Significant Factors Causing Delay in the Cambodian Construction Industry

Faham Tahmasebinia 1,* and Vicheth Song 2

1 School of Civil Engineering, The University of Sydney, Sydney, NSW 2008, Australia
2 School of Built Environment, The University of New South Wales, Sydney, NSW 2052, Australia; v.song@student.unsw.edu.au
* Correspondence: faham.tahmasebinia@sydney.edu.au

Abstract: The construction sector is one of the essential sectors in the world; it aids in developing all the countries in the world because it is the foundation of other industries. However, delays in construction projects are a common issue that has been found in all global construction projects. This research aims to understand the issues that lead to construction project delay, ranking the ten most significant causes of construction delay and providing instructive recommendations to overcome the discussed issue in the construction sector. The first ten substantial delay factors are poor planning and scheduling, late delivery of material, change of scope by owners during the construction phase, poor site management and supervision, insufficient finances of contractors or sub-contractors, lack of experience of the contractor’s team, delay due to design error, low productivity of labor, delay in process payment by the owner, and delay in the decision making of the owners and consultants. Subsequently, it was discovered that the contractors, consultants, and owners must cooperate and collaborate in all aspects to improve the construction industry.

Keywords: time overrun; delay factors; Cambodia; construction projects; relative importance index

1. Introduction

The construction sector is one of the indispensable sectors in the world which aids in the development of all the countries in the world. Without this sector, the world would have a different image today as it is the foundation of other industries [1]. It helps to build buildings for people to work and live in and roads for transportation, as well as dams to generate electricity. According to Deloitte 2019, the construction industry’s total income equals over USD 1.3 trillion, indicating a rise of 10% from 2017. This enormous amount of income has contributed to enhancing the world economy.

However, delays in construction projects are a common issue that has been found in all global construction projects [2]. Kikwasi [3] presents the cause and effect of the time invested in construction in Tanzania. Another study in Qatar found that 72% of public construction failed to complete the projects before the timeline between 2000 and 2013 [4]. These two studies above indicate the delays in construction projects which are demanding for both developed and developing countries. Notably, the overall project budget will increase due to the construction delay [5]. This is because the extra money will be spent on labor, equipment, and other aspects.

Cambodia is one of the countries that would fall into this category because this country experienced war in late 1970, leading to a lack of experience and slow improvement in the construction field.

Furthermore, the construction industry is one of the core elements of Cambodian economic growth. The speed of construction has been increased recently. Around 7% of the economic growth each year is from this sector. In addition, it is expected that approximately one-third of the Cambodian population will have moved into urban areas by 2030 [6], which
means that construction will be needed to meet the demands of the residents. Nonetheless, some construction projects have been closed or delayed. Consequently, it is vital to examine the significant factors causing delays in the Cambodian construction industry and address the solutions to decrease the impacts.

This research will determine the factors causing delays in the Cambodian construction industry and provide the strategies to overcome these challenging problems in order to improve the quality of construction in Cambodia. Thus, the main research question is how we could avoid having a delay in the construction industry, based on controlling the main and key factors.

1.1. Objective

This research aims to provide the following:

- The perception of the issues that lead to the construction project delay.
- A ranking of the ten most significant causes of construction delay.
- Instructive recommendations to overcome the discussed issue in the construction sector.

1.2. Literature Review

Numerous articles have defined the factors that cause the delays in the construction projects. The construction delay argument can be found in several countries, including Malaysia, Portugal, the United States, the United Kingdom, and India. Moreover, the main two articles studied the construction delay in Cambodia; however, they focused on certain particular construction projects. Construction delay is the most common thing that occurs in the construction sector. Firstly, this article will start by discovering the construction delays in other countries before working on the previous report in Cambodia.

1.2.1. Global

A report by Assaf and Al-Hejji [7], studied the cause of delay in large construction projects in Saudi Arabia by collecting the data from three parties: the owners, consultants, and contractors. In the report, a factor was found which was agreed on by all the three parties: the scope change by the owner is the most important factor that leads to construction delay. The other factors were agreed on by two parties. Frimpong et al. [8] also collected the data from owners, consultants, and contractors; however, there were five most influential factors which were agreed on by all the three parties in the Ghana construction industry, which are “monthly payment complications from agencies, poor contractor management, material procurement, poor technical performances, and escalation of material prices”. Assaf and Al-Hejji [7] also pointed out the slightest critical aspects, such as the “effect of social and cultural factors, traffic control and restrictions at the site, accidents during construction, and changes in government regulations”. Finally, the authors stated that contractors and laborers are the leading causes of construction delay from the consultants’ and owners’ perspectives, while the contractors claimed that the owners and consultants are the main causes of a construction delay. Faridi and El-Sayegh [5] agreed with the perspective of the Saudi Arabian owners and consultants. Their study identified that the contractors are the most significant group that causes a delay in the UAE construction industry. They located the first five significant factors in this group. Gunduz et al. [9] also found a similar result. Rao et al. [10], however, partially accepted that the contractor group is the main group causing the delay. Their study only found two factors in the contractor group among the first ten factors, while they recognized three factors in the owner group among the first ten factors which lead to the delay in construction. Those three factors are delay in payment, variations during construction, and slow decision making. Later, Mpofu et al. [11] strongly agreed on two factors that were discovered by Rao, Shekar, Jaiswal, Jain, and Saxena [10]. They recognized that scope change and changes in orders and slowness in the owners’ decision-making processes are the top ten significant factors in construction delays. They also pointed out another factor in the first ten important factors,
which is the unrealistic contract duration imposed by the client. Moreover, this is also known as the first significant factor that leads to construction project delays.

Doloi et al. [12] researched the factors causing delays in Indian construction projects and found several factors, but the research team classed them into seven groups, including sub-standard contract, lack of communication, lack of clarity in the project's scope, improper planning, poor site coordination, inefficient site management, and lack of commitment. In the study, they analyzed and ranked those factors by using the Relative Importance Index analysis method. Gunduz, Nielsen, and Ozdemir [9], Matin [13], Khair et al. [14], and Shrivas and Singla [15] adopted the same analysis method in their studies. With this analysis, the lack of commitment is found to be the number one group that leads to the delay in the Indian construction projects. They said that the cooperation of the projects' stakeholders acts as a robust foundation that leads to the projects' completion. A few years later, this factor was also confirmed by Aziz [16], Bekr [17], Bagaya and Song [18], Durdyev et al. [19], and Alhajri and Alshibani [20].

Bagaya and Song [18] demonstrated the factors that lead to time overrun in the public construction projects of Burkina Faso. In the study, the factors were indicated in three aspects: contractors, consultants, and owners. The authors presented five substantial factors that resulted in time overrun in the public construction projects. These were poor subcontractor performance, slow payments of completed work, equipment availability of the contractor, financial difficulties of the owners, and financial capability of the contractor. This study was a quantitative research method combined with three techniques, such as the frequency, severity, and importance index analysis method. Akogbe et al. [21], Bekr [17], Rao, Shekar, Jaiswal, Jain, and Saxena [10], Santoso and Soeng [22], Chiu and Lai [23], Islam and Suhariadi [24], and Yap et al. [25] adopted similar analysis methods in their study. As the study has used several analysis methods, the authors also used Spearman’s rank correlation coefficient. The suggested tool aimed to reach the accuracy level between two parties [20]. Moreover, the study was compared with other 11 countries, and it was discovered that the contractor’s financial capability was most often the time overrun factors in the other five regions and equaled over 45% among the major five factors.

Kog [26] researched the factors that caused the delay in Iran’s construction projects. It was reported that there are nine main delay factors from fourteen studies presented by the author. Those delay factors are incompetent workforce, subcontractor issues, slow decisions by the owner, projects awarded to the lowest bid price, equipment failure and availability, financing issues of the contractor, inadequate planning and scheduling, inability of the contractor, shortage or late delivery of construction materials, poor site management and supervision, variation of orders or changes of the scope by the owner during construction, and finance and payments of finished work by the owners. Subsequently, Choong Kog [27] carried out another study of the delay factors in construction projects. However, the authors compared the delay factors of three countries, Portugal, the United Kingdom (UK), and the United States (US), by collecting the previous studies reported between 1971 and 2015. It was reported that one of the most common delay factors which can be found among these three countries was the scope creep by the owner during construction. This factor was also determined in the previous studies. While other factors were found between the two countries, these include slow decisions from the owner, ineffective planning and scheduling by contractors, late delivery or shortage of construction materials, unqualified workforce or low-skilled labor, and government and regulation and permit approval. It indicates that the delay factors in both studies were found to be similar. Matin [13] agrees that the additional work during the construction phase would mean taking extra time to complete the work. Amri and Marey-Pérez [28] strongly agreed that a change of scope by the owner is the root cause of the client-related cause leading to the delay in the construction. Moreover, they also supported other factors found in the Kog [26,27] studies.

Mydin et al. [29] conducted a study on the “Assessment of Influential Causes of Construction Project Delay in Malaysian Private Housing from Developer’s Viewpoint”. Ten significant points caused the delay in the Malaysian private housing construction
projects. The weather condition was stated to be the first factor. The main obstacle that prevents a high productivity result in the construction projects is the uncertain weather. It was indicated that there were other factors, such as lack of experience on the part of consultant site staff, incomplete documentation, poor site management by the contractors, poor site condition, and others.

In reported research on the construction delay in petrochemical projects in Saudi Arabia, over 80 people participated in a survey. Over 40% of the respondents had been working for more than ten years. The authors used the Relative Importance Index (RII) to define the most critical factors from 23 factors, precisely the same as the studies mentioned earlier. According to the Frequency Adjusted Importance Index (FAII), the most significant factor that led to delay in the petrochemical construction projects in Saudi Arabia was the late materials or equipment delivery, which resulted in over 50% [20]. Doloi, Sawhney, Iyer, and Rentala [12] strongly supported the finding that the delay in material delivery is the main delay issue. The material shortage results from the miscalculation of the lead time by the seller [12].

Quraishi and Bashir [30] researched factors causing a delay in the oil and gas construction projects by collecting the data resulting from questioning with closed-type questions. The seven most important factors were identified as poor interaction with vendors in the engineering and procurement stage, ineffective communication among project stakeholders, failure to deliver construction materials on time, poor management of the contractors’ schedule, inadequate planning and scheduling of the project by contractors, problems with subcontractors, and poor site management and supervision by contractors. Poor site management was found to be the majority delay factor in the study of Frimpong et al. [8] and Yap, Chow, and Shavarebi [25]. Yap, Chow, and Shavarebi [25] argued that all construction projects need excellent site management because this will contribute to completing construction projects within the different aspects (cost, quality, and time).

Another article, by Ji et al. [31], discussed the delay in the Chinese construction industry. Nonetheless, they only addressed the delay in prefabricated concrete building projects. Twenty-four delay factors were pointed out from several literature reviews. Within those 24 factors, the authors grouped them into seven categories, such as construction techniques (D1), workforce (D2), resources (D3), machinery (D4), clients (D5), contractors (D6), and external conditions (D7). D6, moreover, contains nine delay factors which are the largest factors among the other categories. Based on the research, this D6 is the most influential group leading to the delay in a prefabricated concrete building in Chinese construction projects. Six of the top ten significant delay factors were originally discovered from this group, such as wrong delivery requirements and routes, re-manufacturing due to component damage, poor planning and scheduling, the weak relationship among stakeholders, re-handling components, and incompetent structural connections.

Shrivas and Singla [15] researched the “Factors Causing Delay in Marine Construction Projects in India”. The results of the study indicated results which were similar those of the other studies, which have been discussed before. The authors used the Relative Importance Index method to rank all the factors. After the analysis, the major delay factor causing the delay in the marine construction projects is poor project control. The poor project control was also agreed upon by Assaf and Al-Hejji [7], Doloi, Sawhney, Iyer, and Rentala [12], and Ruqaishi and Bashir [30]. They found out that this factor is one of the first ten potential factors leading to a delay in the construction projects. Furthermore, the authors also mentioned other factors, such as lack of a defined project management plan, lack of proper construction methodology and sequencing, erroneous quantity survey and estimations, lack of contractual clarity, and others.

Chiu and Lai [23] researched a project delay case study in electrical construction in Hong Kong. The authors highlighted and discussed the first ten main causes in the project delay, which are the lack of on-site coordination, poor workmanship and labor skills, lack of communication between parties, reworking due to error, change of client’s orders, the inadequate experience of consultants, the cash-flow problems of the electrical contractor,
insufficient electrical contractors, late decision making of the client, and insufficient labor. Most of the articles above found that the lack of labor is not located among the first ten delay factors; however, it is the primary reason that is causing the delay in Hong Kong construction projects. They claimed that a lack of human resources is a common phenomenon that can be found in Hong Kong. According to the projection, there were 320,000 registered construction laborers but around 70,000 workers were active at the time. This results in low work productivity [23].

Another article has discussed the delay in another construction industry, which is the highway construction projects in Thailand. In the article, eight significant factors out of 26 delay factors were found from ten project managers who had been working for over 20 years. Those eight factors include the shortage of materials, poor site management, lack of traffic safety during construction, delay in relieving the environment impact, shortage of project engineer experience, delay in relocating the existing utility structures, lack of equipment efficiency or financial status of contractors, and incomplete drawings [32]. Four factors from those mentioned above have been found in other articles as well.

Mahamid et al. [33] analyzed the factors causing the delay in the road construction projects in Palestine. The five most influential factors were highlighted: the shortage of equipment, progress payment delay by the owner, the award of the project to the lowest bid price, limited movement between areas, and the political situation. The project payment delay by the owners was strongly agreed upon by Rao, Shekar, Jaiswal, Jain, and Saxena [10]. Moreover, Assaf and Al-Hejji [7], Aziz [16], Gündüz, Nielsen, and Ozdemir [9], Ruqaishi and Bashir [30], Bagaya and Song [18], and Durdyev, Omarov, and Ismail [19] have discovered this point in their studies. Aziz [16] strongly agreed with the progress payment delay. This factor is the first issue leading to the delay in the construction projects in Egypt. Frimpong, Oluwoye, and Crawford [8], Bagaya and Song [18], and Islam and Suhariadi [24] accepted that the selection of the lower bidder was one of the potential factors that caused the time overrun in the construction projects. Mahamid [34] and Alhajri and Alshibani [20], however, were the only researchers who found the political situation in their study, but it was found to be the least identical factor in their studies.

Khair, Mohamed, Mohammad, Farouk, and Ahmed [14] were also the authors who discovered the delay factors in the road construction projects as well. They studied the delay factors in Sudan. The authors identified 66 delay factors, but they grouped them into six categories: external, technical skills, teamworking trust, knowledge competence experience, project management, and financial competence. The “finance competence group” is the most critical group leading to the time overrun in Sudan construction projects. Moreover, five factors come from this finance competence group: the inflation effect on material purchasing, inadequate client finance and payment for completed work, insufficient funds, delays in payment to the contractors, and cash flow problems (irregular payment). Mahamid [35,36], Amoatey and Ankrah [37], Elawi et al. [38], and Alfakhri et al. [39] also discovered similar factors in their studies.

Based on the three articles that discuss road construction projects, it seems that some factors have been found in each study. Khair, Mohamed, Mohammad, Farouk, and Ahmed [14] supported the finding that the progress payment delay by owners in the study of Mahamid, Bruland, and Dmaidi [33] is one of the main issues that leads to the delay in the construction projects that were found in the study. Moreover, they also agreed with Thapanont, Santi, and Pruethipong [32] on the management aspect. They claimed that management is the key to reducing the impact on construction project delays. Thapanont, Santi, and Pruethipong [32] agreed with Mahamid, Bruland, and Dmaidi [33] on the shortage of equipment. Equipment is a crucial item for road work. With a lack of supply and poor condition, the project will result in low productivity, causing a delay in the construction projects [33].

It seems that most of the articles presented three parties contained in the construction sector Bekr [17]; however, the authors included another party in the research: the external factors group. This research discovered “Causes of Delay in Public Construction Projects in Iraq”. This group was found to be the priority factor that caused the delay in the
construction projects. The first three significant factors were in this group, including “security measure, government change of regulations and bureaucracy, and official and non-official holidays”. Nonetheless, the author did not detail any information on the security measure.

1.2.2. Cambodia

The delay in the Cambodian construction industry was discussed before in 2016 and 2017. One of the articles discussed the residential construction projects while another discussed the road construction projects. Durdyev, Omarov, and Ismail [19] explored the delay in residential construction projects. The research contained 48 of 75 responses that are useable as analysis for defining the delay in the residential construction projects. They found 31 delay factors in the study. Two factors that cause the time overrun in residential construction projects are the lack of on-site material and the late delivery of on-site material; these were found to be the first and third factors, respectively. They claimed that Cambodia depends on imported construction materials from the neighboring nations. Moreover, this factor was found in other studies mentioned earlier.

Another article, which reported on “Analysing Delays of Road Construction Projects in Cambodia: Causes and Effects”, was researched by Santoso and Soeng [22]. The research was analyzed from 153 responses. Sixty-four delay factors were identified in the study. Working during the rainy season and flooding were recognized as the most critical issues, leading to the delay in road construction projects. They clarified that Cambodia is a tropical region where it can rain between May and October, leading to low productivity.

These two Cambodian studies focus on the specific field of study; one focuses on road construction projects while the other focuses on residential construction projects.

1.2.3. Summary

The delay in the construction sector is a common event that occurs in the world, for both the developing and the developed countries. Moreover, construction project delays can be found in different construction environments, such as residential, building, road, petrochemical, and marine construction projects. Moreover, this also includes the pre-fabrication construction projects as well. The author notices that there are some common factors in the literature studies. Table 1 will indicate the common delay factors among the first ten found in the abovementioned studies, and Table 2 will indicate some of the studies’ analysis methods.

From Table 1, six common factors have been found among the first ten significant factors, such as inadequate planning and scheduling, poor site management and supervision, delay in payment by the owner, variation of orders or scope changes by the owner, financial constraints of contractors, and delay in material delivery. Furthermore, five of the six factors are discovered in Cambodian construction projects, except that the contractors’ financial constraint is the only factor that is not identified in Cambodian construction projects. Weather conditions are not the root cause of the delay in construction projects; however, this issue is in the first ten significant factors in two Cambodian studies and a Malaysian case study. Based on the geography, both countries are located in Southeast Asia, where there is a tropical climate that experiences only rainy and dry seasons. Consequently, the tropical weather country could experience a time overrun due to the rain.
Table 1. The Delay Factor Among the First Ten of Each Study.

| Factor | Case Study | Location | Authors/References |
|--------|------------|----------|-------------------|
| Delay in material delivery by vendors | Construction projects, Petrochemical, Oil and Gas industry, Prefabricated concrete, Residential construction projects | India, Iran, Saudi Arabia, Oman and GCC, Cambodia, China, UAE | Doloi et al. (2011), Kog (2017), Alhajri and Alshibani (2018), Ruqaishi and Bashir (2015), Ji et al. (2018), Durdyev, Omarov, and Ismail (2017), Faridi and El-Sayegh (2007) |
| Non-availability of drawing/design on time | Construction projects, Marine, Highway construction projects | Benin, India, Thailand, UAE, UK, USA, Portugal | Doloi et al. (2011), Hrivas and Ingla (2018), Thapanont, Santi, and Pruethipong (2018), Faridi and El-Sayegh (2007), Akogbe, Feng, and Zhou (2012), Kog (2018) |
| Financial constraints of contractor | Construction projects, Public, Groundwater, Electrical, Road, Highway construction projects | Benin, India, Burkina Faso, Ghana, Malaysia, Hong Kong, Sudan, Thailand, UAE | Doloi et al. (2011), Bagaya and Song (2016), Mydin et al. (2014), Chiu and Lai (2017), Khair et al. (2017), Thapanont, Santi, and Pruethipong (2018), Faridi and El-Sayegh (2007), Frimpong, Oluwoye, and Crawford (2002), Akogbe, Feng, and Zhou (2012) |
| Increase in scope of work/variation orders/scope changes | Construction projects, Private housing, Petrochemical, Electrical, Residential construction projects | Benin, Cambodia, India, Iran, Malaysia, Saudi Arabia, Hong Kong, UK, USA, Portugal | Doloi et al. (2011), Kog (2017), Mydin et al. (2014), Alhajri and Alshibani (2018), Chiu and Lai (2017), Durdyev, Omarov and Ismail (2017), Akogbe, Feng and Zhou (2012), Kog (2018) |
| Obtaining permission from local authorities | Construction projects | Benin, India, UAE | Doloi et al. (2011), Faridi and El-Sayegh (2007), Bagaya and Song (2016), Mahamid, Brulan, and Dmaidi (2012), Thapanont, Santi, and Pruethipong (2018), Aziz (2013), Akogbe, Feng, and Zhou (2012) |
| Equipment availability | Construction projects, Public, Road, Highway construction projects | Benin, Burkina Faso, Palestine, Thailand | Bagaya and Song (2016), Kog (2017), Mahamid, Brulan, and Dmaidi (2012), Khair et al. (2017), Santoso and Soeng (2016), Aziz (2013), Frimpong, Oluwoye, and Crawford (2002), Kog (2018) |
| Delay in payment | Groundwater, Public, Road construction projects | Burkina Faso, Cambodia, Ghana, Iran, Palestine, Sudan, UK, Portugal | Bagaya and Song (2016), Ruqaishi and Bashir (2015), Akogbe, Feng, and Zhou (2012) |
| Poor subcontractor performance | Construction projects, Public, Oil and Gas industry, Road construction projects | Benin, Burkina Faso, Oman and GCC | Bagaya and Song (2016), Ruqaishi and Bashir (2015), Akogbe, Feng, and Zhou (2012) |
| Factor                          | Case Study                                                                 | Location                                                                                       | Authors/References                                                                 |
|--------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Inadequate planning and scheduling | Construction projects, Groundwater, Public, Petrochemical, Oil and Gas industry, Prefabricated concrete, Marine, Road, Residential construction projects | Benin, Burkina Faso, Cambodia, Ghana, Iran, Saudi Arabia, Oman and GCC, China, India, Sudan, UAE, UK, Portugal | Bagaya and Song (2016), Kog (2017), Alhajri and Alshibani (2018), Ruqaishi and Bashir (2015), Ji et al. (2018), Hrivas and Ingla (2018), Khair et al. (2017), Durdyev, Omarov, and Ismail (2017), Aziz (2013), Faridi and El-Sayegh (2007), Frimpong, Oluwoye, and Crawford (2002), Akogbe, Feng, and Zhou (2012), Kog (2018) |
| Poor site management and supervision | Construction projects, Private housing, Petrochemical, Oil and Gas industry, Road, Highway construction projects | Iran, Malaysia, Saudi Arabia, Oman and GCC, India, Sudan, Thailand, Cambodia, UAE | Kog (2017), Mydin et al. (2014), Alhajri and Alshibani (2018), Ruqaishi and Bashir (2015), Hrivas and Ingla (2018), Khair et al. (2017), Thapanont, Santi, and Pruehipong (2018), Santoso and Soeng (2016), Aziz (2013), Faridi, and El-Sayegh (2007) |
| Inadequate contractor experience | Construction projects, Highway, Residential, Road construction projects | Cambodia, Iran, Thailand | Kog (2017), Thapanont, Santi, and Pruehipong (2018), Durdyev, Omarov, and Ismail (2017), Santoso and Soeng (2016), Aziz (2013) |
| Weather condition               | Groundwater, Private housing, Road construction projects | Cambodia, Ghana, Malaysia | Mydin et al. (2014), Durdyev, Omarov, and Ismail (2017), Santoso and Soeng (2016), Frimpong, Oluwoye, and Crawford (2002) |
| Slow decision making by the owner | Petrochemical, Electrical construction projects | Saudi Arabia, Hong Kong, UK, Portugal | Chiu and Lai (2017), Durdyev, Omarov, and Ismail (2017), Santoso and Soeng (2016) |
| Labor Shortage                 | Construction projects Electrical, Residential construction projects | Cambodia, Hong Kong, UAE | Chiu and Lai (2017), Durdyev, Omarov, and Ismail (2017), Faridi, and El-Sayegh (2007), Mahamid, Brulan, and Dmaidi (2012) |
| Political situation            | Road construction projects | Palestine | Khair et al. (2017), Frimpong, Oluwoye, and Crawford (2002) |
| Inflation effect on material purchasing | Groundwater, Road construction projects | Sudan, Ghana | Aziz (2013) |
| Rework due to errors           | Construction projects | Egypt | Frimpong, Oluwoye, and Crawford (2002) |
| Poor contract management       | Groundwater construction projects | Ghana | Frimpong, Oluwoye, and Crawford (2002) |
Table 2. Analysis Methods Based on Each Study.

| Analysis Method                          | Study Area   | Authors/References       |
|-----------------------------------------|--------------|--------------------------|
| Frequency, Severity, and Importance Index | Saudi Arabia | Assaf and Al-Hejji (2005) |
| Relative Importance Index               | UAE          | Faridi and El-Sayegh (2007) |
| Relative Importance Index               | India        | Dolio et al. (2011)      |
| Severity Index                          | Palestine    | Mahamid, Bruland, and Dmaidi (2012) |
| Frequency, Severity, and Importance Index | Benin        | Akogbe, Feng, and Zhou (2012) |
| Relative Importance Index               | Egypt        | Aziz (2013)              |
| Frequency, Severity, and Importance Index | Iraq         | Bekr (2015)              |
| Frequency, Severity, and Importance Index | Burkina Faso | Bagaya and Song (2016)   |
| Relative Importance Index               | Iran         | Matin (2016)             |
| Frequency, Severity, and Importance Index | Cambodia    | Santosso and Soeng (2016) |
| Relative Importance Index               | Cambodia     | Durdyev, Omarov, and Ismail (2017) |
| Frequency, Severity, and Importance Index | Sudan       | Khair et al. (2017)      |
| Frequency, Severity, and Importance Index | Bangladesh  | Islam and Suhariadi (2018) |
| Frequency, Severity, and Importance Index | Malaysia    | Yap, Chow, and Shavarebi (2019) |

2. Materials and Methods

2.1. Research Methodology

Figure 1 clearly illustrates the relevant research methodology.

This research is used as a mixed approach research method. Mixed methods research is a combination of both quantitative and qualitative research. Qualitative research explores the study’s problems in-depth because it obtains ideas based on the participant’s experience. On the other hand, quantitative research involves collecting the variables and measures with statistical analysis [40]. However, this research mainly focuses on qualitative research rather than qualitative research because the study’s objective is to identify the ten most significant factors causing a delay in the Cambodian construction industry. To rank the factors, numbered data are needed to analyze them. The online survey is conducted to obtain information and data from participants to process this method.

The questionnaires were conducted according to the various factors found in the literature reviews to accomplish the research’s aim and objectives. Before the survey questionnaires were published for the participants, these questionnaires were submitted to the University of New South Wales Ethics Research Department for approval first to ensure that they met the research standards. To obtain a good quality result for the research, there is inclusion and exclusion of the participants involved in the survey questionnaires. This research invites only those who have a construction and architecture background and are working in the Cambodian construction industry and the construction project owners. This is because this research study focuses on the Cambodian construction industry. Those who have not been working in this country are not qualified to take part in the survey.
Based on the literature reviews, it also shows that each study identified different factors. Some found these factors to be the most significant factors, while others found the same factors but as the least important factors in the study. So, this research set up a focus group to be involved in the survey to obtain an enhanced and accurate result.

2.2. Data Collection

This research used the online survey on the Qualtrics platform to collect data from the participants. It mainly focuses on the Cambodian construction industry and, due to COVID-19, there is a travel restriction, which means the online survey becomes the best and most efficient platform to obtain the data. Furthermore, the online survey is one of the survey platforms that could obtain an enormous number of practitioners involved in the survey. Moreover, using this technique, there are some benefits, such as cost-saving and time [41].

The survey questionnaires were divided into two parts. Firstly, some questions ask the participants about their educational background, work experiences, work position, and current working projects. The second part of the questionnaires asks participants to identify ten delay factors, rank the ten selected factors from the previous question, and discuss the questions on which the participants can discuss their opinion. Moreover, the online survey questionnaire comes with the UNSW Online Participant Information consent form, including Term and Conditions.

There were three sampling methods used in the research to collect the data. Firstly, this research used the convenience sample method. It is a sampling method that the researcher uses to collect the data from the people who are conveniently involved in the research [42]. The invitation letters were sent to the known participants to be involved in the survey. This invitation letter comes with the survey link with which the participants will go directly to the online survey platform by clicking on that link. Secondly, the snowball sample method was used. The snowball sampling method is also known as the chain sampling method, in which the researcher asks the participants involved in the survey to invite others to join the survey [43]. The author asked the participants who were surveyed to share these online survey questionnaires with their colleagues and others working in the construction industry in order for them to be involved in the survey. Lastly, the anonymous link and the description of the research purpose were posted to the Cambodian construction group on social media to invite other construction staff to participate in the survey.

As there was a short period to conduct this research, the survey distribution was set within 3 weeks to collect the data. The data collection was closed after this period. A reminder of the online survey was also re-posted and sent to participants to remind them to participate in the survey. During the first phase of data collection, there were two issues. The first issue was the language. According to English First [44], Cambodia’s English Proficiency Index ranks 84th in 100 countries, with an English Proficiency Index score of 435, and is considered “very low”. However, the author spent time explaining the survey to the participants and told them that if there were other issues, the participants could contact back at any time to resolve all those issues. Secondly, the author noticed a low return rate and uncompleted and unacceptable results. A combination of sending reminders and explaining was used, which became the best strategy for overcoming this problem. As a result, this research obtained more complete and accurate results from them.

2.3. Data Analysis

The data were recorded in the excel worksheet when the data collection was completed three weeks after being published. The data were recorded based on each question from the participants involved in the online survey on the Qualtrics online survey platform. There were 100 responses involved in the survey, but 44 responses were useable or completed.

The statistical method was used to analyze the data for this research study. In this case, the excel worksheet aids to identify the complete and incomplete responses to analyze.
Incomplete responses were not used in the data analysis because they missed the study’s critical point, which was the ranking question. The study’s objective was to identify the ten significant factors causing the delay in the Cambodian construction industry. One of the questions is a Likert scale with ten options for participants to choose from, where 1 is the most important and 10 is the least important. The result will be used in the statistical analysis for analyzing the data.

The qualitative analysis is also used in the research to observe the participants’ opinions, which helps the researchers understand the factors clearly and deeply. However, 8 responses answered “Yes” and described it. The responses will be used to support the factors and their rank, which is found in the quantitative analysis.

This study will use the following analysis to measure and identify the rank.

2.3.1. Relative Importance Index

The Relative Importance Index (RII) analysis method identifies the importance of each factor based on the RII result [10]. The higher value of RII means that it is the most critical factor, while the lower value of RII means that it is a minor critical factor in the result [15]. Moreover, it is one of the common methods which have been used in ranking-factors research [9]. Moreover, the researchers did not use the standard deviation and mean value because it is not fitting for determining the rankings and reflecting their relationship [12].

The following is the formula used to determine it:

\[
RII = \frac{\sum W}{A \times N} \tag{1}
\]

where

- \( W \): Weight is given by each respondent; it ranges from 1 to 10 (where 1 is the most important and 10 is the least important in this case);
- \( N \): Total number of respondents;
- \( A \): The highest weight (10 is the highest weight in this case).

2.3.2. Spearman’s Rank Correlation

Spearman’s Rank Correlation is used to identify the strength between two parties [5]. It was also used to determine the level of agreement between the parties [19]. The Spearman’s Rank Correlation value ranges from \(-1\) to \(+1\), where \(-1\) means a disagreement and \(+1\) means an agreement [20].

The following is the formula used to determine it:

\[
rs = 1 - \frac{6 \sum d^2}{(N^3 - N)} \tag{2}
\]

where:

- \( rs \): Spearman rank correlation coefficient;
- \( d \): Difference in ranking between two parties;
- \( N \): Number of samples.

2.3.3. Thematic Analysis

The qualitative approach was used to obtain further information from the participants’ opinions and the experiences that they have had in their working lives. This could help the audiences clearly understand the factors. Thematic analysis is a part of the qualitative analysis method used to identify and analyze the data.

In this study, the discussion questions were included at the end of the survey questionnaire to obtain their opinions and the reasons behind their choosing of the factors. In addition, these discussion questions came with two options for the participants to choose whether they would like to express their ideas or not.
Later, the results of this analysis will be used to support the relative importance index’s result in the discussion section.

3. Results

Tables 3 and 4 indicate the questionnaire’s variables and the factors list and its code, which will be used later in the research.

Table 3. Identification of Variables.

| Code | Variable                                      |
|------|----------------------------------------------|
| A1   | Educational Background                       |
| A2   | Work Experience                             |
| A3   | Job Position                                 |
| A4   | Project Type                                 |
| B1   | Experienced in Construction Delay            |
| D1   | Discuss Selected Factors                     |
| D2   | Discuss Reason for Ranking Factor            |
| D3   | Recommendation                               |

Table 4. Identification of Factors.

| Code | List of Factors                                      |
|------|-----------------------------------------------------|
| C1   | Accident in site                                    |
| C2   | Additional work/requirements                        |
| C3   | Change of scope by owners during the construction phase |
| C4   | Conflict among the workers or colleagues            |
| C5   | Delay due to subcontractors                         |
| C6   | Delay in decision making of the owner or consultant  |
| C7   | Delay in inspection and test                        |
| C8   | Delay in process payment by the owner               |
| C9   | Delay in sample testing                             |
| C10  | Delay due to design error                           |
| C11  | Delay due to problems with the local community       |
| C12  | Difficulties in obtaining work permits from the authorities |
| C13  | Equipment breaks down                               |
| C14  | Government and political issues related to the construction |
| C15  | Hot weather effect on the work field                |
| C16  | Insufficient finances of contractors/sub-contractor  |
| C17  | Lack of labor                                       |
| C18  | Lack of skilled labor                               |
| C19  | Lack of experience of the contractor’s team          |
| C20  | Lack of communication/cooperation among the stakeholders |
| C21  | Late delivery of material                           |
| C22  | Late in approving a design and document related to work |
| C23  | Late submitting documents/reports of the            |
| C24  | contractor/sub-contractor to the owner/consultant    |
| C25  | Low efficiency of the equipment                     |
| C26  | Low productivity of labor                           |
| C27  | Poor site management and supervision                |
| C28  | Poor planning and scheduling                        |
| C29  | Public holiday                                      |
| C30  | Project complexity                                  |
| C31  | Rework due to work errors                           |
| C32  | Rework due to low-quality work                      |
Table 4. Cont.

| Code | List of Factors                      |
|------|--------------------------------------|
| C33  | Shortage of material on site         |
| C34  | Shortage of equipment                |
| C35  | Time loss due to traffic jam         |
| C36  | Unexpected geological conditions     |

As stated in the Data Analysis section, 44 responses were usable for analysis. Table 5 indicates the result of the participants’ background information involved in the survey questionnaire, and it also indicates the result related to the delay in the Cambodian construction industry. First is the educational background information. Those who hold a bachelor’s degree were the largest group in the educational information who participated in the survey, which equals 38 responses or 86%. Those who hold a master’s degree represented 14%. Ph.D. degrees and high school graduates were not found in the survey. The second is the work experience category. Those who participated in the survey who had been working for less than 2 years and between 2–5 years were 14% and 52%, respectively. The participants who had worked between 5–10 years and more than 10 years were 11% and 23%, respectively. As a result, the participants who had worked between 2–5 years are an enormous group in the category, followed by those working for more than 10 years. The third is the job position information. The largest group in this category comprises those working as site engineers, which equals 27%. The second largest group comprises those working as structural engineers, which equals 20% of the result. Fourteen percent of the participants are working as project managers. The combination of the other five roles, such as safety engineer, site manager, quantity surveyor, cost estimator, and architect, is 25%. Fourteen percent, or six participants, had other job positions such as project executive, assistant of resident engineer, secretary, materials engineer, road design engineer, and site inspector.

Table 5. Frequency Data of Participants’ Information.

| Code   | Variable               | Sub-Variable           | Frequency | Valid Percent | Cumulative Percent |
|--------|------------------------|------------------------|-----------|---------------|--------------------|
|        | A1 Educational Background | High School Graduate | 0         | 0%            | 0%                 |
|        |                        | Bachelor’s Degree      | 38        | 86%           | 86%                |
|        |                        | Master’s Degree        | 6         | 14%           | 100%               |
|        |                        | Ph.D. Degree           | 0         | 0%            | 100%               |
|        |                        | Other                  | 0         | 0%            | 100%               |
|        | A2 Work Experience     | Less than 2 years      | 6         | 14%           | 14%                |
|        |                        | Between 2–5 years      | 23        | 52%           | 66%                |
|        |                        | Between 5–10 years     | 5         | 11%           | 77%                |
|        |                        | More than 10 years     | 10        | 23%           | 100%               |
|        | A3 Job Position        | Site Engineer          | 12        | 27%           | 27%                |
|        |                        | Safety Engineer        | 1         | 2%            | 30%                |
|        |                        | Site Manager           | 4         | 9%            | 39%                |
|        |                        | Quantity Surveyor      | 3         | 7%            | 45%                |
|        |                        | Cost Estimator         | 1         | 2%            | 48%                |
|        |                        | Schedule Estimator     | 0         | 0%            | 48%                |
|        |                        | Architect              | 2         | 5%            | 52%                |
|        |                        | Structural Engineer    | 9         | 20%           | 73%                |
|        |                        | Project Manager        | 6         | 14%           | 86%                |
|        |                        | Other                  | 6         | 14%           | 100%               |
Table 5. Cont.

| Code | Variable       | Sub-Variable         | Frequency | Valid Percent | Cumulative Percent |
|------|----------------|----------------------|-----------|---------------|--------------------|
| A4   | Project Type   | Residential Project  | 8         | 18%           | 18%                |
|      |                | Medium-Rise Building | 4         | 9%            | 27%                |
|      |                | High-Rise Building   | 11        | 25%           | 52%                |
|      |                | Road Construction    | 14        | 32%           | 84%                |
|      |                | Bridge Construction  | 2         | 5%            | 89%                |
|      |                | Dam Construction     | 0         | 0%            | 89%                |
|      |                | Other                | 5         | 11%           | 100%               |

However, a schedule estimator was not found in the study. The last category under the participants’ background information is their current project. The results of residential, medium-rise building, and high-rise building projects are 18%, 9%, and 25%, respectively. Thirty-two percent of the result comes from those who were working on the road project. Only 5% of those who were selected who were working on the bridge project. Eleven percent, or five participants, were working on other projects. However, the dam project was not found in the study. Hence, it could be a complete result because of the responses received from different areas, which were valuable results for this research.

Figure 2 indicates the construction delay rate of the participants. Seventy-five percent of the participants had experienced construction project delays, 25% of the participants had not experienced construction project delays during their work. This shows that construction delay in Cambodia is a common issue.

Figure 2. Construction Delay Rate.

There were 36 delay factors that were identified for the participants to choose. Figure 3 illustrates the frequency results of the top most selected factors by percentage. Poor planning and scheduling are the most common factors that were selected by the participants. Sixty-six percent of the participants usually experience this issue. Sixty-one percent and 55% of the participants experience late delivery of material and change of scope by the owners during the construction phase, respectively. Thirty-nine percent of the participants experience delay due to design error, delay in process payment by the owner, and rain effect on the work field. Hence, this figure shows the most frequently selected factors that the participants are usually involved with during their work, but it does not mean the factors that the participants usually experience will be the critical factors that lead to the delay in the Cambodian construction projects. The ten most significant factors will be shown in Table 7.
There were 36 delay factors that were identified for the participants to choose. Figure 3 illustrates the frequency results of the top most selected factors by percentage. Poor planning and scheduling are the most common factors that were selected by the participants. Sixty-six percent of the participants usually experience this issue. Sixty-one percent and 55% of the participants experience late delivery of material and change of scope by the owners during the construction phase, respectively. Thirty-nine percent of the participants experience delay due to design error, delay in process payment by the owner, and rain effect on the work field. Hence, this figure shows the most frequently selected factors that the participants are usually involved with during their work, but it does not mean the factors that the participants usually experience will be the critical factors that lead to the delay in the Cambodian construction projects. The ten most significant factors will be shown in Table 7.

Figure 3. Frequency of the Ten Most Selected Factors.

3.1. Relative Importance Index Result

Table 6 indicates the result of the RII analysis and its rank of each factor. The highest RII value is 0.48864, while the lowest RII value is 0.00909. The most significant delay factor in the Cambodian construction industry is poor planning and scheduling (C27), followed by late delivery of material (C21), change of scope by owners during the construction (C3), poor site management and supervision (C26), insufficient finances of contractors/sub-contractors (C16), lack of experience of the contractor’s team (C19), delay due to design error (C10), low productivity of labor (C25), delay in process payment by the owner (C8), and delay in decision making of the owners or consultants (C6). Table 7 illustrates the ten most significant delay factors in rank order and their RII values.

Table 6. Relative Importance Index and Rank of The Delay Factors.

| Code | List of Factors                                                                 | Overall RII | Rank |
|------|--------------------------------------------------------------------------------|-------------|------|
| C1   | Accident on site                                                              | 0.07955     | 26   |
| C2   | Additional work/requirements                                                   | 0.15682     | 15   |
| C3   | Change of scope by owners during the construction phase                       | 0.36136     | 3    |
| C4   | Conflict among the workers or colleagues                                      | 0.03636     | 32   |
| C5   | Delay due to subcontractors                                                    | 0.17500     | 11   |
| C6   | Delay in decision making of the owner or consultant                            | 0.17955     | 10   |
| C7   | Delay in inspection and test                                                   | 0.10227     | 23   |
| C8   | Delay in process payment by the owner                                          | 0.18864     | 9    |
| C9   | Delay in sample testing                                                       | 0.06818     | 27   |
| C10  | Delay due to design error                                                      | 0.26136     | 7    |
| C11  | Delay due to problems with the local community                                | 0.03636     | 32   |
| C12  | Difficulties in obtaining work permits from the authorities                   | 0.00909     | 36   |
| C13  | Equipment breaks down                                                         | 0.17045     | 13   |
| C14  | Government and political issues related to the construction                   | 0.03864     | 31   |
| C15  | Hot weather effect on the work field                                          | 0.02500     | 34   |
| C16  | Insufficient financial of contractors/sub-contractor                           | 0.27955     | 5    |
| C17  | Lack of labor                                                                 | 0.12045     | 22   |
| C18  | Lack of skilled labor                                                         | 0.17273     | 12   |
| C19  | Lack of experience of the contractor’s team                                   | 0.26818     | 6    |
| C20  | Lack of communication/cooperation among the stakeholders                      | 0.06136     | 29   |
| C21  | Late delivery of material                                                      | 0.37727     | 2    |
| C22  | Late in approving a design and document related to work                       | 0.12727     | 21   |
Table 6. Cont.

| Code | List of Factors                                                                 | Overall |
|------|-------------------------------------------------------------------------------|---------|
|      |                                                                               | RII     | Rank   |
| C23  | Late submitting documents/reports of the contractor/sub-contractor to the owner/consultant | 0.08182 | 25     |
| C24  | Low efficiency of the equipment                                               | 0.08409 | 24     |
| C25  | Low productivity of labor                                                     | 0.20909 | 8      |
| C26  | Poor site management and supervision                                          | 0.35682 | 4      |
| C27  | Poor planning and scheduling                                                  | 0.48864 | 1      |
| C28  | Public holiday                                                                | 0.13864 | 17     |
| C29  | Project complexity                                                            | 0.06364 | 28     |
| C30  | Rain effect on the work field                                                 | 0.13409 | 18     |
| C31  | Rework due to errors                                                          | 0.16818 | 14     |
| C32  | Rework due to low-quality work                                                 | 0.12955 | 20     |
| C33  | Shortage of material on site                                                  | 0.14545 | 16     |
| C34  | Shortage of equipment                                                         | 0.13182 | 19     |
| C35  | Time loss due to traffic jam                                                  | 0.05000 | 30     |
| C36  | Unexpected geological conditions                                              | 0.02273 | 35     |

Table 7. The Ten Most Significant Delay Factors.

| Code | List of Factors                                                                 | Overall |
|------|-------------------------------------------------------------------------------|---------|
|      |                                                                               | Rank   | RII   |
| C27  | Poor planning and scheduling                                                  | 1      | 0.48864|
| C21  | Late delivery of material                                                     | 2      | 0.37727|
| C3   | Change of scope by owners during the construction phase                       | 3      | 0.36136|
| C26  | Poor site management and supervision                                          | 4      | 0.35682|
| C16  | Insufficient financial of the contractor/Sub-contractor                        | 5      | 0.27955|
| C19  | Lack of experience of the contractor’s team                                    | 6      | 0.26818|
| C10  | Delay due to design error                                                     | 7      | 0.26136|
| C25  | Low productivity of labor                                                     | 8      | 0.20909|
| C8   | Delay in process payment by the owner                                         | 9      | 0.18864|
| C6   | Delay in decision making of the owner or consultant                           | 10     | 0.17955|

3.2. Spearman’s Rank Correlation Result

In this study, the Spearman Rank Correlation is analyzed to check the difference between those who had been working less than 5 years and those for more than 5 years. Table 8 illustrates the ranks of both parties, and the result of the Spearman’s Rank Correlation is 0.41 which means that there is an agreement between these two parties.

Table 8. The Spearman’s Rank Correlation between Less Than 5 Years and More Than 5 Years Work Experience.

| Code | List of Factors                                                                 | <5 Years | >5 Years | d  | d²  |
|------|-------------------------------------------------------------------------------|----------|----------|----|-----|
|      |                                                                               | RII      | Rank     | RII | Rank |     |
| C1   | Accident on site                                                              | 0.11034  | 20       | 0.0200 | 29 | -9  | 81  |
| C2   | Additional work/requirements                                                   | 0.15862  | 15       | 0.15333 | 17 | -2  | 4   |
| C3   | Change of scope by owners during the construction phase                       | 0.45862  | 2        | 0.17333 | 12 | -10 | 100 |
| C4   | Conflict among the workers or colleagues                                       | 0.05517  | 28       | 0.00000 | 33 | -5  | 25  |
### Table 8. Cont.

| Code | List of Factors | <5 Years |   | >5 Years |   |   |   |   |
|------|-----------------|----------|---|----------|---|---|---|---|
|      |                 | RII      | Rank | RII      | Rank | d | d² |
| C5   | Delay due to subcontractors | 0.15862  | 15  | 0.20667  | 8   | 7 | 49 |
| C6   | Delay in decision making of the owner or consultant | 0.16207  | 14  | 0.21333  | 7   | 7 | 49 |
| C7   | Delay in inspection and test | 0.07586  | 24  | 0.15333  | 17  | 7 | 49 |
| C8   | Delay in process payment by the owner | 0.23793  | 8   | 0.09333  | 23  | −15 | 225 |
| C9   | Delay in sample testing | 0.02069  | 35  | 0.16000  | 14  | 21 | 441 |
| C10  | Delay due to design error | 0.31379  | 5   | 0.16000  | 14  | −9 | 81 |
| C11  | Delay due to problems with the local community | 0.03103  | 34  | 0.04667  | 25  | 9 | 81 |
| C12  | Difficulties in obtaining work permits from the authorities | 0.00000  | 36  | 0.02667  | 26  | 10 | 100 |
| C13  | Equipment breaks down | 0.06207  | 27  | 0.38000  | 5   | 22 | 484 |
| C14  | Government and political issues related to the construction | 0.04483  | 29  | 0.02667  | 26  | 3 | 9 |
| C15  | Hot weather effect on the work field | 0.03793  | 30  | 0.00000  | 33  | −3 | 9 |
| C16  | Insufficient financial of contractors/sub-contractor | 0.18276  | 11  | 0.46667  | 1   | 10 | 100 |
| C17  | Lack of labor | 0.07586  | 24  | 0.20667  | 8   | 16 | 256 |
| C18  | Lack of skilled labor | 0.17931  | 12  | 0.16000  | 14  | −2 | 4 |
| C19  | Lack of experience of the contractor's team | 0.16897  | 13  | 0.46000  | 2   | 11 | 121 |
| C20  | Lack of communication/cooperation among the stakeholders | 0.03448  | 32  | 0.11333  | 21  | 11 | 121 |
| C21  | Late delivery of material | 0.38621  | 3   | 0.36000  | 6   | −3 | 9 |
| C22  | Late in approving a design and document related to work | 0.19310  | 9   | 0.00000  | 33  | −24 | 576 |
| C23  | Late submitting documents/reports of the contractor/sub-contractor to the owner/consultant | 0.08276  | 23  | 0.08000  | 24  | −1 | 1 |
| C24  | Low efficiency of the equipment and supervision | 0.03793  | 30  | 0.17333  | 12  | 18 | 324 |
| C25  | Low productivity of labor | 0.26552  | 6   | 0.01000  | 22  | −16 | 256 |
| C26  | Poor site management | 0.33793  | 4   | 0.39333  | 4   | 0 | 0 |
| C27  | Poor planning and scheduling | 0.52414  | 1   | 0.42000  | 3   | −2 | 4 |
| C28  | Public holiday | 0.14138  | 17  | 0.13333  | 20  | −3 | 9 |
| C29  | Project complexity | 0.08966  | 22  | 0.01333  | 32  | −10 | 100 |
| C30  | Rain effect on the work field | 0.12759  | 18  | 0.14667  | 19  | −1 | 1 |
| C31  | Rework due to work errors | 0.24138  | 7   | 0.02667  | 26  | −19 | 361 |
| C32  | Rework due to low-quality work | 0.18621  | 10  | 0.02000  | 29  | −19 | 361 |
| C33  | Shortage of material on site | 0.11724  | 19  | 0.20000  | 10  | 9 | 81 |
| C34  | Shortage of equipment | 0.10000  | 21  | 0.19333  | 11  | 10 | 100 |
| C35  | Time loss due to traffic jam | 0.06552  | 26  | 0.02000  | 29  | −3 | 9 |
| C36  | Unexpected geological conditions | 0.03448  | 32  | 0.00000  | 33  | −1 | 1 |

| Total | 4582 |
| Spearman’s Rank | 0.41 |

#### 3.3. Thematic Analysis Result

Table 9 indicates the data of the discussion questions. The first is the experience of construction delay. The majority of the participants have experienced a construction delay.
Seventy-five percent of the participants have experienced construction delay, while 25% have not experienced construction delay. In contrast to this category, some participants also decided to answer “Yes” and discussed the Selected Factors, Reason of Ranking Factors, and Provide the Recommendation. There are eight participants involved in the discussion section; however, they did not discuss all three discussion questions. The results of the participants involved in the Discussion Selected Factors, Reason for Ranking Them, and Provide Recommendation are 7%, 5%, and 14%, respectively.

Table 9. The Participants Involved in the Discussion Questions.

| Code | Variable                  | Sub-Variable | Frequency | Valid Percent | Cumulative Percent |
|------|---------------------------|--------------|-----------|---------------|--------------------|
| D1   | Discussion of Select Factors | Yes          | 2         | 4.5%          | 4.5%               |
|      |                           | No           | 42        | 94.5%         | 100%               |
| D2   | Discussion of Reason for Ranking Factor | Yes | 2         | 4.5%          | 4.5%               |
|      |                           | No           | 42        | 94.5%         | 100%               |
| D3   | Providing Recommendation | Yes          | 6         | 13.6%         | 13.6%              |
|      |                           | No           | 38        | 86.4%         | 100%               |

A cost estimator in one of the road construction projects who had been working for over five years said that:

“In order to process the project smoothly, the contractor shall have the sufficient financial with experiences, good at managing (preparing plan and construction schedule) and good engineer or skill-labor, who could understand the project work; otherwise the project will be delayed.”

The participant also explained the reason behind choosing the rank:

“For example, in my current project for road construction; the project was delayed due to the insufficient financing, the main contractor could not pay for working team on time, they were waiting for Interim Payment Certificate (IPC) in general payment per IPC shall take two or three months. So, the working team demobilized their equipment.”

The participant also provided a suggestion to overcome the challenge as well. The suggestion is:

“Before selecting the contractor during bidding, experts such as project manager and engineers shall check and clarify carefully of contractors’ financial, experience, and qualification.”

The contractors’ finances are one of the issues causing the delay; however, the suggestion also indicates a lack of management skill in the project management unit of the project, leading to the contractors’ insufficient finances. Other participants said that:

“The construction management should be improved. And another participant would like to suggest that the project director should give power to the consultant strongly than currently because that is a big problem of delay work when the consultants have no power to suggest or push work on the contractor by contractor did not follow the consultants on-site that make the project delay and poor quality.”

It clearly highlights that there is a lack of management of the higher roles in the projects. In addition to the management, the other participants also pointed out other issues. A participant had experienced an issue with the owners’ decision making. The unclear decision making causes the project’s scope change, which will impact the project’s duration.

A participant suggested that:

“Owner should be clear on making decision of final architect.”

The last point that the participants pointed out is the education and technology in Cambodia. In order to be good at something, workers need to learn some skills that could result in a positive outcome for both the individual and the firms. However, there is a lack of technical classes to teach them, which means that some workers might not have a basic foundation to do the work, impacting the project schedule. A participant stated that:

“Ministry of Education should provide more technical class.”
In addition, it can be seen that technology has been involved in all the industry sectors in the world because each sector can gain an enormous benefit from adopting technology in their firms, especially if it increases the operating speed. However, Cambodia is far behind in adopting technology in its firms. A participant said that:

“Almost every Architecture, Engineering, and Construction (AEC) firm in Cambodia is still adopting traditional 2D applications for project design and visualization which take too much time to complete and revise, comparing to today’s modern AEC industry that makes the projects seem overwhelming, designers getting more frustrating after many revisions during the document detailing stage. Building Information Modeling (BIM) approach should be implemented to every project to avoid any errors, structural elements conflicts and clash detections due to lack of 3-Dimensional visualization.”

Although the participants pointed out different aspects of the issues, they all highlighted issues and provided suggestions that strongly support the first ten most significant factors found in Section 4.1.

4. Discussion

The first ten significant factors have been shown in Table 7. As a result, the first ten significant factors found in this study were also found among the first ten critical factors in over 20 studies. Moreover, five studies strongly agreed with six factors among these first ten significant factors in their ten most influential factors.

4.1. Poor Planning and Scheduling (C27)

Firstly, poor planning and scheduling (C27) is the most significant factor with an RII value of 0.48864. Fourteen studies strongly agreed that this is one of the ten most critical factors causing the construction industry’s delay. Planning and scheduling are important tasks in achieving the project’s objective and defining the project duration. Moreover, planning and scheduling aid projects in mitigating the risks, improving performance, building a strong relationship among stakeholders, and reducing cost and time overrun because employees know which work activity that they should do first, which type of equipment is suitable for the work, and how many resources they should use to accomplish the work. A participant involved in the survey claimed that “the lack of managing in planning and scheduling will prevent the project to complete on time”. Inaccurate scheduling increases the likelihood of project delays [19]. Doloj, Sawhney, Iyer, and Rentala [12] explained that inaccurate planning and scheduling could result from the inexperienced employees in this field who underestimated other external and internal factors that could impact planning and scheduling, such as “weather condition, lack of skilled operators for specialized equipment, inefficient use of equipment, poor coordination among parties, delay in material procurement”. Furthermore, they also stated that the estimators misunderstood the lead time of the work activity and material delivery, impacting the project’s duration.

4.2. Late Delivery of Material (C21)

Secondly, the late delivery of material (C21) is the second most significant factor, with an RII value of 0.37727. Construction material is the core element in constructing construction projects. It will impact the work if the material cannot arrive on time. Rahman et al. [45] argued that the late delivery of material is one of the critical issues causing the delay in the global construction industry. They also stated that the workers need to clearly define the material delivery time and available materials to reduce the impact. Compared to the previous study by Durdyev, Omarov, and Ismail [19], it is more critical than the past studies. It was the third critical delay factor while it currently is the second critical delay factor. Durdyev, Omarov, and Ismail [19] also stated that the Cambodian construction industry relies on imported products from other countries. As a result, the late delivery of material (C21) remains one of the ten significant delay factors in the Cambodian construction industry, with no improvement seen in this issue after the previous study.
4.3. Change of Scope by Owners during the Construction (C3)

Thirdly, the owners’ change of scope during the construction (C3) is the third most significant factor, with an RII value of 0.36136. The scope of work defines which deliverable tasks are required in the project. An unidentified scope will cause a change or variation later in the project. Once the scope changes, it could increase the time to complete the work because each activity takes a different length of time to finish. Change might always harm the project, and it is a common event that occurs in the project [46]. Moreover, they stated that it impacts “project schedule, re-estimation of work statement, and extra demands of equipment, materials, labor, and overtime.” Matin [13] stated that adding or changing the scope of the work could extend the project’s duration. Mpofu, Ochieng, Moobela, and Pretorius [11] reported that an undefined scope of work from the client in the design phase would result in rework, additional work, and other issues during the construction phase.

4.4. Poor Site Management and Supervision (C26)

Fourthly, poor site management and supervision (C26) is the fourth most significant factor, with an RII value of 0.35682. In contrast to planning and scheduling, site management and supervision are other responsible tasks for the project managers. It directly involves the ongoing activities on the construction site. This factor is one of the other factors causing the construction industry’s delay compared to other studies. This factor is among the first ten most significant factors in the other 13 studies. Good site management and supervision will result in a positive performance and a high quality of the construction projects. Akogbe, Feng, and Zhou [21] stated that capable managers could develop a sound management system for construction projects. The reasons could be hiring unqualified employees and workers for the job position who lack the skill and knowledge to do the work [30]. Doloi, Sawhney, Iyer, and Rentala [12] reported that the workers and subcontractors’ inability could result in unproductiveness and indecision. Those statements support the participants’ idea. They stated that “there is a lack of technical class in Cambodia for people to learn the skill”. Technical class or an institute is one of the solutions that could mitigate some impacts of this factor.

4.5. Insufficient Financial of Contractors or Sub-Contractors (C16)

Fifthly, the insufficient finances of the contractors or sub-contractors (C16) is the fifth most significant factor, with an RII value of 0.17955. Good cash flow management will result in a successful project delivery [45]. The insufficient finances of contractors or subcontractors are not linked to the owners’ progress payment [11]. The participant involved in the survey claimed that “his current road construction project is delayed due to the contractor’s insufficient financing. The main contractor could not pay their working team on time and wait for the Interim Payment Certificate (IPC) that could take up to two or three months, leading them to demobilize their equipment to another place for another work with another team”. However, in some cases, contractors or subcontractors’ insufficient finances might link to the owners’ payment if they have only a project in their hand. Cash flow is the lifeblood of the construction company. Mahamid, Bruland, and Dmaidi [33] said that some contractors rely on the owners’ payment to support their expense. The financial scarcity will cause them to suspend their work [13].

4.6. Lack of Experiences of the Contractor’s Team (C19)

Sixthly, the lack of experience of the contractor’s team (C19) is the sixth most significant factor, with an RII value of 0.26818. Junior contractors who have just started a business might have less construction work experience and could misunderstand or take a long time to understand the work, which might cause rework or delay. If they could get the work right after trying to understand it, it would have a positive result. However, if they could not get it right, it would lead them to redo the work, which will impact on the project duration. Those inexperienced contractors might cause a delay in construction projects [47]. Hence, they could make some mistakes during construction which would
need time to rectify. Choma [48] argued that hiring an unknown profile or the inexperience of the contractors could lead to unsuccessful project delivery. It will increase the project’s risks, such as time and cost overrun, low quality, and accidents.

4.7. Delay Due to Design Error (C10)

Seventhly, the delay due to design error (C10) is the seventh most significant factor, with an RII value of 0.26136. Project design is key to determining the project’s deliverable tasks. However, when there is an error in the design, the project’s estimation will be wrong, which will lead to re-design and re-estimation, and require a lot of time to rework it. Moreover, if it is not found in the early phase, it will result in additional work that will have an even higher impact on the project duration and budget. Han et al. [49] claimed that design errors result in rework and/or design changes, impacting project duration and budget.

4.8. Low Productivity of Labour (C25)

Eighthly, the low productivity of labor (C25) is the eighth most significant factor, with an RII value of 0.20909. Labor is one of the primary workforces in construction to achieve the project’s objective. OpenStax [50] stated that “labor productivity is the outcome of each employee produce per unit of their input. Human capital is one of the elements that is used to determine labor productivity. Human capital is the experience, education and skills of the labor. The project will result in a high labor productivity rate if the human capital has a higher rate.

Santoso and Soeng [22] stated that most Cambodian construction workers are from the rural areas. The workers will accept any kind of job as they find one. In this case, they have no experience or skill in working in the construction industry and no training course is provided to them to learn. A construction company should be providing a training course to develop labor productivity [47]. With these two points, this will result in the low productivity of work. Moreover, the weather condition is another factor that is causing work productivity, especially during the hot season, and salary is another crucial factor [11].

4.9. Delay in Process Payment by the Owner (C8)

Ninthly, the delay in process payment by the owner (C8) is the second least significant factor among the first ten significant factors, with an RII value of 0.19964. The contractors’ insufficient finances is one of the issues; however, the owners’ delay in progress payment is another financial issue. Financial scarcity will negatively impact project delivery. Without a budget, the contractors would not have the ability to pay for their expenses. If the owners could pay the contractors on time, it could reduce some limitations or restrictions for contractors to continue working on their jobs [8]. They also claimed that the contractors could not reach the project objective if the owners failed to provide the payment on time. Akinsiku and Ajayi [51] highlighted that the delay in payment impacts the project’s performance, such as in quality, cost, and time. In addition, Matin [13] reported that if the owners fail to provide the payment on time, the contractors might be inactive in finishing their work, and it could also impact the work quality and project timeline. Bagaya and Song [18] supported the finding that the owners’ delay in process payment is a barrier that de-motivated the contractor team.

4.10. Delay in the Owner or Consultant’s Decision-Making (C6)

Lastly, the delay in the owner or consultant’s decision-making (C6) is the least significant factor among the first ten significant factors, with an RII value of 0.17955. In order to carry out the work, the contractors require approval from the owners. Moreover, construction work is being carried out every day. However, once the owner delays in decision making, this impacts the project’s duration. There might be a possible time overrun if the owners take a long time to decide or approve [20]. The delay in decision making might impact the material supply. Rahman, Yap, Ramli, Dullah, and Shamsuddin [45] argued that
last-minute decision making could impact material ordering from overseas, which might cause a delay in the material delivery.

5. Conclusions

Delay in the construction industry is a common phenomenon that has been found in both the developed and the developing countries. Cambodia is no exemption. Seventy-five percent of the responses have experienced delays in construction, and all the given 36 factors were identified. The Relative Importance Index was used in this research to define the delay factors. The first ten most significant delay factors in Cambodian construction projects are poor planning and scheduling, late delivery of material, change of scope by owners during the construction phase, poor site management and supervision, insufficient finances of contractors or sub-contractors, lack of experience of the contractors’ team, delay due to design error, low productivity of labor, delay in process payment by the owners, and delay in the decision making of the owners or consultants.

Recommendation

The following are some recommendations based on the above finding which could mitigate the risk of time overrun in the construction projects:

- The owners should clearly define a project’s scope before commencing the construction phase because it will extend the project’s duration with new design and estimation when the scope is changed during the construction phase.
- The owners should hire experts in the field to reduce time on decision making because experts understand the work better.
- The owners should pay for the contractors on time or after no longer than 15 days because this could mitigate the contractors’ cash flow problems.
- The government should provide a technical institute for workers to enroll before they participate in the work, and the company should provide training courses to the workers for improvement because this could reduce the work errors and result in high productivity when the workers have developed their skills.
- Those contractors’ teams who have less work experience in construction work should seek experts to increase the speed of understanding of the work.
- The contractors should inquire and inform the suppliers before purchasing the construction materials to ensure that they can be delivered to the site on time.
- The contractors should have enough budget to cover an individual project before accepting the offer because if the contractors do not have enough finances and rely on payment by the owners, the contractors will not have the budget to pay their workers which will impact the project’s duration.
- The work could be delayed if the design is in error. As a result, the design manager should check it as soon as it is finished because they could have time to rectify it without impact on the project’s duration.
- The company should have its in-house database or create its schedule estimation standard depending on the project size because the requirement for each project size is different. Moreover, the in-house database will be a valuable tool for future use.
- The estimators should consider other events when estimating the project duration, such as weather conditions, labor productivity, equipment productivity, and lead time.
- BIM should be adopted in the AEC firms to avoid some errors and increase operation speed because BIM is the application that aids in increasing the design quality.

Author Contributions: Conceptualization, F.T. and V.S.; methodology, F.T. and V.S.; software, F.T. and V.S.; validation, F.T. and V.S.; formal analysis, F.T. and V.S.; investigation, F.T. and V.S.; resources, F.T. and V.S.; data curation, F.T. and V.S.; writing—original draft preparation, F.T. and V.S.; writing—review and editing, F.T.; visualization, F.T. and V.S.; supervision, F.T.; project administration, F.T.; funding acquisition, F.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.
Conflicts of Interest: The authors declare no conflict of interest.

References

1. Mahamid, I. Factors affecting contractor’s business failure: Contractors’ perspective. Eng. Constr. Archit. Manag. 2012, 19, 269–285. [CrossRef]
2. Ullah, K.; Khan, M.; Lakhiar, M.; Vighio, A.; Sohu, S. Ranking of effects of construction delay: Evidence from malaysian building projects. J. Appl. Eng. Sci. 2018, 8, 79–94. [CrossRef]
3. Kikwasi, G. Causes and effects of delays and disruptions in construction projects in Tanzania. Australas. J. Constr. Econ. Build. Conf. Ser. 2013, 1, 52–59. [CrossRef]
4. Senouci, A.; Ismail, A.; Eldin, N. Time delay and cost overrun in Qatari public construction projects. Procedia Eng. 2016, 164, 368–375. [CrossRef]
5. Faridi, A.S.; El-Sayegh, S.M. Significant factors causing delay in the UAE construction industry. Constr. Manag. Econ. 2006, 24, 1167–1176. [CrossRef]
6. Ministry of Land Management, Urban Planning and Construction (MOLMUP). Cambodia Urban Forum Report 2019; MOLMUP: Phnom Penh, Cambodia, 2019.
7. Assaf, S.A.; Al-Hejji, S. Causes of delay in large construction projects. Int. J. Proj. Manag. 2006, 24, 349–357. [CrossRef]
8. Frimpong, Y.; Oluwoye, J.; Crawford, L. Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study. Int. J. Proj. Manag. 2003, 21, 321–326. [CrossRef]
9. Gunduz, M.; Nielsen, Y.; Ozdemir, M. Fuzzy assessment model to estimate the probability of delay in Turkish construction projects. J. Manag. Eng. 2015, 31, 04014055. [CrossRef]
10. Rao, B.P.; Shekar, S.C.; Jaiswal, N.; Jain, A.; Saxena, A.D. Delay analysis of construction projects. J. Inf. Technol. Econ. Dev. 2016, 7, 15–24.
11. Mpofu, B.; Ochieng, E.G.; Moobela, C.; Pretorius, A. Profiling causative factors leading to construction project delays in the United Arab Emirates. Eng. Constr. Archit. Manag. 2017, 24, 346–376. [CrossRef]
12. Doloi, H.; Sawhney, A.; Iyer, K.; Rentala, S. Analysing factors affecting delays in Indian construction projects. Int. J. Proj. Manag. 2012, 30, 479–489. [CrossRef]
13. Matin, D.M. Identifying the effective factors for cost overrun and time delay in water construction projects. Eng. Technol. Appl. Sci. Res. 2016, 6, 1062–1066. [CrossRef]
14. Khair, K.; Mohamed, Z.; Mohammad, R.; Farouk, H.; Ahmed, M.E. A management framework to reduce delays in road construction projects in Sudan. Arab. J. Sci. Eng. 2018, 43, 1925–1940. [CrossRef]
15. Shrivas, A.; Singla, H.K. Factors causing delay in marine construction projects in India. i-Manag. J. Civ. Eng. 2018, 8, 12.
16. Aziz, R.F. Ranking of delay factors in construction projects after Egyptian revolution. Alex. Eng. J. 2013, 52, 387–406. [CrossRef]
17. Bekr, G.A. Causes of delay in public construction projects in Iraq. Jordan J. Civ. Eng. 2015, 9, 149–162.
18. Bagaya, O.; Song, J. Empirical study of factors influencing schedule delays of public construction projects in Burkina Faso. J. Manag. Eng. 2016, 32, 05016014. [CrossRef]
19. Durdyev, S.; Omarov, M.; Ismail, S. Causes of delay in residential construction projects in Cambodia. Cogent Eng. 2017, 4, 1291117. [CrossRef]
20. Alhajri, A.R.; Alshibani, A. Critical Factors behind Construction Delay in Petrochemical Projects in Saudi Arabia. Energies 2018, 11, 1652. [CrossRef]
21. Akogbe, R.-K.T.; Feng, X.; Zhou, J. Importance and ranking evaluation of delay factors for development construction projects in Benin. KSCE J. Civ. Eng. 2013, 17, 1213–1222. [CrossRef]
22. Santoso, D.S.; Soeng, S. Analyzing delays of road construction projects in Cambodia: Causes and effects. J. Manag. Eng. 2016, 32, 05016020. [CrossRef]
23. Chiu, B.W.; Lai, J.H. Project delay: Key electrical construction factors in Hong Kong. J. Civ. Eng. Manag. 2017, 23, 847–857. [CrossRef]
24. Islam, M.S.; Subhariadi, B.T. Construction delays in privately funded large building projects in Bangladesh. Asian J. Civ. Eng. 2018, 19, 415–429. [CrossRef]
25. Yap, J.B.H.; Chow, I.N.; Shavarebi, K. Criticality of construction industry problems in developing countries: Analyzing Malaysian projects. J. Manag. Eng. 2019, 35, 04019020. [CrossRef]
26. Kog, Y.C. Major delay factors for construction projects in Iran. Int. J. Constr. Proj. Manag. 2017, 9, 83–97.
27. Choong Kog, Y. Major construction delay factors in Portugal, the UK, and the US. Pract. Period. Struct. Des. Constr. 2018, 23, 04018024. [CrossRef]
28. Amri, T.; Marey-Pérez, M. Towards a sustainable construction industry: Delays and cost overrun causes in construction projects of Oman. J. Proj. Manag. 2020, 5, 87–102. [CrossRef]
29. Mydin, M.O.; Sani, N.M.; Salim, N.A.; Alias, N.M. Assessment of Influential Causes of Construction Project Delay in Malaysian Private Housing from Developer’s Viewpoint. In E3S Web of Conferences; EDP Sciences: Les Ulis, France, 2014; p. 01027.
30. Ruqashi, M.; Bashir, H.A. Causes of delay in construction projects in the oil and gas industry in the gulf cooperation council countries: A case study. J. Manag. Eng. 2015, 31, 05014017. [CrossRef]
31. Ji, Y.; Qi, L.; Liu, Y.; Liu, X.; Li, H.X.; Li, Y. Assessing and prioritising delay factors of prefabricated concrete building projects in China. *Appl. Sci.* 2018, 8, 2324. [CrossRef]

32. Thapanont, P.; Santi, C.; Pruethipong, X. Causes of delay on highway construction projects in Thailand. In *MATEC Web of Conferences*; EDP Sciences: Les Ulis, France, 2018; p. 02014.

33. Mahamid, I.; Bruland, A.; Dmaidi, N. Causes of delay in road construction projects. *J. Manag. Eng.* 2012, 28, 300–310. [CrossRef]

34. Mahamid, I. Analysis of schedule deviations in road construction projects and the effects of project physical characteristics. *J. Financ. Manag. Prop. Constr.* 2017, 22, 192–210. [CrossRef]

35. Mahamid, I. Risk matrix for factors affecting time delay in road construction projects: Owners’ perspective. *Eng. Constr. Archit. Manag.* 2011, 18, 609–617. [CrossRef]

36. Mahamid, I. Common risks affecting time overrun in road construction projects in Palestine: Contractors’ perspective. *Australas. J. Constr. Econ. Build.* 2013, 13, 45–53. [CrossRef]

37. Amoatey, C.T.; Ankrah, A.N.O. Exploring critical road project delay factors in Ghana. *J. Facil. Manag.* 2017, 15, 110–127. [CrossRef]

38. Elawi, G.S.A.; Algahtany, M.; Kashiwagi, D. Owners’ perspective of factors contributing to project delay: Case studies of road and bridge projects in Saudi Arabia. *Procedia Eng.* 2016, 145, 1402–1409. [CrossRef]

39. Alfakhri, A.; Ismail, A.; Muhammad, A.; Arhad, I.; Irtema, H. A conceptual model of delay factors affecting road construction projects in Libya. *J. Eng. Sci. Technol.* 2017, 12, 3286–3298.

40. Creswell, J.W.; Creswell, J.D. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*; Sage Publications: Thousand Oaks, CA, USA, 2017.

41. Van Selm, M.; Jankowski, N.W. Conducting online surveys. *Qual. Quant.* 2006, 40, 435–456. [CrossRef]

42. Battaglia, M. Convenience Sampling. In *Encyclopedia of Survey Research Methods*; Lavrakas, P.J., Ed.; Sage Publications: Thousand Oaks, CA, USA, 2008; Volume 1.

43. Oregon State University. Snowball Sampling. Available online: https://research.oregonstate.edu/irb/policies-and-guidance-investigators/guidance/snowball-sampling (accessed on 13 March 2021).

44. EF EPI. EF English Proficiency Index: A Ranking of 100 Countries and Regions by English Skill. Available online: https://www.ef.com/epi (accessed on 29 April 2021).

45. Rahman, M.M.; Yap, Y.H.; Ramli, N.; Dullah, M.; Shamsuddin, M. Causes of shortage and delay in material supply: A preliminary study. *IOP Conf. Ser. Mater. Sci. Eng.* 2017, 271, 012037.

46. Hao, Q.; Shen, W.; Neelamkavil, J.; Thomas, R. Change management in construction projects. In Proceedings of the International Conference on Information Technology in Construction, Santiago, Chile, 15–17 July 2008.

47. Zhang, D.; Zhang, H.; Cheng, T. Causes of Delay in the Construction Projects of Subway Tunnel. *Adv. Civ. Eng.* 2020, 2020, 8883683. [CrossRef]

48. Choma, A. How to Reduce Risks in Contractors’ Management. Available online: https://www.pmi.org/learning/library/reduce-risks-contractors-management-6985 (accessed on 4 April 2021).

49. Han, S.; Love, P.; Peña-Mora, F. A system dynamics model for assessing the impacts of design errors in construction projects. *Math. Comput. Model.* 2013, 57, 2044–2053. [CrossRef]

50. OpenStax. *Principles of Economics*; Rice University: Houston, TX, USA, 2022.

51. Akinsiku, O.; Ajayi, O. *Effects of Delayed Payment of Contractors on Construction Project Delivery in Nigeria*; Royal Institution of Chartered Surveyors: London, UK, 2016.