	0.524
2	The owner is behind schedule in project appraisal and approval	O2	0.553
3	The owner is behind schedule in handing over the site to the contractor.	O3	0.653
4	The owner has difficulty securing the funding for the project	O4	0.618
5	The owner is behind schedule in making agreed payments for construction	O5	0.582
6	The owner changes the requirements during project the execution process.	O6	0.518
II	**Construction contractors-related factors**		
7	Contractors lack experience.	CC1	0.606
8	Contractors encounter financial difficulties during the construction process	CC2	0.659
9	The construction method is not suitable	CC3	0.524
10	Poor construction planning and management	CC4	0.565
11	The contractor’s internal construction site management and supervision are not good	CC5	0.547

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12	The mobilization of construction machinery and equipment to the construction site is behind schedule	CC6	0.565
13	The quality of construction machinery and equipment is poor	CC7	0.553
14	Low labor productivity	CC8	0.576
15	Labor shortage	CC9	0.559
16	The contractor's materials supply logistics are not good	CC10	0.588
17	Construction rework due to mistakes or errors.	CC11	0.512
18	Accidents occurred at the construction site	CC12	0.459
19	Subcontractors lack competency	CC13	0.535
III	**Construction supervision-related factors**		
20	Construction supervision consultants lack experience	SC1	0.535
21	Construction supervision consultants do not properly inspect or supervise the construction works	SC2	0.524
22	Construction supervision consultants are behind schedule in accepting contractors' construction work	SC3	0.541
23	Construction supervision consultants do not allocate enough human resources when supervising project construction	SC4	0.529
IV	**Design consultant-related factors**		
24	Designers lack experience	DS1	0.547
25	The design consultant does not thoroughly survey and collect data before designing	DS2	0.565
26	The design is unclear, lacking details, or has errors.	DS3	0.535
V	**State management agencies-related factors**		
27	Changes in government regulations and laws	SA1	0.559

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28	Delays in processes with state management agencies such as fire prevention and fighting issues, environmental impact assessment, land use rights, design approval, project approval	SA2	0.647
VI	**Multiple project stakeholders-related factors**		
29	Poor communication between project stakeholders	PS1	0.482
30	Conflicts between project stakeholders	PS2	0.535
31	Contract-related issues: lack of consistency between contract parts, not mentioning necessary standards, specifications...	PS3	0.535
VII	**External context-related factors**		
32	Unfavorable weather, geological, hydrological and tidal conditions	E1	0.606
33	Natural disaster	E2	0.571
34	General market conditions are not favorable: for example, rising steel prices, shortage of construction sand mines...	E3	0.682
35	Global or regional economic crisis/recession	E4	0.629
36	The project location has unfavorable economic/political/cultural conditions)	E5	0.541
37	Wars, conflicts	E6	0.471
38	Diseases pandemic	E7	0.594
39	Influence from neighboring projects	E8	0.476

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Appendix E: Questionnaire survey form

Phiếu khảo sát về mức độ ảnh hưởng của các nhân tố có thể dẫn đến chậm tiến độ tại các dự án xây dựng công trình giao thông tại Việt Nam (A survey questionnaire on the impact level of potential factors causing project schedule overruns in transportation construction project in Vietnam)

Xin kính chào Quý Anh, Chị

Xin phép được giới thiệu, tôi tên là Nguyễn Anh Tú, là sinh viên chương trình thạc sĩ liên kết giữa Khoa Xây dựng, Đại học Quốc gia Đài Loan và Trường Đại học Xây Dựng Hà Nội. Tôi đang thực hiện đề tài nghiên cứu với tiêu đề "**Mức độ ảnh hưởng của các nhân tố có thể gây ra chậm tiến độ dự án xây dựng công trình giao thông tại Việt Nam"**.

Để hoàn thành và nâng cao chất lượng nghiên cứu nói trên, việc lấy ý kiến của các chuyên gia trong lĩnh vực xây dựng là hết sức quan trọng. **Do vậy, tôi trân trọng kính mời Anh/Chị tham gia khảo sát sau đây nhằm đánh giá mức độ ảnh hưởng của các nhân tố có thể gây ra chậm tiến độ dự án xây dựng công trình giao thông tại Việt Nam**.

Tôi xin cam đoan các thông tin do Anh/Chị cung cấp trong phiếu khảo sát sẽ được bảo mật và chỉ được dùng cho mục đích nghiên cứu. Nếu Anh/Chị có câu hỏi hoặc góp ý cho khảo sát, xin vui lòng liên hệ qua email: nganhtu211@gmail.com.

Tôi xin trân trọng cảm ơn anh chị đã dành thời gian và sự ủng hộ cho nghiên cứu của chúng tôi!

Nguyễn Anh Tú

Sinh viên cao học tại Khoa Xây dựng, Đại học Quốc gia Đài Loan

(English version below)

Dear Sir/Madam,

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My name is Nguyen Anh Tu, and I am currently a student in the joint master program between the Department of Civil Engineering, National Taiwan University, Taiwan, and the Hanoi University of Civil Engineering, Vietnam. I am currently working on a research program with the title **"Impact levels of potential factors causing schedule overruns in transportation construction projects in Vietnam"**.

To complete and enhance the quality of this above-indicated research, obtaining the opinions of experts in the field of construction is of great importance. Hence, I would like to invite you to join a survey questionnaire on **the impact levels of potential factors causing schedule overruns in transportation construction project in Vietnam.**

The information provided in this survey will be kept confidential and will only be used for research purposes. If you have any questions or comments about our research, please contact us through email address: nganhtu211@gmail.com.

Thank you very much for your time and your support in our research!

Nguyen Anh Tu

Master student at the Department of Civil Engineering, National Taiwan University

Thông tin về người tham gia khảo sát (Information about the survey participant)

Đơn vị công tác hiện tại của Anh/Chị thuộc loại nào dưới đây? (What is the type of your current working organization?)*

- Chủ đầu tư (Owner)
- Nhà thầu xây dựng (Construction contractor)
- Tư vấn thiết kế (Design consultant)
- Nhà thầu thiết kế và thi công (Design and construction contractor)
- Nhà thầu thiết kế, thi công và cung cấp thiết bị (Engineering, Procurement, and Construction (EPC) Contractor)

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- Tư vấn giám sát thi công (Construction supervision consultant)
- Tư vấn quản lý dự án (Project management consultant)
- Cơ quản quản lý nhà nước liên quan đến hoạt động xây dựng (Construction-related government agency)

Vị trí công tác hiện tại của Anh/Chị? (What is your current position in your organization?)

- Quản lý cấp cao: chủ tịch, phó chủ tịch, giám đốc, phó giám đốc, CEO,... (Top-level manager: chairman, vice-chairman, director, deputy director, CEO...)
- Quản lý cấp trung: quản lý bộ phận, phòng ban... (Middle-level manager: department/unit manager...)
- Quản lý cấp thấp: giám sát nhóm nhỏ,... (Bottom-level manager: team manager,...)
- Nhân viên (Staff)

Anh chị đã có bao nhiêu năm kinh nghiệm trong ngành xây dựng nói chung? (How many years of experience have you participated in the construction industry?)

- Dưới 5 năm (Below 5 years)
- Từ 5 đến 10 năm (From 5 to 10 years)
- Từ 10 đến 20 năm (From 10 to 20 years)
- Trên 20 năm (Over 20 years)

Anh chị đã có bao nhiêu năm kinh nghiệm tham gia các dự án xây dựng công trình giao thông tại Việt Nam? (How many years of experience have you participated in transportation construction projects in Vietnam?)

- Dưới 2 năm (Below 2 years)
- Từ 2 đến 5 năm (From 2 to 5 years)

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- Từ 5 đến 10 năm (From 5 to 10 years)
- Từ 10 đến 15 năm (From 10 to 15 years)
- Trên 15 năm (Over 15 years)

Các dự án xây dựng công trình giao thông tại Việt Nam mà Anh/Chị đã tham gia có xảy ra hiện tượng chậm tiến độ hay không? (Are there any schedule overruns in transportation construction projects in Vietnam that you have participated in?)

- Nhiều: > 30% dự án (Many: over 30% projects)
- Ít: từ 5% đến 30% dự án (Not many: from 5% to 20% projects)
- Không đáng kể: dưới 5% (Negligible: below 5%)
- Chưa từng tham gia dự án xây dựng công trình giao thông tại Việt Nam bị chậm tiến độ (Never participated in a transportation construction project in Vietnam that was behind schedule)

Thông tin chung về các dự án xây dựng công trình giao thông bị chậm tiến độ tại Việt Nam mà người trả lời khảo sát đã tham gia (General information about schedule overrun in transportation construction project in Vietnam that respondent have participated in)

Anh/Chị vui lòng cung cấp các thông tin chung về các dự án xây dựng công trình giao thông ở Việt Nam bị chậm tiến độ mà Anh/Chị đã tham gia như nguồn vốn, loại hình dự án, khu vực đặt dự án.

Please provide general information about schedule-overrun transportation construction projects in Vietnam that you have participated in, such as the type of funding, the type of project, and the project location.

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Nguồn vốn của các dự án đó thuộc loại nào? Có thể chọn nhiều câu trả lời. (What are the funding types for these projects? Multiple answers can be applied.)

- Vốn nhà nước (Public funding)
- Vốn tư nhân (Private funding)
- Vốn nhà nước và tư nhân (Public - Private Partnership funding)

Các dự án đó thuộc loại nào? Có thể chọn nhiều câu trả lời. (What are the types of these projects? Multiple answers can be applied.)

- Đường bộ (Road)
- Đường sắt (Railway)
- Tàu điện ngầm (Underground Metro)
- Cầu (Bridge)
- Hầm (Tunnel)
- Hàng hải (Waterway)
- Bến cảng (Port)
- Sân bay (Airport)
- Loại công trình giao thông khác (Other types of transportation construction projects)

Các dự án đó nằm ở khu vực nào? (In which areas are these projects located?)

- Hà Nội (Hanoi)
- Thành phố Hồ Chí Minh (Ho Chi Minh city)
- Đà Nẵng (Danang city)
- Các khu vực đô thị khác (Other urban areas)
- Các vùng nông thôn (Rural areas)

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Đánh giá mức độ ảnh hưởng của các nhân tố có thể gây ra chậm tiến độ dự án xây dựng công trình giao thông tại Việt Nam (Evaluate the impact level of potential factors causing schedule overrun in transportation construction project in Vietnam)

Dựa trên kinh nghiệm thực tế từ các dự án xây dựng công trình giao thông tại Việt Nam bị chậm tiến độ mà Anh/Chị đã tham gia, hãy đánh giá mức độ ảnh hưởng của các nhân tố có thể gây ra chậm tiến độ các dự án xây dựng công trình giao thông tại Việt Nam.

Nếu Anh/Chị chưa từng tham gia dự án xây dựng công trình giao thông nào bị chậm tiến độ tại Việt Nam, hãy sử dụng kinh nghiệm tổng quát trong ngành xây dựng của mình để đánh giá.

Anh/Chị có thể lựa chọn 1 trong 6 lựa chọn dưới đây: 1 - Không chút nào; 2 - Nhỏ; 3 - Vừa phải; 4 - Lớn; 5 - Nghiêm trọng; 6 - Tôi không rõ

Based on your practical experience from behind-schedule transportation construction projects in Vietnam that you have participated in, please evaluate the impact levels of potential factors causing project schedule overruns in transportation construction projects in Vietnam.

If you have never participated in behind-schedule transportation construction projects in Vietnam, please use your general experience in the construction industry for your evaluation.

You can choose 1 out of 6 options below: 1 - Not at all; 2 - Slightly; 3 - Moderate; 4 - Significant; 5; Extreme; 6 - I don't know

Mức độ ảnh hưởng của các nhân tố liên quan đến chủ đầu tư dự án (The impact levels of factors related to project owners)

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	1 - Không chút nào (1 - Not at all)	2 - Nhỏ (2 - Slightly)	3 - Vừa phải (3 - Moderate)	4 - Lớn (4 - Significant)	5 - Nghiêm trọng (5 - Extreme)	6 - Tôi không rõ (6 - I don't know)
Chủ đầu tư chậm trễ trong việc lựa chọn bên nhận thầu và trao thầu. (The owner is behind schedule in selecting the contractors and awarding the contracts.)						
Chủ đầu tư chậm trễ thẩm định, phê duyệt dự án. (The owner is behind schedule in project appraisal and approval.)						
Chủ đầu tư chậm bàn giao mặt bằng cho nhà thầu. (The owner is behind schedule in handing over the site to the contractor.)						
Chủ đầu tư gặp khó khăn để đảm bảo nguồn vốn cho dự án. (The owner has difficulty securing the funding for the project.)						
Chủ đầu tư chậm tạm ứng, thanh toán cho bên nhà thầu thi công/tư vấn. (The owner is						

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behind schedule in making agreed payments in construction.)						
Chủ đầu tư thay đổi yêu cầu trong quá trình triển khai dự án. (The owner changes the requirements during project execution process.)						

Mức độ ảnh hưởng của các nhân tố liên quan đến nhà thầu thi công (The impact levels of factors related to the construction contractors)

	1 - Không chút nào (1 - Not at all)	2 - Nhỏ (2 - Slightly)	3 - Vừa phải (3 - Moderate)	4 - Lớn (4 - Significant)	5 - Nghiêm trọng (5 - Extreme)	6 - Tôi không rõ (6 - I don't know)
Nhà thầu thiếu kinh nghiệm thi công. (Contractors lack experience.)						
Nhà thầu gặp khó khăn về tài chính trong quá trình thi công. (Contractors encounter financial difficulties during the construction process.)						
Phương pháp thi công không phù hợp. (Construction						

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method is not suitable.)						
Lập và quản lý kế hoạch xây dựng không tốt. (Poor construction planning and management)						
Quản lý và giám sát công trường của nội bộ nhà thầu không tốt. (The contractor's internal construction site management and supervision are not good.)						
Việc điều động máy móc, thiết bị thi công đến công trường bị chậm trễ. (The mobilization of construction machinery and equipment to the construction site is behind schedule.)						
Chất lượng máy móc, thiết bị thi công kém. (Quality of construction machinery and equipment is poor)						
Năng suất lao động thấp (Low labor productivity)						
Thiếu hụt lao động (Labor shortage)						
Công tác cung ứng vật liệu của nhà thầu không tốt. (The						

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contractor's materials supply logistics is not good)						
Sai sót trong quá trình thi công dẫn đến phải làm lại. (Construction rework due to mistakes or errors.)						
Xảy ra tai nạn trên công trường thi công. (Accidents occurred at the construction site)						
Nhà thầu phụ không đủ năng lực. (Subcontractors lack competency.)						

Mức độ ảnh hưởng của các nhân tố liên quan đến tư vấn giám sát thi công (The impact levels of factors related to the construction supervision consultants)

	1 - Không chút nào (1 - Not at all)	2 - Nhỏ (2 - Slightly)	3 - Vừa phải (3 - Moderate)	4 - Lớn (4 - Significant)	5 - Nghiêm trọng (5 - Extreme)	6 - Tôi không rõ (6 - I don't know)
Tư vấn giám sát thi công thiếu kinh nghiệm. (Construction supervision consultants lack experience.)						
Tư vấn giám sát thi công chưa kiểm tra, giám sát tốt quá trình thi công. (Construction supervision consultants do						

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not properly inspect or supervise the construction works.)						
Tư vấn giám sát thi công chậm nghiệm thu khối lượng công việc của nhà thầu. (Construction supervision consultants are behind schedule in accepting contractors' construction work.)						
Tư vấn giám sát thi công không bố trí đủ nhân lực khi giám sát thi công dự án. (Construction supervision consultants do not allocate enough human resources when supervising project construction.)						

Mức độ ảnh hưởng của các nhân tố liên quan đến tư vấn thiết kế (The impact levels of factors related to the design consultants)

	1 - Không chút nào (1 - Not at all)	2 - Nhỏ (2 - Slightly)	3 - Vừa phải (3 - Moderate)	4 - Lớn (4 - Significant)	5 - Nghiêm trọng (5 - Extreme)	6 - Tôi không rõ (6 - I don't know)
Tư vấn thiết kế thiếu kinh nghiệm. (Designers lack experience)						

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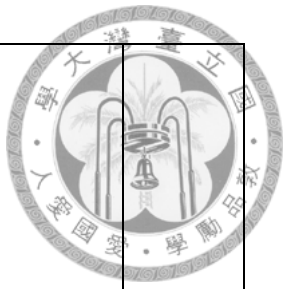

Tư vấn thiết kế chưa khảo sát và thu thập dữ liệu đầy đủ trước khi thiết kế. (The design consultant do not fully survey and collect data before designing)						
Bản thiết kế không rõ ràng, thiếu chi tiết, hoặc bị lỗi (The design is unclear, lacking details, or has errors.)						

Mức độ ảnh hưởng của các nhân tố liên quan đến cơ quan quản lý nhà nước có liên quan đến dự án (The impact levels of factors related to the state management agencies involved in the projects)

	1 - Không chút nào (1 - Not at all)	2 - Nhỏ (2 - Slightly)	3 - Vừa phải (3 - Moderate)	4 - Lớn (4 - Significant)	5 - Nghiêm trọng (5 - Extreme)	6 - Tôi không rõ (6 - I don't know)
Thay đổi luật lệ, cơ chế chính sách (Changes in government regulations and laws)						
Chậm trễ trong các quy trình với cơ quan quản lý nhà nước như vấn đề phòng cháy chữa cháy, đánh giá tác động môi trường, quyền sử dụng đất, phê duyệt thiết kế, phê duyệt dự án (Delays in						

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processes with state management agencies such as fire prevention and fighting issues, environmental impact assessment, land use rights, design approval, project approval)						

Mức độ ảnh hưởng của các nhân tố nào liên quan đến nhiều bên hữu quan của dự án (The impact levels of factors related to many project stakeholders)

	1 - Không chút nào (1 - Not at all)	2 - Nhỏ (2 - Slightly)	3 - Vừa phải (3 - Moderate)	4 - Lớn (4 - Significant)	5 - Nghiêm trọng (5 - Extreme)	6 - Tôi không rõ (6 - I don't know)
Giao tiếp kém giữa các bên hữu quan của dự án (Poor communication between project stakeholders)						
Mâu thuẫn giữa các bên hữu quan của dự án (Conflicts between project stakeholders)						
Vấn đề liên quan đến hợp đồng: thiếu nhất quán giữa các phần của hợp đồng, không đề cập tiêu chuẩn, quy chuẩn cần thiết... (Contract-related issues: lack of consistency between contract parts, not mentioning necessary						

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standards, specifications...)						

Mức độ ảnh hưởng của các nhân tố khách quan bên ngoài khác (The impact levels of other external objective factors)

	1 - Không chút nào (1 - Not at all)	2 - Nhỏ (2 - Slightly)	3 - Vừa phải (3 - Moderate)	4 - Lớn (4 - Significant)	5 - Nghiêm trọng (5 - Extreme)	6 - Tôi không rõ (6 - I don't know)
Điều kiện thời tiết, địa chất, thủy văn, thủy triều không thuận lợi (Unfavorable weather, geological, hydrological and tidal conditions)						
Thảm họa thiên nhiên (Natural disaster)						
Điều kiện chung trên thị trường không thuận lợi: ví dụ giá thép tăng cao, thiếu hụt mỏ cát... (General market conditions are not favorable: for example, rising steel prices, shortage of construction sand mines...)						
Khủng hoảng/suy thoái kinh tế toàn cầu hoặc khu vực (Global or regional economic crisis/recession)						
Nơi đặt dự án có điều kiện kinh tế/chính trị/văn hóa không thuận lợi (The project location has unfavorable economic/political/cultural conditions)						
Chiến tranh, xung đột (Wars, conflicts)						

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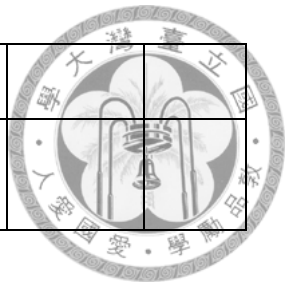
Dịch bệnh (Diseases pandemic)					
Ảnh hưởng từ các dự án lân cận (Influence from neighboring projects)					



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