**Journal of Surveying, Construction and Property (JSCP)** **Volume 16, 2025 Issue 1**
e-ISSN: 1985-7527

# DEVELOPMENT OF AN INSTRUMENT TO INVESTIGATE THE RELATIONSHIP BETWEEN THE RISKS RELATED TO EMPLOYERS' AND CONSULTANTS' CONTRACTUAL RESPONSIBILITIES AND CONTRACTORS' WORK PROGRESS, CONSIDERING PROJECT CHARACTERISTICS AS A MODERATOR

**Siaw Chin Pan[1], Umi Kalsum Zolkafli @ Zulkifly[1] and Siaw Chuing Loo[1*]**

[1]Department of Quantity Surveying, Faculty of Built Environment, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

Corresponding author: *siawchuing@um.edu.my

**ABSTRACT**

There is a lack of studies examining the risks faced by contractors related to the non-adherence to contractual responsibilities by employers and consultants, and how project characteristics influence the impact of these risks on the contractors' work progress. Due to the absence of a suitable survey instrument in past studies, this paper aims to introduce a valid survey to investigate the relationship between the risks related to the employers' and consultants' contractual responsibilities and contractors' work progress, and the moderating effect of project characteristics. A 43-item survey instrument was developed based on the PAM Contract 2018, past studies, and insights from industry experts. The instrument was validated through a qualitative approach (expert judgment) and a quantitative approach (content validity index). The validation method adopted in the study ensures that the items included in the proposed survey are clear and appropriately represent the key variables (employer-related risks, consultants-related risks, project characteristics, and contractors' work progress). The final 40-item survey instrument has an average content validity index of 0.951, indicating excellent content validity. This paper presents the procedures adopted for developing and validating the survey instrument. The findings of this paper are valuable for future researchers in developing survey instruments.

**Keywords:** Content Validity, Contractual Risks in Construction, Employer-Related Risks, Consultants-Related Risks, Construction Project Characteristics.

Received: 17 December 2024 | Revised : 18 February 2025 | Accepted: 4 March 2024

## 1. INTRODUCTION

The Contractor shall constantly use his best endeavour to prevent or reduce delay in the progress of the Works, and to do all that may reasonably be required to prevent and reduce delay or further delay in the completion of the Works beyond the Completion Date (PAM, 2018). However, contractors are often exposed to risks such as disruptions that delay the construction activities, not solely because of the contractors' fault, but due to various reasons beyond a contractor's control. Taylan et al. (2014) described risk as an uncertain event or condition whereas, Khodeir and Mohamed (2015) explained that risk is known among those involved in the construction industry as the phenomenon of continuously facing situations, which are unknown, unexpected, frequently undesirable, and often unpredictable.

Delay in receiving payment from employers, the scope of work not being properly defined and delay in approving shop drawings by the consultants are among the risks frequently encountered by contractors during construction. Findings from past studies by Abdellatif and Alshibani (2019), Alenazi et al. (2022), Wang et al. (2018), Yap et al. (2021) and Zidane and Andersen (2018) revealed that one of the top contributing risks leading to project delay was delays by employers in making progress payments to contractors. The project characteristics could influence the occurrence of the risks. For instance, in a study on delays caused by employers, the researchers Alenazi et al. (2022) found contract value has a significant and positive correlation with late payments to contractors. A comparative study that was performed by Sánchez et al. (2020) observed that delay factors vary between the types of projects. The researchers found that the delay in roadwork progress was due to employers' late payment to contractors. In contrast, for building projects, the delay was caused by the financial difficulties of contractors.

Over the years, various research efforts have focused on the identification of construction risks (Aziz & Abdel-Hakam, 2016; Yap et al., 2021; Zidane & Andersen, 2018) and the impact of risks on project performance (Alshihri et al., 2022; Taylan et al., 2014; Wang et al., 2018; Yousri et al., 2023). However, there are limited studies that examine the risks related to the contractual responsibilities of employers and consultants affecting the contractors' work progress. In addition, the emphasis of the past studies from the perspective of project characteristics has mostly been on exploring the effect of project characteristics on project performance (Anuar Othman et al., 2006; Assaad et al., 2020; Cho et al., 2009; Heravi & Mohammadian, 2021; Ling et al., 2004; Shehu et al., 2015), and the relationship between project characteristics and project risks (Francis et al., 2022; Okudan & Budayan, 2020) . There is still a lack of studies assessing the influence of project characteristics on the risks related to the contractual responsibilities of employers and consultants toward the contractors' work progress. There were no empirical and qualitative studies found and consequently, no survey instrument available to be adopted in the past studies. This motivates the need to conduct a study assessing the risks faced by contractors due to the non-adherence to the contractual responsibilities by employers and consultants affecting the contractors' work progress, in considering the moderating effect of project characteristics, which would provide informative insights on effective contract management in resolving construction issues such as delayed projects in the Malaysian construction industry.

As there is no appropriate survey instrument to be adopted from past studies, this paper aims to establish a valid instrument to investigate the relationship between the risks related to the employers' and consultants' contractual responsibilities and contractors' work progress, and the moderating role of project characteristics. To fulfill this aim, this paper has two objectives: -

1. To introduce a survey instrument based on a mixed method approach, and
2. To assess the content validity of the proposed instrument through expert judgment.

The survey instrument consists of a questionnaire with items that were formulated based on the Agreement and Conditions of PAM Contract 2018, past literature, and opinions obtained during an unstructured interview with two experts with over 30 years of experience in the construction industry. Specifically, the survey was intended for contractors registered under CIDB Grade G6 (tendering capacity less than RM10,000,000) and Grade G7 contractors (unlimited tendering capacity) in Malaysia, who are the main contractors involved in handling and managing construction projects. The unit of analysis focused on new building construction projects located in Klang Valley which were awarded under the private sector. However, the survey instrument is still suitable for adaptation in a diverse setting and with different sampling populations.

When a new scale is developed, researchers following rigorous scale development procedures are expected to provide extensive information about the scale's reliability and validity (Polit & Beck, 2006). In short, a proposed survey instrument must be tested before it is used for its intended purpose. Content, criterion, and construct validity are among the standard validity measures reported in the literature (Almanasreh et al., 2019). In many studies, the instrument's content validity is assessed first, followed by other subsequent validity measures (Lopez et al., 2023). Content validity concerns the degree to which a sample of items, taken together, constitutes an adequate operational definition of a construct (Polit & Beck, 2006). Meanwhile, Almanasreh et al. (2019) explained that content validity provides evidence about the degree to which elements of an assessment instrument are relevant to and representative of the targeted construct for a particular assessment purpose. It is important to clarify that the new survey instrument introduced in this paper must be tested to ensure that each item constructed is relevant to the study, and clear, simple and unambiguous to the intended respondents as well as the comprehensiveness of the survey instrument. The proposed survey instrument in this paper was validated through expert judgment and the content validity index (CVI) method to assess its content validity. This study enhances the previous work on contractual risks in construction by introducing an instrument that integrates relevant and appropriate items (the risks related to the employers' and consultants' contractual responsibilities) within a contract that could be affected by project characteristics.

The following section (Section 2) of this paper provides the literature review and the conceptual framework for the instrument development and validation. Section 3 presents the approach adopted for developing and validating the survey instrument. Section 4 covers the findings and the discussion. Finally, the paper concludes with limitations and suggestions for future research in Section 5.

## 2. LITERATURE REVIEW

### 2.1 Risks Related to Contractual Responsibilities of Employers and Consultants

Besides delay in making contractors' payments by employers as mentioned earlier, other top influencing risks that relate to employers (or clients) as found in past studies were the scope of work not properly defined or change of scope (Bin Seddeeq et al., 2019; Doloi et al., 2012; Memon, 2014) and frequent change orders by employers (Alshihri et al., 2022; Bin Seddeeq et al., 2019; Mahamid, 2017a; Muya et al., 2013; Yap et al., 2021). Meanwhile, the top most significant risks involving the consultants (referred to architects, engineers, and quantity surveyors) were delays in approving design documents (Abdellatif & Alshibani, 2019), frequent design change (Memon, 2014; Zidane & Andersen, 2018), and design errors (Aziz & Abdel-Hakam, 2016; Bin Seddeeq et al., 2019; Tessema et al., 2022). These risks are associated with the contractual responsibilities of the employers and consultants despite the parties involved (employers and consultants) knowing that their responsibilities are clearly stated in the construction contract.

Contractual responsibilities refer to the specific duties each party to a construction contract must fulfill to achieve the project's objectives (time, cost, and quality). Adherence as defined by Combley (2011), is the act of doing something according to a particular rule, standard, agreement, etc. Adherence to a contract is shown by obeying the terms and conditions of the contract. Under a contract, the employer and consultants have to exercise reasonable care and skills in furnishing the contractor with the required information on time during construction. For instance, one of the employer's contractual responsibilities is to give possession of the site to the contractor on the Date of Commencement as stated under Clause 21.1 of the PAM Contract 2018. Failure of an employer to adhere to the clause would disrupt and delay the contractor's Completion Date.

This study focused on the risks faced by contractors due to the non-adherence of contractual responsibilities by employers and consultants. For this reason, the study referred to the selected construction contract to scrutinize the risks related to the employers' and consultants' contractual responsibilities. The construction contracts available for private sector projects in the Malaysian construction industry are the standard forms of contracts issued by the Pertubuhan Arkitek Malaysia (PAM), the Institution of Engineers Malaysia (IEM), the Construction Industry Development Board (CIDB) Malaysia, the Asian International Arbitration Centre (AIAC) and the International Federation of Consulting Engineers (FIDIC). The choice of implementing a construction contract depends on factors such as the project owner or the scale of the project. For instance, government-funded projects would implement standard forms published by the Public Works Department (PWD), while private sector projects may use PAM or FIDIC contracts. By particularly focusing on PAM, FIDIC and IEM contracts, there are few distinct differences in the administration and use of the contracts. The PAM contracts are administered by

architects, and are typically used for private sector projects. FIDIC contracts are administered by engineers and commonly applied for projects that involve international companies. Similar to FIDIC, IEM contracts are also administered by engineers but are used more specifically in civil engineering projects. PAM contract was selected as the main reference in this study as it is the most commonly used standard form of construction contract for private sector projects in Malaysia. However, the same risks would be examined if contracts other than the PAM contract were used.

In this study, the risks faced by the contractors due to the non-adherence of contractual responsibilities by employers and consultants are referred to as employer-related and consultant-related risks, respectively. A compilation of 26 potential risks affecting contractors' work progress was identified in the PAM Contract 2018 (the latest edition). The risks as shown in Table 1, were then categorized into contractual, technical, and financial.

Table 1: Employer-Related and Consultants-Related Risks Identified in the PAM Contract 2018

| No. | Description | Related clause | Risk type * | Category |
|---|---|---|---|---|
| | From Articles of Agreement | | | |
| 1 | Scope of work not well-defined | - | ER | Contractual |
| 2 | Scope of work differs from the Contract | - | ER | Contractual |
| | From Conditions of Contract | | | |
| 3 | Discrepancies between bills of quantities, drawings & specifications | 1.4 | CR | Technical |
| 4 | Inaccurate design | 1.4 | CR | Technical |
| 5 | Incomplete drawings or details | 1.4 & 3.4 | CR | Technical |
| 6 | Delay in receiving architect instruction corresponding to verbal instruction | 2.2 & 11.3 | CR | Contractual |
| 7 | Delay in receiving contract drawings & unpriced contract bills | 3.3 | CR | Contractual |
| 8 | Delay in receiving drawings, setting-out, specifications & related information | 3.4 & 5.1 | CR | Contractual |
| 9 | Delay in approving shop drawings | 6.1 & 6.2 | CR | Contractual |
| 10 | Delay in approving & confirming the material specifications | 6.2 & 11(b) | CR | Contractual |
| 11 | Delay in performing inspection & testing | 6.3 | CR | Contractual |
| 12 | Frequent design changes by the consultants | 11.1(a) | CR | Technical |
| 13 | Rework due to frequent change orders by the employer | 11.1(a)&(c) | ER | Contractual |
| 14 | Frequent changes of materials & specifications by the employer | 11.1(b) | ER | Contractual |
| 15 | Frequent changes of materials & specifications by the consultants | 11.1(b) | CR | Contractual |
| 16 | Delay in receiving architect instruction, confirmation or approval for variation works | 11.2 & 11.3 | CR | Contractual |
| 17 | Unjustified amount certified for variation claim | 11.5 | CR | Financial |
| 18 | Delay in confirming the agreed amount for the variation claim | 11.9 | CR | Financial |
| 19 | Delay in giving site possession | 21.1 | ER | Contractual |
| 20 | Inadequate duration of contract period | 21.1 | ER | Contractual |
| 21 | Delay in receiving written notice (issue notice of rejection or issue certificate of EOT) after submission of EOT application | 23.4 | CR | Contractual |
| 22 | Failure to be reimbursed for direct loss and/or expense | 24.4 | ER | Financial |
| 23 | Delay in receiving materials, goods or labour that the employer (or contractors engaged by the employer) had agreed to supply or engage | 29.1 | ER | Contractual |
| 24 | Delay in receiving interim payment | 30.1 | ER | Financial |
| 25 | Delay in issuing the interim certificate | 30.1 | CR | Financial |
| 26 | Failure to be reimbursed for the claim on late payment interest (Interest charged by the contractor when interim payment is received after the Period of Honouring Certificate) | 30.17 | ER | Financial |

**Note**:
* ER = employer-related risks, CR = consultants-related risks

### 2.2 Contractors' Work Progress

Researchers Memon et al. (2012) and Mydin et al. (2014) recommended contractors to closely monitor the work progress from time to time to prevent delay, however, there are still many unforeseen risks affecting the

work progress that eventually affect a contractor's ability to complete the project. Previous studies reported that failure in dealing with project risks during construction had caused time and cost overruns to the construction projects (Abdellatif & Alshibani, 2019; Alshihri et al., 2022; Bin Seddeeq et al., 2019; Mahamid, 2017b; Muya et al., 2013; Sambasivan & Soon, 2007), quality deprivation (Mahamid, 2017b; Muya et al., 2013), loss of efficiency (Gunduz & Mohammad, 2020; Singh et al., 2018), unsustainability environment (Taylan et al., 2014) and loss of labour productivity (Cheng et al., 2015). Other outcomes mentioned by Sambasivan and Soon (2007) were disputes, arbitration, litigation, and total abandonment. Table 2 shows the impact of risks on project performance identified from past studies.

As there is a lack of literature exploring the consequences of risks affecting contractors' work progress, the consequences of risks affecting project performance were extracted from 14 previously published journals (as shown in Table 2) and opinions obtained from two industry experts with over 30 years of experience in the construction industry, A list of eight consequences was identified, subsequently, four items (time overrun, cost overrun, poor quality and loss of efficiency) were then adapted in this study as being the consequences of the occurrence of risks affecting the contractors' work progress, to investigate the relationship between the risks related to the employers' and consultants' contractual responsibilities and contractors' work progress.

Table 2: The Consequences of Risks Affecting Contractors' Work Progress

| No. | Description | Previous studies* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Remark |
| 1 | Time overrun | √ | √ | | √ | | √ | √ | √ | √ | | √ | √ | √ | √ | Adapted |
| 2 | Cost overrun | √ | √ | | | | √ | √ | √ | √ | | √ | | | | Adapted |
| 3 | Poor quality | | | | | | √ | √ | | | | √ | | | | Adapted |
| 4 | Loss of efficiency | | | | | √ | | | | | √ | | | | | Adapted |
| 5 | Unsustainability environment | | | | | | | | | | | √ | | | | Excluded |
| 6 | Loss of labour productivity | | | √ | | | | | | | | | | | | Excluded |
| 7 | Disputes, arbitration and litigation | | | | | | √ | | √ | | | | | | | Excluded |
| 8 | Total abandonment | | | | | | | | √ | | | | | | | Excluded |

**Note**:
* 1=Abdellatif and Alshibani (2019), 2=Alshihri et al. (2022), 3=Cheng et al. (2015), 4=Doloi et al. (2012), 5=Gunduz and Mohammad (2020), 6=Mahamid (2017b), 7=Muya et al. (2013), 8=Sambasivan and Soon (2007), 9=Bin Seddeeq et al. (2019), 10=Singh et al. (2018), 11=Taylan et al. (2014), 12=Wang et al. (2018), 13=Yap et al. (2021), 14=Zidane and Andersen (2018)

### 2.3 Project Characteristics

Table 3: Classification of Project Characteristics

| Past studies | Category |
|---|---|
| Ling et al. (2004) | (1) Project characteristics<br>(e.g. type of building, form of building contract, level of design and complexity, percentage of repetitive elements, etc.)<br>(2) Owner and consultants' characteristics<br>(e.g. owner and consultants' experience with similar projects, etc.)<br>(3) Contractors' characteristics<br>(e.g. level of construction sophistication of the contractors and experience with similar projects, etc.) |
| Cho et al. (2009) | (4) Project environment characteristics<br>(e.g. project scale, type of project, level of complexity, site location, percentage of repetitive elements)<br>(1) Project participants characteristics<br>(e.g. client's capability of construction management, client's experience with similar projects, client's level of control over the design changes, communication among project team members, contractor's capability for construction management). |

Project characteristics can be defined as unique project features that can be used to describe a project (Okudan & Budayan, 2020). Table 3 shows the classification of project characteristics presented in the past studies. Ling et al. (2004) examined the project characteristics affecting project performances in three categories such as project characteristics, owner and consultants' characteristics, and contractors' characteristics while Cho et al. (2009) categorized project characteristics into project environment characteristics and project participants' characteristics.

This study portrayed project characteristics as potential moderators on the relationship between the risks (employer-related risks and consultant-related risks) and the contractors' work progress. Thus, the project characteristics referred to in this paper were focused on project environment characteristics based on Cho et al. (2009).

A list containing 15 project environment characteristics related to risks and project performance was shortlisted from 16 published journals (as shown in Table 4). Then, seven types of project characteristics (type of construction project, type of construction procurement method, type of standard forms of building contract, contract value, project complexity, fast-track project, and new technology involvement) that were considered relevant to the contractual responsibilities of the employers and consultants, and frequently mentioned in the past literature were adapted in this study. The remaining eight types of project characteristics were excluded from the study. Three types of project characteristics such as the type of client, type of project and location of the project were excluded as the unit of analysis of this study focused only on new building construction projects located in Klang Valley awarded under the private sector. The project characteristics such as accessibility of the site, project size (area), comprehensiveness of geotechnical investigation, site condition and weather conditions which were not related to the aim of this paper were also excluded. Additionally, this study introduced different sub-categories, that applied to the unit of analysis of this study (new construction projects under the private sector) (Refer to Table 9).

Table 4: Type of Project Environment Characteristics

| No. | Type of project characteristics * | Previous literature*** | | | | | | | | | | | | | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
| 1 | Type of client (e.g. Government or private) | | | | | √ | | √ | | √ | | | | | | √ | | Excluded |
| 2 | Type of project (e.g. New, expansion or renovation) | | | | | | | | √ | | | | | | | √ | | Excluded |
| 3 | Type of construction project (e.g. Residential, commercial, industrial or infrastructure) | √ | | | | √ | | | | √ | | | √ | √ | | √ | | Adapted** |
| 4 | Location of project | | | | | | | √ | | | √ | | √ | √ | | | | Excluded |
| 5 | Type of construction procurement method (e.g. Traditional or design & build) | | | | | √ | | √ | | | | | | | | √ | | Adapted** |
| 6 | Type of standard forms of building contract (e.g. Proper standard document or improper standard document) | | | | | √ | | | | √ | | | √ | | | | | Adapted** |
| 7 | Contract value (RM) | √ | | | | √ | | √ | √ | | | | √ | | | √ | | Adapted** |
| 8 | Project size (area) | | | | | √ | | | | √ | √ | | | | √ | | | Excluded |
| 9 | Project complexity | | | √ | | √ | √ | √ | | √ | | √ | √ | | √ | | √ | Adapted** |
| 10 | Fast-track project | | √ | | | | | | | | | | | | | | | Adapted** |
| 11 | New technology involvement | | | | √ | | | | | √ | | | | | | | | Adapted** |
| 12 | Accessibility of the site | | | | | | | | | | | | √ | | | | | Excluded |
| 13 | Site condition (e.g. Ordinary or differing) | | | | | √ | | | | | | | | | | | | Excluded |
| 14 | Comprehensiveness of geotechnical investigation | | | | | | | | | | | | √ | | | | | Excluded |
| 15 | Climate & weather conditions | | | | | | | | | | | | √ | | | | | Excluded |

**Note**:
* Multiple-choice answer option varies by research
** Adapted and introduced different sub-categories in this paper (Refer to Table 9 where the multiple-choice answer option refers to sub-category)
*** 1=Alenazi et al. (2022), 2=Alhomadi et al. (2011), 3=Assaad et al. (2020), 4=Cai et al. (2019), 5=Francis et al. (2022), 6=Kamal et al. (2022), 7=Lavikka et al. (2019), 8=Lee and Kim (2021), 9=Ling et al. (2004), 10=Mahamid (2017a), 11=Nguyen et al. (2019), 12=Okudan and Budayan (2020), 13=Sánchez et al. (2020), 14=Shah (2016), 15=Shehu et al. (2015), 16=Simushi and Wium (2020)

### 2.4 Conceptual Model

A conceptual model as depicted in Figure 1 is formulated for the survey instrument development to investigate the relationship between employer-related risks and consultant-related risks (ER and CR as the

independent variables) and contractors' work progress (WP as the dependent variable), and to examine the influence of project characteristics (the moderating variable) on the strength of the relationship between the independent variables and the dependent variable. The directions of the arrows were the assumptions made for relationships between the variables for the survey instrument development and validation in the following sections.

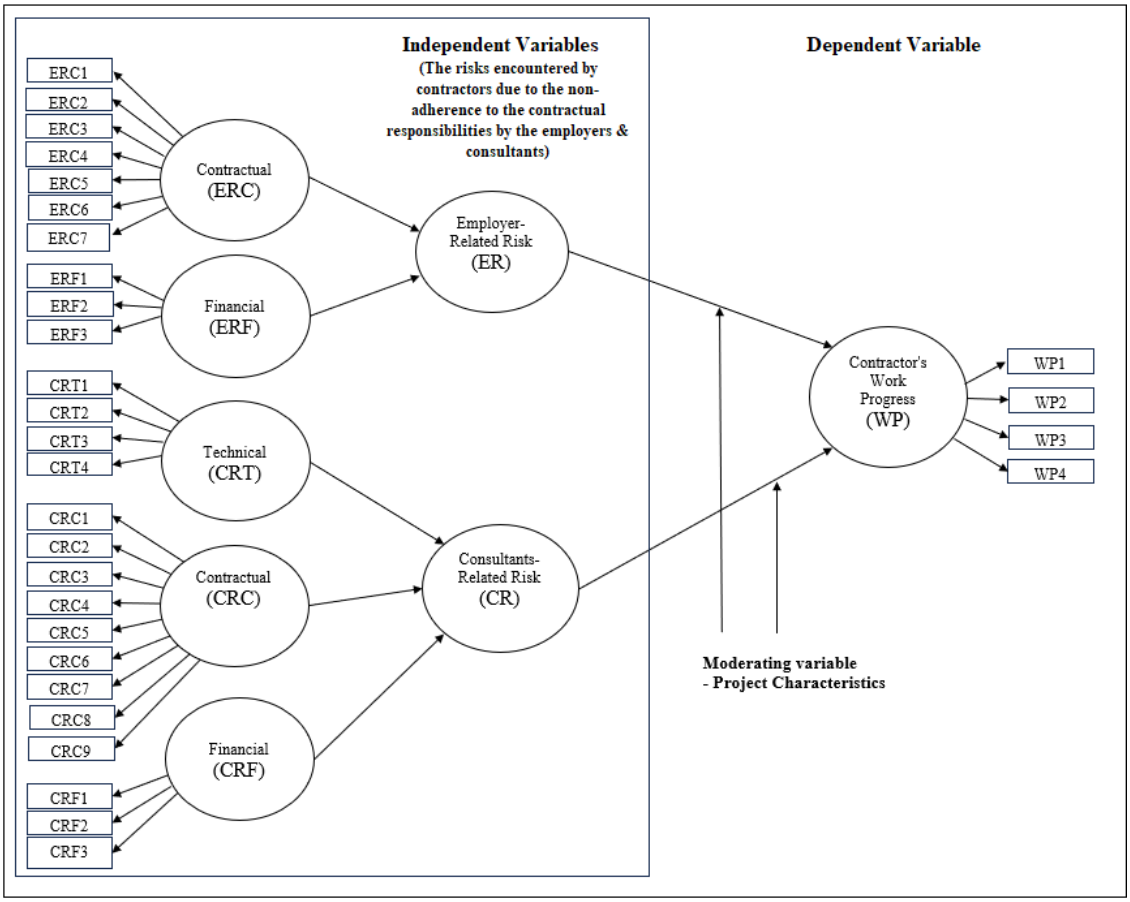


Figure 1: Conceptual Model for Survey Instrument Development

## 3. METHODOLOGY

The process from the generation of variables for instrument development to validation of the instrument used was modified from Almanasreh et al. (2019) who suggested using a three-stage process (instrument development, judgment-quantification, and reformation of the instrument). The following subsections describe the procedures involved in achieving the objectives of this paper, developing a survey instrument, and validating the instrument through expert judgment.

### 3.1 Instrument Development

The list of variables and the corresponding items (37 items) was generated based on the PAM Contract 2018, past literature, and opinions obtained from industry experts. Then, the conceptual term and operational term for each variable were defined. A 43-item survey instrument was designed. The survey was a semi-structured questionnaire in a mixed method (quantitative-qualitative) approach.

### 3.2 Instrument validation

#### 3.2.1 Expert judgment

The method used for instrument validation was content validity through expert judgment. As Almanasreh et al. (2019) suggested using between five and 10 experts, this study referred to eight experts (two employers, two

architects, two quantity surveyors, and two contractors). All the experts are the key personnel of the respective company and have at least 25 years of experience in the construction industry. The experts who represented the employers and contractors were selected based on their involvement in project management. Meanwhile, the architects were chosen based on their expertise in contract management, and the quantity surveyors are the experts in contract and commercial management. The experts in this study were selected from a diverse background and expertise to ensure that different perspectives were considered to mitigate biases during the instrument validation.

An invitation letter was designed to request the selected industry experts' participation in the content validity assessment of the survey questionnaire. The research title, the aim of the study, the objectives of the study and the role of the expert were mentioned in the letter, followed by an attachment of a brief introduction to the study with the definition of terms, a draft questionnaire, and an expert's response form. The response form was divided into three parts (expert's information, content validity assessment, and expert's comments and recommendations). The invitation letters were sent to the experts via email. Upon receiving the experts' agreement to participate in the content validity assessment, the hard copies of the letter of invitation were provided to the experts during the interviews. Each expert was required to rate the relevance of each item to the study, and the clarity, simplicity and ambiguity of each item using a four-point Likert scale as shown in Table 5.

Table 5: Rating Criteria for the Content Validity

| Item | Rating criteria | |
|---|---|---|
| Relevance | 1 = Not relevant | 3 = Relevant but needs minor revision |
| | 2 = The item needs some revision | 4 = Very relevant |
| Clarity | 1 = Not clear | 3 = Clear but needs minor revision |
| | 2 = The item needs some revision | 4 = Very clear |
| Simplicity | 1 = Not simple | 3 = Simple but needs minor revision |
| | 2 = The item needs some revision | 4 = Very simple |
| Ambiguity | 1 = Doubtful | 3 = No doubt but needs minor revision |
| | 2 = Somewhat ambiguous | 4 = Meaning is clear |

**(**Yaghmaie, 2003)

### 3.2.2 Data Analysis

Numerous methods of quantifying experts' degree of agreement regarding the content relevance of an instrument have been proposed (Polit & Beck, 2006). According to the researchers, the most widely reported approach was the content validity index (CVI). As explained by Polit and Beck (2006), the two types commonly used are the content validity of individual items (I-CVI) and the content validity of the overall scale (Ave-CVI).

The data analysis used in this paper for content validity was the content validity index (CVI) and modified Kappa. Past studies have applied different criteria for an acceptable standard of I-CVI. Polit and Beck (2006) recommended that each item should have a minimum I-CVI of 0.78 to be considered relevant and acceptable. This paper validated the relevance of the items to the study based on Polit and Beck (2006) approach, to cut off the I-CVI at 0.78 and Ave-CVI at 0.90 or higher. By referring to Polit et al. (2007), the modified Kappa for each item can be calculated based on the following equations: -

$$\textbf{Modified Kappa, } K = (\text{I-CVI} - P_c) \div (1 - P_c)$$

Where, probability of a chance agreement, $P_c = [N! \div A!\,(N-A)!] * .5^N$
with N= number of experts and A= number of experts who rated 3 or 4 for agreeing on good relevance

Polit et al. (2007) mentioned that after controlling items by calculating modified Kappa, each item with I-CVI equal to or higher than 0.78 would be considered excellent. In other words, modified Kappa could be used to support the interpretation of the I-CVI value for each item in the instrument. This way, the decision to retain or delete an item in the instrument after the I-CVI computation can be re-confirmed with the item's modified Kappa value.

The procedures involved in instrument development and validation for this study are illustrated in Figure 2.

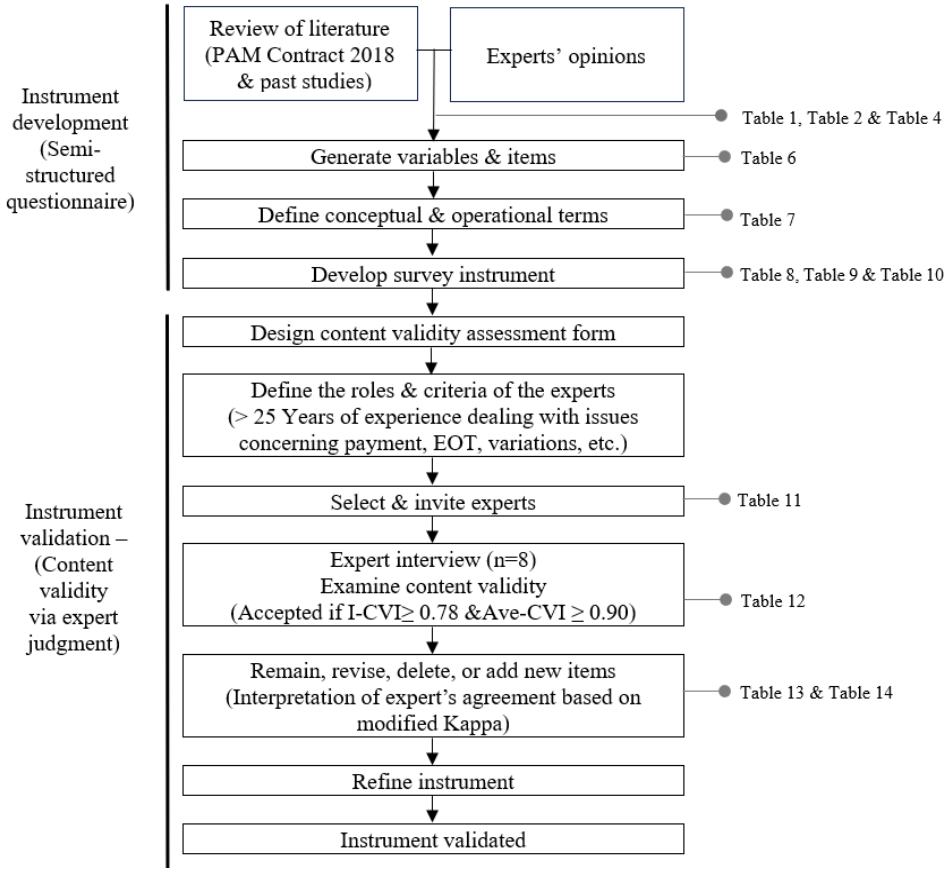


Figure 2: Flow Diagram of Instrument Development and Validation

## 4. FINDINGS AND DISCUSSION

### 4.1 Instrument development

A list of variables and the corresponding items (37 items) as shown in Table 6 was compiled from Section 2 (Literature Review).

Table 6: Variables and Items

| Variable | | Category | Item | Description |
|---|---|---|---|---|
| Independent variable | Employer-related risks (ER) (10 risks) | Contractual | ERC1 | Scope of work not well-defined |
| | | | ERC2 | Scope of work differs from the Contract |
| | | | ERC3 | Delay in giving site possession |
| | | | ERC4 | Inadequate duration of contract period |
| | | | ERC5 | Frequent changes of materials & specifications by the employer |
| | | | ERC6 | Rework due to frequent change orders by the employer |
| | | | ERC7 | Delay in receiving materials, goods or labour that the employer (or contractors engaged by the employer) had agreed to supply or engage |
| | | Financial | ERF1 | Failure to be reimbursed for direct loss and/or expense |
| | | | ERF2 | Delay in receiving interim payment |
| | | | ERF3 | Failure to be reimbursed for the claim on late payment interest (Interest charged by the contractor when interim payment is received after the Period of Honouring Certificate) |
| | Consultants-related risks (CR) | Technical | CRT1 | Discrepancies between bills of quantities, drawings & specifications |
| | | | CRT2 | Incomplete drawings or details |

| | | | | |
|---|---|---|---|---|
| | (16 risks) | | CRT3 | Inaccurate design |
| | | | CRT4 | Frequent design changes by the consultants |
| | | Contractual | CRC1 | Delay in receiving architect instruction corresponding to verbal instruction |
| | | | CRC2 | Delay in receiving contract drawings & unpriced contract bills |
| | | | CRC3 | Delay in receiving drawings, setting-out, specifications & related information |
| | | | CRC4 | Delay in approving & confirming the material specifications |
| | | | CRC5 | Delay in approving shop drawings |
| | | | CRC6 | Delay in performing inspection & testing |
| | | | CRC7 | Frequent changes of materials & specifications by consultants |
| | | | CRC8 | Delay in receiving architect instruction, confirmation or approval for variation works |
| | | | CRC9 | Delay in receiving written notice (issue notice of rejection or issue certificate of EOT) after submission of EOT application |
| | | | CRF1 | Unjustified amount certified for variation claim |
| | | | CRF2 | Delay in confirming the agreed amount for the variation claim |
| | | | CRF3 | Delay in issuing the interim certificate |
| Moderating variable | Project characteristics (PC) (7 items) | | PC1 | Type of construction project |
| | | | PC2 | Type of construction procurement method |
| | | | PC3 | Type of standard forms of building contract |
| | | | PC4 | Contract value (RM) |
| | | | PC5 | Project complexity |
| | | | PC6 | Fast-track project |
| | | | PC7 | New technology involvement |
| Dependent variable | Contractors' work progress (WP) (4 items) | | WP1 | The work progress is disrupted and delays the Completion Date. |
| | | | WP2 | The work progress is disrupted and causes cost overrun to the project. |
| | | | WP3 | The work progress is disrupted and affects the quality of the project. |
| | | | WP4 | The work progress is disrupted and affects the efficiency of the project. |

Table 7: Conceptual and Operational Terms

| Variable | Conceptual definition | Operational definition |
|---|---|---|
| Employer-related risks (ER) | ER refers to the risks encountered by contractors due to the non-adherence to the contractual responsibilities by employers that are beyond a contractor's control | ER is determined by the frequency of occurrence of risks and the impact of risks due to the non-adherence to the contractual responsibilities by employers |
| Consultants-related risks (CR) | CR refers to the risks encountered by contractors due to the non-adherence to the contractual responsibilities by consultants that are beyond a contractor's control | CR is determined by the frequency of occurrence of risks and the impact of risks due to the non-adherence to the contractual responsibilities by consultants |
| Project characteristics (PC) | PC refers to project environment characteristics based on Cho et al. (2009) (e.g. the project scale, the type of project, the level of complexity, site location, etc.) | PC is represented by selecting any items from the list (based on the research hypotheses) that could likely moderate the relationship between the risks (employer-related risks and consultants-related risks) and contractors' work progress |
| Contractors' work progress (WP) | WP refers to the progression of construction activities that have commenced and are still in the process of being completed | WP is determined by the contractors' perception on the consequences of the risks (disruptions) caused by the non-adherence to the contractual responsibilities by employers and consultants |

Table 7 summarises the definitions of the conceptual and operational terms for the variables in this study. A semi-structured questionnaire was designed to consist of four sections as shown in Table 8.

Table 8: Contents of The Questionnaire

| Section | Description | No. of item | Response option |
|---|---|---|---|
| SECTION A | Respondent's Profile | 3 | Multiple-choice |
| SECTION B | Project Information | 7 | |
| SECTION C | Employer-Related Risks & Consultants-Related Risks | 26 | 5-Point Likert scale |
| SECTION D | Work Progress of the Construction Project | | |
| | - PART 1 | 4 | |
| | - PART 2 | 6 (Open-ended questions) | Face-to-face interview (voluntary basis) |

Section A contained three demographic items of respondents. Section B on project information (means project characteristics in this paper) covered seven project characteristics as indicated in Table 9, along with the corresponding multiple-choice answer options that include any possible answers.

Table 9: Project Information Under Section B of The Questionnaire

| Item | Type of project information | Multiple-choice answer option |
|---|---|---|
| PC1 | Type of construction project | Residential, non-residential, or social amenities |
| PC2 | Type of construction procurement method | Traditional, design and build, or others |
| PC3 | Type of standard forms of building contract | PAM Contract 2018/2006, IEM (2017), FIDIC Red Book (2017), AIAC (2019), CIDB (2000), or others |
| PC4 | Contract value (RM) | <RM25m, RM25m - RM49.999m, RM50m - RM99.999m, RM100m - RM249.999m, or ≥RM250m |
| PC5 | Project complexity | Less complex, moderately complex, or highly complex |
| PC6 | Fast-track project | Yes, the project accelerates, overlaps, or compresses schedules with little time buffer between the construction activities, or no |
| PC7 | New technology involvement (BIM, drones, prefabrication, modular construction, AI & robotic, advanced building materials, plant & machinery) | Yes or no |

Subsequent sections of the questionnaire focused on the two independent variables (Section C: employer-related risks and consultants-related risks) and the dependent variable (Section D: contractor's work progress). For Section C, respondents will be asked to rate using a 5-point Likert scale on the frequency of occurrence (1: very unlikely, 2: low likely, 3: likely, 4: highly likely, and 5: near certain) and the level of impact (1: very low, 2: low, 3: medium, 4: high, and 5: very high) of 26 risks on the sampling project. Under Part 1 of Section D, the respondent will be asked about the consequences encountered due to disruptions, and must be answered with a 5-point Likert scale (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, and 5: strongly agree).

Under Section D (Part 2), there were 6 open-ended questions. The questions were designed based on the information and insights obtained during an interview with two industry experts. This part was intended for respondents who volunteered to disclose their real-life experiences on issues about employers' and consultants' non-adherence to contractual responsibilities. Table 10 displays the list of proposed questions and the intention (purpose) of each question to the study.

Table 10: Open-ended Questions Under Section D (Part 2) of the Questionnaire

| Item | Proposed question | Intention |
|---|---|---|
| Q1 | What are the top three risks related to the employers' & consultants' contractual responsibilities that you have encountered during construction? | To justify the quantitative data collected from Section A, Section B, Section C and Section D (Part 1) |
| Q2 | What is the impact of these risks on the overall progress of work? | |
| Q3 | Do you think the occurrence of these risks is related to the project characteristics? If yes, please elaborate. | |

| | | |
|---|---|---|
| Q4 | Are there any other project characteristics (other than the one mentioned in Section B) that influence the occurrence of these risks? If yes, please elaborate. | To discover new ideas for future research |
| Q5 | How do you deal with the non-adherence of the employer & consultants during construction? | 1. To ascertain the effectiveness of the actions taken by the contractor to resolve the issue(s)<br>2. To discover new ideas for future research |
| Q6 | Is there any specific clause(s) in the building contract that you wish to highlight related to the non-adherence of the employers' & consultants' contractual responsibilities? If yes, please elaborate. | To identify (from the contractor's perspective) the clause(s) in the contracts that need to be reviewed by the contracting parties during the tender stage to minimize the issue of non-adherence by employers and consultants for future projects |

### 4.2 Instrument Validation

#### 4.2.1 Expert Judgment

The invitation letters were issued to the experts by email, followed up with phone calls, and received positive responses from all eight experts. An interview was conducted face-to-face with each expert at the expert's convenience over three weeks, commencing between 8th May 2024 and 29th May 2024. Each expert was briefed with an introduction to the study and a guide on the rating scales before conducting the assessment individually. The experts then rated the relevance, clarity, simplicity, and ambiguity of each item using a four-point Likert scale without interference. After completing the tasks, the experts were asked to discuss the reasons for giving low ratings (if any). Before the session ended, the experts suggested ways to improve the questionnaire. The profile of the experts is shown in Table 11.

Table 11: Profile of the Experts

| Expert ID | E1 | E2 | E3 | E4 | E5 | E6 | E7 | E8 |
|---|---|---|---|---|---|---|---|---|
| Designation | Employer | Employer | Architect | Architect | Quantity Surveyor | Quantity Surveyor | Main Contractor | Main Contractor |
| Academic qualification | Master Degree | First Degree | First Degree | First Degree | First Degree | First Degree | Diploma | Diploma |
| Years of experience | 25 | 28 | 28 | 32 | 25 | 26 | 38 | 34 |

#### 4.2.2 Data Analysis and Findings

After the interview, the CVI for each item in the questionnaire (I-CVI) and the average CVI (Ave-CVI) for the relevancy of the questionnaire were calculated and the result is presented in Table 12. Based on Polit et al. (2007) approach, the CVI for each item (I-CVI) was calculated using Microsoft Excel by adding the number of experts who rated the item as 3 or 4, then dividing the total by the number of experts (N = 8 experts). Subsequently, the Ave-CVI for the overall questionnaire was calculated by adding all the I-CVI and dividing it by the number of items in the questionnaire.

As shown in Table 12, 38 out of 43 items have I-CVI above 0.78 and the remaining items have I-CVI below 0.78. Based on Polit et al. (2007) approach, these 38 items were relevant and accepted without changes by the experts, meanwhile, the other five items required either revision or omission according to the interpretation of experts' ratings. The Ave-CVI for the overall questionnaire was initially calculated as 0.902.

Table 12: Content Validity Index (on the relevance of the item)

| Item | E1 | E2 | E3 | E4 | E5 | E6 | E7 | E8 | I-CVI | Interpretation of Expert's Agreement * |
|---|---|---|---|---|---|---|---|---|---|---|
| PC1 | 3 | 2 | 4 | 3 | 4 | 2 | 4 | 3 | 0.75 | Need revision/ omission |
| PC2 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 0.25 | Need revision/ omission |
| PC3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 0.25 | Need revision/ omission |
| PC4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 1.00 | Relevant |
| PC5 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 1.00 | Relevant |
| PC6 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 1.00 | Relevant |
| PC7 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 0.88 | Relevant |
| ERC1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1.00 | Relevant |
| ERC2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1.00 | Relevant |
| ERC3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 0.88 | Relevant |
| ERC4 | 2 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 0.88 | Relevant |
| ERC5 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 1.00 | Relevant |
| ERC6 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 1.00 | Relevant |
| ERC7 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 0.88 | Relevant |
| ERF1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 0.88 | Relevant |
| ERF2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1.00 | Relevant |
| ERF3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 1.00 | Relevant |
| CRT1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 1.00 | Relevant |
| CRT2 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 1.00 | Relevant |
| CRT3 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 1.00 | Relevant |
| CRT4 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 1.00 | Relevant |
| CRC1 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 1.00 | Relevant |
| CRC2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 0.00 | Need revision/ omission |
| CRC3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 1.00 | Relevant |
| CRC4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1.00 | Relevant |
| CRC5 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 1.00 | Relevant |
| CRC6 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 1.00 | Relevant |
| CRC7 | 3 | 3 | 2 | 1 | 2 | 1 | 3 | 3 | 0.50 | Need revision/ omission |
| CRC8 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 1.00 | Relevant |
| CRC9 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 1.00 | Relevant |
| CRF1 | 3 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 1.00 | Relevant |
| CRF2 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 1.00 | Relevant |
| CRF3 | 3 | 3 | 3 | 3 | 4 | 3 | 2 | 4 | 0.88 | Relevant |
| WP1 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 1.00 | Relevant |
| WP2 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 1.00 | Relevant |
| WP3 | 3 | 3 | 4 | 3 | 3 | 4 | 2 | 3 | 0.88 | Relevant |
| WP4 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 1.00 | Relevant |
| Q1 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 1.00 | Relevant |
| Q2 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 1.00 | Relevant |
| Q3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 1.00 | Relevant |
| Q4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 1.00 | Relevant |
| Q5 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 1.00 | Relevant |
| Q6 | 3 | 3 | 3 | 3 | 3 | 2 | 4 | 4 | 0.88 | Relevant |
| No. of items | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | | |
| No. of agreement | 41 | 41 | 39 | 39 | 37 | 36 | 37 | 40 | | |
| Proportion of agreement | 0.95 | 0.95 | 0.91 | 0.91 | 0.86 | 0.84 | 0.86 | 0.93 | | |
| Ave-CVI | | | | | | | | | 0.902 | |

**Note:**
* Item is relevant and acceptable if I-CVI ≥ 0.78 (Polit & Beck, 2006); or item requires revision or omission if I-CVI < 0.78 (Polit et al., 2007)

Next, the modified Kappa for each item was calculated as shown in Table 13 by referring to Polit et al. (2007) to support the interpretation of the I-CVI value for each item in the questionnaire, before deciding to remain,

revise, or delete the item. As shown the table, 38 items have modified Kappa values above 0.74 (I-CVI above 0.78), indicating excellent agreement among the experts. In contrast, there were five items (PC1, PC2, PC3, CRC2 and CRC7) with modified Kappa values below 0.74 (I-CVI below 0.78) which means good or poor agreement from the experts. These items required reconsideration of whether to delete or retain in the questionnaire.

Table 13: Content Validity Index, Modified Kappa and Final Decision (on the relevance of the item)

| Variable | Item (43) | Expert's rating of 3 or 4 (Relevant) | Expert's rating of 1 or 2 (Not relevant) | I-CVI | Pc | K* | Interpretation of Expert's Agreement** | Final decision made (Remained/ revised/deleted) |
|---|---|---|---|---|---|---|---|---|
| PC | PC1 | 6 | 2 | 0.75 | 0.109 | 0.72 | Good | Remained |
| | PC2 | 2 | 6 | 0.25 | 0.109 | 0.16 | Poor | Deleted |
| | PC3 | 2 | 6 | 0.25 | 0.109 | 0.16 | Poor | Remained |
| | PC4 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | PC5 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | PC6 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | PC7 | 7 | 1 | 0.88 | 0.031 | 0.87 | Excellent | Remained |
| ER | ERC1 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | ERC2 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | ERC3 | 7 | 1 | 0.88 | 0.031 | 0.87 | Excellent | Remained |
| | ERC4 | 7 | 1 | 0.88 | 0.031 | 0.87 | Excellent | Remained |
| | ERC5 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | ERC6 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | ERC7 | 7 | 1 | 0.88 | 0.031 | 0.87 | Excellent | Remained |
| | ERF1 | 7 | 1 | 0.88 | 0.031 | 0.87 | Excellent | Remained |
| | ERF2 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | ERF3 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| CR | CRT1 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRT2 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRT3 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRT4 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRC1 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRC2 | 0 | 8 | 0 | 0.004 | 0.00 | Poor | Deleted |
| | CRC3 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRC4 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRC5 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRC6 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRC7 | 4 | 4 | 0.50 | 0.273 | 0.31 | Poor | Deleted |
| | CRC8 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRC9 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRF1 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRF2 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | CRF3 | 7 | 1 | 0.88 | 0.031 | 0.87 | Excellent | Remained |
| WP | WP1 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | WP2 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | WP3 | 7 | 1 | 0.88 | 0.031 | 0.87 | Excellent | Remained |
| | WP4 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| - | Q1 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | Q2 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | Q3 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | Q4 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | Q5 | 8 | 0 | 1 | 0.004 | 1 | Excellent | Remained |
| | Q6 | 7 | 1 | 0.88 | 0.031 | 0.87 | Excellent | Remained |

**Note**:
*Modified Kappa, $K= (I\text{-}CVI- P_c) \div (1- P_c)$ Where, probability of a chance agreement, $P_c = [N! \div A! (N -A)!] *.5^N$
with N= number of experts and A= number of experts who rated 3 or 4 for agreeing on good relevance
** The agreement interpretation criteria for Kappa, using guidelines described in Cicchetti and Sparrow (1981) with Fair if K 0.40 - 0.59; Good if K 0.60 - 0.74; and Excellent if K>0.74.

Finally, out of the five items with both low I-CVI and modified Kappa values, two items (PC1 and PC3) were maintained, and three items (PC2, CRC2, and CRC7) were deleted from the questionnaire (Table 14). The new Ave-CVI for the overall questionnaire was 0.951. Since no further items were suggested by the experts to be included in the variables, the final 34 items representing the variables of PC, ER, CR and WP were deemed sufficient.

Table 14: Summary of Refined Instrument

| Variable | No. of items in the questionnaire | | |
|---|---|---|---|
| | Before validation | After validation | Remark |
| PC | 7 | 6 | 1 item deleted (PC2) |
| ER | 10 | 10 | - |
| CR | 16 | 14 | 2 items deleted (CRC2 & CRC7) |
| WP | 4 | 4 | - |
| - | 6 | 6 | - |
| | **43** | **40** | |

There were a few advice from the experts to improve the questionnaire, (1) to highlight in each section that the survey is merely referring to one construction project to avoid confusing the respondents and affecting the outcome of the study; and (2) to add simple definitions to contractual and construction-related terms such as risk, complexity, late payment interest, change order, cost overrun, etc. to avoid misinterpretation. There was a common agreement among the experts that the questionnaire was comprehensive, and there were no issues with the items' clarity, simplicity and ambiguity. In summary, the wording and meaning of each item in the questionnaire were easily interpreted and clear to the intended respondents from the experts' perspectives. Overall, the experts' feedback was positive. Therefore, only one round of content validity assessment was carried out.

### 4.2.3 Discussion

The minimum requirement for any developed instrument is to have sufficient content validity to advocate the representativeness of its content and the appropriateness of its development process (Almanasreh et al., 2019). The Ave-CVI of 0.951 verified that the overall questionnaire has excellent content validity according to Polit and Beck (2006). The value indicated that the content validity of the questionnaire was not an issue. Hence, the aim to design a valid instrument for investigating the relationship between the risks related to the employers' and consult ants' contractual responsibilities and contractors' work progress, and the moderating role of project characteristics, is accomplished.

Table 15: Summary of Instrument Development and Validation

| Variable | Instrument development (Semi-structured questionnaire) | Instrument validation (Content validity through expert judgment) | |
|---|---|---|---|
| | | No. of items (before validation) | No. of items (after validation) |
| Project Characteristics (PC) | The items were adapted from various sources and different sub-categories were introduced in this paper | 7 | 6 |
| Employer-related risks (ER) | The items (risks related to employers' contractual responsibilities affecting contractors' work progress) were identified by referring to the clauses in the PAM Contract 2018 | 10 | 10 |
| Consultants-related risks (CR) | The items (risks related to consultants' contractual responsibilities affecting contractors' work progress) were identified by referring to the clauses in the clauses in the PAM Contract 2018 | 16 | 14 |
| Contractors' work progress (WP) | The items (outcome due to occurrence of risks during the progress of work) were adapted from various sources | 4 | 4 |
| - | The questions were based on the information and insights obtained during an interview with industry experts who were viewing from contractors' perspectives | 6 | 6 |
| | | **43** | **40** |

The items were refined and a minor revision was made to the questionnaire by considering the experts' opinions. The final version of the validated questionnaire was reduced from 43 items to 40 items (34 items representing the variables; and 6 open-ended questions). The final 34 items in the questionnaire were relevant in representing the variables (PC, ER, CR and WP). Table 15 summarises the findings following the objectives of this paper, (1) to introduce a survey instrument based on a mixed method approach, and (2) to assess the content validity of the proposed instrument through expert judgment.

As seen in Table 13, out of the five items with low I-CVI and low modified Kappa values, two items were retained, and three items were deleted. Two items, item PC1 (the type of construction project) and PC3 (the type of standard forms of building contract) were retained even though the items seemed unnecessary and irrelevant from the experts' viewpoint. The type of construction project (PC1) was retained as it was frequently mentioned in past studies (Refer to Table 4, Item 3). Furthermore, the factors causing cost and time overruns may change due to the type of construction project (Alshihri et al., 2022). As for the types of standard forms of building contract (PC3), Okudan and Budayan (2020) confirmed that contract type was one of the most critical project characteristics affecting the occurrence of risks in construction that could be due to differences in contract structure including risks distribution among the contracting parties. Moreover, this item is meant to obtain further data on the type of building contracts preferred for the different projects or contract values. Item PC3 was therefore retained in the questionnaire.

On the other hand, the other three items were deleted as the items were considered irrelevant and unnecessary from the experts' perspectives. The items were PC2 (type of construction procurement method), CRC2 (delay in receiving contract drawings and unpriced contract bills), and CRC 7 (frequent changes of materials and specifications by consultants). As indicated in Table 12, it was understood by the experts (6 consultants) that the study is related to the risks faced by contractors beyond a contractor's control, which applies to traditional contracts. Thus, item PC2 can be omitted. Meanwhile, all the experts agreed that item CRC2 should be removed because contractors are unlikely to experience delays in receiving contract drawings and unpriced contract bills when both the employer and the contractor have signed the agreement. Lastly, four out of eight experts who rated item CRC7 as irrelevant justified that the item was unnecessary, as based on their experience, the changes of materials and specifications are usually instructed by the employers rather than the consultants.

The results for the I-CVI values (Table 12) and the modified Kappa results (Table 13) were similar. The additional procedures and time spent to compute the modified Kappa values did not yield any considerable difference in the results. The decisions regarding whether to remain, revise, or delete the items remained contingent on the rationale provided to ascertain the significance of these items to the overall study.

Previous studies concerning construction risks employed diverse methods of instrument validation although the validity assessments were not described in detail. The predominant ones were conducting pilot studies (Abdellatif & Alshibani, 2019; Alshihri et al., 2022; Sambasivan & Soon, 2007; Shehu et al., 2015; Singh et al., 2018; Wang et al., 2018; Yap et al., 2021; Yousri et al., 2023) and obtaining views from subject matter experts (Banerjee Chattapadhyay et al., 2021; Bin Seddeeq et al., 2019) to verify the validity, relevance and clarity of the proposed items. However, according to Souza et al. (2017), conducting validation of a new survey instrument that is merely based on interviews or discussions may produce biased outcomes. Therefore, the validation of the survey instrument in this study involved two approaches, the qualitative approach (expert judgment) and the quantitative approach (content validity index) as recommended by Souza et al. (2017). The advantage of engaging the experts in this study was evidenced when the consensus among the experts verified that certain items (5 out of 43 items) required further evaluation and consideration, before the decision to remain, revise, or delete the items was made. Meanwhile, the CVI approach was adopted in this study as according to Almanasreh et al. (2019), CVI has been the most extensively applied practice, user-friendly, and easily interpreted by the instrument developer to decide whether to retain, modify, or omit items from an instrument.

## 5. CONCLUSION

This paper introduced a survey instrument and validated it through expert judgment, where the CVI method was applied to quantify content validity. The approach adopted in the study ensures that the items included in the proposed instrument are clear and appropriately represent the key variables (employer-related risks, consultants-related risks, project characteristics, and contractors' work progress) crucial to the study in enhancing the contractors' work progress in the Malaysian construction industry. The validated instrument is intended to be used

by future researchers who explore the risks related to the non-adherence to the contractual responsibilities by employers and consultants, and the moderating role of project characteristics on the relationship between the risks and contractors' work progress. This paper presents the procedures adopted for developing and validating the survey instrument. The findings of this paper are valuable for future researchers in developing survey instruments. A deeper understanding of instrument development processes would motivate them to critically evaluate and apply the variables appropriately within their contexts.

Two limitations in this paper should be explored to provide directions for future research. First, the selection of items for the independent variables (employer-related risks and consultants-related risks) was only based on one source (the PAM Contract 2018) rather than involving a few sources. Despite the similar clauses across various standard forms of building contracts, the way the risks are allocated among the contracting parties on each clause and the time provisions in the PAM Contract 2018 may not be the same as other building contracts. Consequently, the findings in this paper may lack generalizability across building construction projects that use different types of contracts. Hence, it is recommended that future research explore other standard forms of building contracts as a comparison. Secondly, the proposed instrument that was intended to analyze the new building construction projects for the private sector has only undergone one round of content validity assessment. Researchers interested in exploring the issue in the future in different construction contexts are encouraged to pre-test the deemed validated instrument to determine its reliability before distributing it to the intended respondents.

## 6. REFERENCES

Abdellatif, H., & Alshibani, A. (2019). Major factors causing delay in the delivery of manufacturing and building projects in Saudi Arabia. *Buildings*, *9*(4), 93.

Alenazi, E., Adamu, Z., & Al-Otaibi, A. (2022). Exploring the nature and impact of client-related delays on contemporary Saudi construction projects. *Buildings*, *12*(7), 880.

Alhomadi, A., Dehghan, R., & Ruwanpura, J. (2011). The predictability of fast-track projects. *Procedia Engineering*, *14*, 1966-1972.

Almanasreh, E., Moles, R., & Chen, T. F. (2019). Evaluation of methods used for estimating content validity. *Research in social and administrative pharmacy*, *15*(2), 214-221.

Alshihri, S., Al-Gahtani, K., & Almohsen, A. (2022). Risk factors that lead to time and cost overruns of building projects in Saudi Arabia. *Buildings*, *12*(7), 902.

Anuar Othman, A., Victor Torrance, J., & Hamid, M. A. (2006). Factors influencing the construction time of civil engineering projects in Malaysia. *Engineering, construction and Architectural management*, *13*(5), 481-501.

Assaad, R., El-Adaway, I. H., & Abotaleb, I. S. (2020). Predicting project performance in the construction industry. *Journal of construction engineering and management*, *146*(5), 04020030.

Aziz, R. F., & Abdel-Hakam, A. A. (2016). Exploring delay causes of road construction projects in Egypt. *Alexandria Engineering Journal*, *55*(2), 1515-1539.

Banerjee Chattapadhyay, D., Putta, J., & Rao P, R. M. (2021). Risk identification, assessments, and prediction for mega construction projects: A risk prediction paradigm based on cross analytical-machine learning model. *Buildings*, *11*(4), 172.

Bin Seddeeq, A., Assaf, S., Abdallah, A., & Hassanain, M. A. (2019). Time and cost overrun in the Saudi Arabian oil and gas construction industry. *Buildings*, *9*(2), 41.

Cai, S., Ma, Z., Skibniewski, M. J., & Bao, S. (2019). Construction automation and robotics for high-rise buildings over the past decades: A comprehensive review. *Advanced Engineering Informatics*, *42*, 100989.

Cheng, M.-Y., Wibowo, D. K., Prayogo, D., & Roy, A. F. (2015). Predicting productivity loss caused by change orders using the evolutionary fuzzy support vector machine inference model. *Journal of Civil Engineering and Management*, *21*(7), 881-892.

Cho, K., Hong, T., & Hyun, C. (2009). Effect of project characteristics on project performance in construction projects based on structural equation model. *Expert systems with applications*, *36*(7), 10461-10470.

Cicchetti, D. V., & Sparrow, S. A. (1981). Developing criteria for establishing interrater reliability of specific items: applications to assessment of adaptive behavior. *American journal of mental deficiency*, *86*(2), 127-137.

Combley, R. (2011). *Cambridge business English dictionary*. Cambridge University Press.

Doloi, H., Sawhney, A., Iyer, K., & Rentala, S. (2012). Analysing factors affecting delays in Indian construction projects. *International journal of project management*, *30*(4), 479-489.

Francis, M., Ramachandra, T., & Perera, S. (2022). Disputes in construction projects: A perspective of project characteristics. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *14*(2), 04522007.

Gunduz, M., & Mohammad, K. O. (2020). Assessment of change order impact factors on construction project performance using analytic hierarchy process (AHP). *Technological and Economic Development of Economy*, *26*(1), 71-85.

Heravi, G., & Mohammadian, M. (2021). Investigating cost overruns and delay in urban construction projects in Iran. *International Journal of Construction Management*, *21*(9), 958-968.

Kamal, A., Abas, M., Khan, D., & Azfar, R. W. (2022). Risk factors influencing the building projects in Pakistan: from perspective of contractors, clients and consultants. *International Journal of Construction Management*, *22*(6), 1141-1157.

Khodeir, L. M., & Mohamed, A. H. M. (2015). Identifying the latest risk probabilities affecting construction projects in Egypt according to political and economic variables. From January 2011 to January 2013. *HBRC journal*, *11*(1), 129-135.

Lavikka, R. H., Kyrö, R., Peltokorpi, A., & Särkilahti, A. (2019). Revealing change dynamics in hospital construction projects. *Engineering, construction and Architectural management*, *26*(9), 1946-1961.

Lee, K.-W., & Kim, K.-H. (2021). Analyzing Cost and Schedule Growths of Road Construction Projects, Considering Project Characteristics. *Sustainability*, *13*(24), 13694.

Ling, F. Y. Y., Chan, S. L., Chong, E., & Ee, L. P. (2004). Predicting performance of design-build and design-bid-build projects. *Journal of construction engineering and management*, *130*(1), 75-83.

Lopez, A., Caffò, A. O., Tinella, L., & Bosco, A. (2023). The four factors of mind wandering questionnaire: content, construct, and clinical validity. *Assessment*, *30*(2), 433-447.

Mahamid, I. (2017a). Analysis of schedule deviations in road construction projects and the effects of project physical characteristics. *Journal of Financial Management of Property and Construction*, *22*(2), 192-210.

Mahamid, I. (2017b). Schedule delay in Saudi Arabia road construction projects: size, estimate, determinants and effects. *International Journal of Architecture, Engineering and Construction*, *6*(3), 51-58.

Memon, A. H. (2014). Contractor perspective on time overrun factors in Malaysian construction projects. *International Journal of science, Environment and technology*, *3*(3), 1184-1192.

Memon, A. H., Rahman, I. A., & Azis, A. A. (2012). Time and cost performance in construction projects in southern and central regions of Peninsular Malaysia. *International Journal of advances in applied sciences*, *1*(1), 45-52.

Muya, M., Kaliba, C., Sichombo, B., & Shakantu, W. (2013). Cost escalation, schedule overruns and quality shortfalls on construction projects: The case of Zambia. *International Journal of Construction Management*, *13*(1), 53-68.

Mydin, M. O., Sani, N. M., Salim, N. A., & Alias, N. M. (2014). Assessment of influential causes of construction project delay in Malaysian private housing from developer's viewpoint. In *E3S Web of Conferences* (Vol. 3, p. 01027). EDP Sciences.

Nguyen, L. D., Le-Hoai, L., Tran, D. Q., Dang, C. N., & Nguyen, C. V. (2019). Effect of project complexity on cost and schedule performance in transportation projects. *Construction Management and Economics*, *37*(7), 384-399.

Okudan, O., & Budayan, C. (2020). Assessment of project characteristics affecting risk occurrences in construction projects using fuzzy AHP. *Sigma Journal of Engineering and Natural Sciences*, *38*(3), 1447-1462.

PAM. (2018). Agreement and Conditions of PAM Contract 2018 (With Quantities). In: Pertubuhan Akitek Malaysia.

Polit, D. F., & Beck, C. T. (2006). The content validity index: are you sure you know what's being reported? Critique and recommendations. *Research in nursing & health*, *29*(5), 489-497.

Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in nursing & health*, *30*(4), 459-467.

Sambasivan, M., & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. *International journal of project management*, *25*(5), 517-526.

Sánchez, O., Castañeda, K., Mejía, G., & Pellicer, E. (2020, March). Delay factors: A comparative analysis between road infrastructure and building projects. In *Construction Research Congress 2020* (pp. 223-231). Reston, VA: American Society of Civil Engineers.

Shah, R. K. (2016). An exploration of causes for delay and cost overrun in construction projects: A case study of Australia, Malaysia & Ghana. *Journal of Advanced College of Engineering and Management*, *2*(1), 41-55.

Shehu, Z., Holt, G. D., Endut, I. R., & Akintoye, A. (2015). Analysis of characteristics affecting completion time for Malaysian construction projects. *Built Environment Project and Asset Management*, *5*(1), 52-68.

Simushi, S., & Wium, J. (2020). Time and cost overruns on large projects: Understanding the root cause. *Journal of Construction in Developing Countries*, *25*(1), 129-146.

Singh, S., Bala, A., Dixit, S., & Varshney, D. (2018). Critical analysis of causes of delay in residential construction projects in India. *International Journal of Civil Engineering and Technology*, *9*(1), 330-345.

Souza, A. C. d., Alexandre, N. M. C., & Guirardello, E. d. B. (2017). Psychometric properties in instruments evaluation of reliability and validity. *Epidemiologia e servicos de saude*, *26*, 649-659.

Taylan, O., Bafail, A. O., Abdulaal, R. M., & Kabli, M. R. (2014). Construction projects selection and risk assessment by fuzzy AHP and fuzzy TOPSIS methodologies. *Applied soft computing*, *17*, 105-116.

Tessema, A. T., Alene, G. A., & Wolelaw, N. M. (2022). Assessment of risk factors on construction projects in gondar city, Ethiopia. *Heliyon*, *8*(11).

Wang, T.-K., Ford, D. N., Chong, H.-Y., & Zhang, W. (2018). Causes of delays in the construction phase of Chinese building projects. *Engineering, construction and Architectural management*, *25*(11), 1534-1551.

Yaghmaie, F. (2003). Content validity and its estimation. *Journal of medical education*, *3*(1).

Yap, J. B. H., Goay, P. L., Woon, Y. B., & Skitmore, M. (2021). Revisiting critical delay factors for construction: Analysing projects in Malaysia. *Alexandria Engineering Journal*, *60*(1), 1717-1729.

Yousri, E., Sayed, A. E. B., Farag, M. A., & Abdelalim, A. M. (2023). Risk identification of building construction projects in Egypt. *Buildings*, *13*(4), 1084.

Zidane, Y. J.-T., & Andersen, B. (2018). The top 10 universal delay factors in construction projects. *International Journal of Managing Projects in Business*, *11*(3), 650-672.