



Exploring the key risk factors impeding the performance of highway construction projects: An evidence from Nigeria

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Abstract

Purpose- Construction projects, and particularly highway infrastructures, are known to be major contributors to the socio-economic growth of developing countries. However, these types of projects are infamous for being highly risky, due to the interplay of numerous risk factors. This study explored the key risk factors impacting on the performance of highway infrastructure projects in Nigeria: from a contextual viewpoint of key industry stakeholders.

Design/methodology/approach- Qualitative data was collected using semi structured interviews. Specifically, 17 in-depth expert interviews were conducted with experienced stakeholders in the highway sector of the Nigerian construction industry. The collected data was transcribed and analysed using an established coding framework (grounded on case study approach, principles of thematic analysis and saliency analysis).

Findings- Overall, 17 key risks were identified from the data analysis process and 6 risks were recognised as the most significant, based on the combination of prevalence of occurrence and significance of the coded information. The 6 top risks were: change in government, corruption, cost of construction materials, inflation, project funding issues and construction project delay. However, the first two of these risks (change in government and corruption) are politically related, which is specific and unique to the setting of Nigeria and thus might be seen as discouraging indicators that could have an impact on attracting foreign investors/contractors to Nigeria.

Originality- The study addressed the gap related with identifying context specific risk factors impeding the performance of highway projects in Nigeria from the viewpoints of industry experts. It is expected that the findings will provide a better insight into the various risk factors and thus aid relevant policy makers to provide context specific mitigating strategies.

Keywords: Nigeria; risk factors; highway construction projects; coding framework; risk identification; performance.

1. Introduction

The construction industry globally, and specifically in developing countries (including Nigeria), has contributed to individual countries' socioeconomic development. In particular, the highway infrastructure sector is one of the bedrocks of this development and one of the largest areas of public sector investment in Nigeria (Mahmud *et al.* 2021).

In recent years, significant funds have been dedicated to the provision and expansion of major highway infrastructure projects in Nigeria, by the Federal Government of Nigeria, in order to bridge the infrastructural gap and enhance the lives of their citizens (Mahmud *et al.* 2022). For instance, over 220 projects worth over N2.3 trillion (\$6.04 billion- 2021 prices) are still ongoing across different regions in Nigeria (Mahmud *et al.* 2021). These projects are mostly funded from the Federal budget and in some instances special intervention funding such as a fixed-income capital market instrument i.e. sovereign Sukuk bonds by the public sector. While construction projects globally are usually faced with significant risk issues such as cost

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overruns, corruption, project delay, technical difficulties, insufficient information and so on, a large number of highway projects in Nigeria have faced risks and uncertainties, which often result in outright abandonment of projects in certain situations (Mahmud *et al.* 2022). In fact, Mahmud *et al.* (2022) cited Nigeria as a perfect example of a developing country with a large number of abandoned projects, including highway projects.

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Project risks play a vital role in the construction industry and can be described in terms of an uncertain situation which, when it happens, will result in a positive or negative impact on one or more project objective (PMI, 2008; El-Sayegh *et al.* 2021). In practice, the negative impact of the risk has devastating consequences for the overall performance of projects. Ensuring effective delivery of construction projects to meet costs, schedule, performance and environmental sustainability requirements requires identifying and managing the risks to the projects at all project stages, from conceptualisation to termination, particularly from a contextual perspective (Mahmud *et al.* 2021). The complexities of highway construction projects, and the involvement of many parties with diverse interests, exposes the construction industry to more risks and uncertainties compared to other industries or businesses (Dey and Ogunlana, 2004; Zeng *et al.* 2007). Many project failures have been related to inadequate identification and understanding of project risks and eventual poor risk management (Zou *et al.* 2007; Abdelgawad and Fayek, 2010), and thus failure to understand and manage construction project risks effectively can lead to an inability to achieve the desired project objectives, resulting in: lack of quality and issues related to the functionality of the facilities (Choudhry and Iqbal, 2013; Zhang, 2016), flawed planning, possible breakdown in the relationship between the client and the contractors, difficulties in delivering the project, and inevitable project delays and cost overruns.

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Previous research efforts in the area of risk identification within the Nigerian context have only been directed towards identifying and evaluating the impact of risk on building projects, specifically from a positivist perspective (Ibrahim *et al.* 2006; Dada and Jagboro 2007; Ogunsanmi *et al.* 2011; Oyewobi *et al.* 2012). Furthermore, considerable research efforts have identified and assessed specific risk factors (such as cost overrun or project delay) or focused on a particular region or state, as attested by Salawu and Abdullah (2015), Amadi and Higham (2017), Anigbogu *et al.* (2019) and Mahmud *et al.* (2021). For instance, the Mahmud *et al.* (2021) study focused on understanding cost overrun issues prevalent in highway projects in Nigeria from a contextual perspective, and not on general highway project risks. Understanding the general risk factors impacting on the performance of highway projects in Nigeria qualitatively is vital in order to acknowledge the contextual circumstances of these risks and the unique peculiarities attributed to the context of Nigeria. Accordingly, the present study examined risk factors impacting on the performance of highway construction projects in Nigeria from a contextual viewpoint of key industry stakeholders.

54 55 56 57 58 59 60 **2. Literature review**

Risks in highway projects have been attracting the attention of researchers for decades globally. Risks have been variously categorised and thus are country specific. For instance, Tar and Carr (2000) categorised risks as being either internal (within the contractor's control) or external (beyond the contractor's control). In the context of highway projects, which are considered

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3 high-risk endeavours due to the involvement of high capital investment, increased complexity
4 and high dependence on economic, social and political uncertainties etc. (Zayed *et al.* 2008;
5 Ahmadi *et al.* 2017; Deep *et al.* 2022), risks are an issue of concern, particularly in highway
6 infrastructure projects. The uncertainties could significantly derail the successful delivery of
7 projects despite investment. To understand the context of the various risk issues, numerous
8 studies were reviewed. For instance, Ogbu and Adindu (2020) evaluated the relationship
9 between direct risk factors and cost performance of road projects in Nigeria from the
10 perspective of the contractors. Their results indicated that a significant positive relationship
11 exists between the aggregate project risk (project risk index of cost (PRIC)) and cost
12 performance of the projects, with eleven risk factors presenting the most direct risks to the cost
13 performance of road projects. These risk factors include: safety and security, force majeure,
14 geotechnical risks, payments delay/cash flow problems, change of input resource prices,
15 interest rate changes/cost of funds, lack of experience, poor estimating, defective design,
16 incompetent supervision, and unethical practices.

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18 Mahmud *et al.* (2021) investigated the drivers of cost overrun risk in highway projects in
19 Nigeria. The analysis identified drivers from macroeconomic, societal, leadership and project
20 management perspectives, with synergistic relationships with each other. Among the main risk
21 factors were: delay in progress of work, political instability, adverse weather, social issues,
22 delay in payment to contractors, and modification of project scope.

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24 Kaliba *et al.* (2009) investigated the main causes and effects of cost escalation and schedule
25 delays risks in highway construction projects in Zambia between 2006 and 2007. The findings
26 of their study revealed that reasons for cost overrun risk are: unfavourable weather, change in
27 scope of projects, environmental issues, schedule delays, civil unrest, pressure from
28 government at a local level, technical difficulties, and inflation.

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30 Mansfield *et al.* (1994) conducted a research on the key cost escalation risks in Nigerian
31 highway projects and identified the following main risk factors: finance and payment for
32 completed works by the client, poor contract management, shortage of materials, inaccurate
33 cost estimates, and fluctuations in prices of materials.

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35 Amadi and Higham (2017) investigated the impact that inadequate geotechnical
36 investigation has on the cost performance of highway projects in the Niger Delta region of
37 Nigeria, and revealed that adverse ground condition is the primary trigger of high cost overrun.

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39 Leo-Olagbaye and Odeyinka (2018) conducted a study on the risk factors that impact the
40 financial performance of highway projects in Osun state, Nigeria. The study found changes in
41 scope, defective design, changes in the initial design, delay in the availability of design
42 information and adverse weather conditions to be the most significant risk factors.

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44 Anigbogu *et al.* (2019) examined the causes of cost overrun risk using questionnaire
45 responses, complemented by analysis of project documents and interviews, to affirm the
46 significance of the factors from key stakeholders involved in highway infrastructure
47 development in the Federal Capital Territory, Nigeria. The findings showed that inflation,
48 fluctuation of prices, exchange rate, government-related issues like changes in policies,
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3 variation, delays in payment to contractors, design changes, corruption and unforeseen ground
4 conditions were the key contributory causes.
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6 Genc (2021) studied the significant risk factors impacting the Turkish construction projects
7 using a questionnaire survey. Findings revealed that delays in payments, speculations on prices,
8 failure to complete the work within expected budget limits, late change-order requests of
9 project stakeholders, economic matters such as inflation, and unqualified
10 subcontractors/workers/staff during the process were the most significant risk factors.
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13 El-Sayegh and Mansour (2015) investigated the risk issues associated with highway
14 construction projects in United Arab Emirates (UAE) based on the perspectives of local
15 construction professionals in the UAE. The study revealed that the most significant risks
16 include: inefficient planning, unexpected ground utilities, quality and integrity of design,
17 delays in approvals, and delays in expropriation. These were categorised into internal or
18 external risk factors, with internal project risks found to be more significant than external risks.
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22 Liu *et al.* (2016) examined the effects of risk on construction projects in China from the
23 contractors' perspective and concluded that different construction standards, uncertainty about
24 subsurface conditions, different measurement systems, unclear specifications, and productivity
25 decrease were the most significant construction risk factors.
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28 Deep *et al.* (2022) investigated the critical factors influencing the performance of highway
29 projects in India based on questionnaire surveys. They concluded that the complexity of the
30 subcontractor's performance, frequent modifications in alignment, project design, loopholes in
31 safety, and ambiguities in specifications were the main factors that impacted the performance
32 of highway projects.
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35 Hiyassat *et al.* (2020) assessed the risk factors affecting the performance of public sector
36 projects in terms of claims and disputes in the Jordanian construction industry. The results
37 indicate that the top-ranking risk factors are: delays in client payments, poorly tailored contract
38 forms, competition, delay in approval of permits, default by subcontractors, unclear
39 specifications, material prices fluctuations, different construction standards, changes in design,
40 and poor design.
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43 Love *et al.* (2015) conducted a study on 49 publicly procured highway projects in Australia
44 to investigate cost overrun risk factors. The findings revealed that scope changes, and errors
45 and omissions in contract documents were identified as the main risk factors.
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48 Creedy *et al.* (2010) investigated cost overrun risk factors in highway construction projects
49 in Queensland, Australia. The findings revealed that design changes and changes in scope were
50 the most significant risk factors in the highway projects.
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53 Gkritza and Labi (2008) investigated the attributable factors of cost overrun risk in Indiana,
54 USA, focusing on specific project attributes such as contract bidding process, the type of the
55 project, and the project physical environment. The study highlighted predominant risk factors,
56 including inaccuracy in project cost estimates, design errors, project delay, changes in scope,
57 unexpected site conditions, increased costs of materials and labour largely due to inflation,
58 and/or unforeseen events.
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3 Verweij *et al.* (2015) analysed 45 transportation projects in the Netherlands, including
4 highways, in order to explore the key risk factors associated with cost overrun. The study
5 identified major contributors, including as scope changes, errors and omissions in contract
6 documentation, and technical challenges due to inadequate geotechnical examination.
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9 Based on the review of relevant literature and the top 5 risk factors as shown in Table I, it
10 is evident that construction projects, and indeed highway projects, particularly in developing
11 countries, are impacted by various risk factors which vary from one context to another.
12 However, the prevailing studies on Nigerian construction projects have focused on specific risk
13 factors rather than general risk factors. As espoused by Durdyev *et al.* (2017), research findings
14 in other contexts may not be fully applicable to the Nigerian context due to divergence in socio-
15 cultural, regulatory, legislative and project specific issues. Therefore, it is vital to examine the
16 contextual risk factors so that relevant stakeholders and policy makers can have a holistic
17 understanding of these risks, which can then support them in making informed policy decisions.
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22 **Table I. Summary of Top Five (5) Risk Factors**

23 **3. Research methodology**

24 *3.1 Data collection*

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26 To understand the risks impacting highway project performance in Nigeria, a qualitative case
27 study approach was adopted as espoused by Ahmed *et al.* (2018), Ahmed *et al.* (2019) and
28 Mahmud *et al.* (2021). This is also in line with the recommendation by Mahmud *et al.* (2021)
29 on taking a contextually embedded view, in order to have a broader understanding of the
30 specific risks impacting the performance of highway projects in Nigeria.
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35 To collect data for the study, interviews were used. Amaratunga *et al.* (2002) emphasised
36 that interviews are the most extensively used data collection technique in construction
37 management research, and hence provide valuable and unique data that unfolds naturally from
38 the viewpoints of participants (Lopez and Whitehead, 2013). Specifically, a semi-structured
39 in-depth expert interview was conducted with experienced stakeholders in the highway sector
40 of the Nigerian construction industry. This is in line with the recommendation of Barriball and
41 White (1994) that semi-structured interviews are well suited for exploring stakeholders' views
42 about complex issues. In all, 17 top management personnel from the public agency,
43 consultants' and contractors' organisations were purposely selected, based on their
44 backgrounds and years of experience, in line with Shafiq (2021) and Olatunde *et al.* (2022),
45 Mahmud *et al.* (2021) and Mahmud *et al.* (2022). The interviews lasted between 45 and 60
46 minutes. This sample size is considered adequate considering the assertion of Flick (2014), and
47 when compared with other studies such as Amadi and Higham (2017) (16 participants), Dora
48 and Babu (2018) (8 participants), Mahmud *et al.* (2021) and Mahmud *et al.* (2022) (16
49 participants). The main criteria for selecting the stakeholders were: their willingness to
50 participate, experience and knowledge in the provision of highway projects in the Nigerian
51 construction industry, and ease of accessibility in line with the recommendation of Jallow
52 (2020). As shown in Table II, the relevant interviewees were presented with their respective
53 organisations, the code assigned to each interviewee, and their years of experience. Each
54 interviewee was represented using their respective organisation type as acronyms and the
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3 sequence of the conduct of the interviews, as espoused by Mahmud *et al.* (2021). For instance,
4 CNT_01 represent interviewee 1 from the contractor organisation, CLI_01 represent
5 interviewee 1 from the client organisation and CON_01 represent interviewee 1 from the
6 consultant organisation respectively.
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9 The participants were asked questions about the major risk factors affecting the performance
10 of highway projects in Nigeria.
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12 **Table II. Summary of interviewees' background information**

13 *3.2 Data analysis*

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15 This research study adopted a framework developed by Mahmud *et al.* (2021) and Mahmud *et*
16 *al.* (2022) to analyse qualitative data collected through interviews. The framework involves
17 five stages of data analysis process (see Figure I). Mahmud *et al.*'s data analysis framework
18 was formulated based on the principles of: thematic analysis (steps 1-5) (Braun and Clarke,
19 2006), saliency analysis (an extension of thematic analysis) (Buetow, 2010), case study
20 approach (which also focuses on theory building) (Yin, 2014), and synthesis of key elements
21 of established coding approaches developed by Turner *et al.* (2013a) (which is adaptable to
22 asynchronous data), (Kim and Andersen (2012), Yearworth and White (2013), Eker and
23 Zimmermann (2016)) to analyse transcribed qualitative data from the interviews. The coding
24 framework incorporates steps 1-5 of the thematic analysis framework. The process entails
25 identifying and defining the problem, and establishing the system boundary through the
26 generation of codes, the categorisation of these codes into themes, further analysis of the data
27 to identify the key themes and the causal statements that reflect the mental models of the
28 stakeholders (steps 1-4), and defining and naming the themes, i.e. identifying the essence of
29 what the theme is about and identifying and establishing any relationships between the various
30 themes (step 5). However, for this study, only steps 1 and 2 of the adopted coding framework
31 were used to analyse the data, as utilised by Mahmud *et al.* (2021), and this corresponds to
32 steps 1-5 of the thematic analysis framework of Braun and Clarke (2006). To perform the
33 coding process, we transcribed the interview data and employed computer-aided qualitative
34 data analysis software, Nvivo 12, which has a distinct feature that is used to establish and
35 maintain links between the coded extracts and the identified codes.
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38 *3.2.1 Identifying codes and discovering themes in the data*

39 This is the first stage of the coding process and it incorporates the first three (3) steps (i.e. steps
40 1, 2 and 3) of the thematic analysis framework introduced by Braun and Clarke (2006). We
41 adopted this stage of the coding process to define and establish the relevant boundaries of the
42 problem, to support the identification of the information relevant to the research question
43 through coding of the transcribed interview data. During the coding process, two (2) forms of
44 statements were identified. Firstly, we identified open statements that clearly provided a clue
45 to a concept (i.e. original terms from the interview transcripts), which were represented by
46 context specific codes. Secondly, there were some statements that did not disclose a concept
47 with clear references, for which the codes were borrowed from existing empirical literature.
48 The essence of identifying these statements was to ensure that concepts that were not explicitly
49 mentioned in the data could be coded.
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To ensure that the problem was narrowed down to the most vital elements and information that would eventually be used or utilised throughout the data analysis process to create the relevant themes, we ensured that the developed codes were revised or revisited numerous times iteratively. At this stage, the idea of which themes represented the coded extracts began to become apparent, and we began to have some initial ideas of the themes that would emerge as a result of observed dominant patterned relationships of the various codes or codes of similar status.

3.2.2 *Categorising and aggregating codes into refined themes from all interview data*

This is the second step of the coding process and incorporates steps 4 and 5 of the thematic analysis framework introduced by Braun and Clarke (2006), which entails examining the generated codes and assessing the collective relevance of the codes to a particular theme. We linked the nodes (in the form of child nodes) that referred to similar concepts to each other, and then assigned a representative theme, and a final coding tree was formed iteratively from this step. We then revised and regrouped the coded data extracts and created refined themes of the aggregated relevant coded information.

To further support the identification of themes which were both important and prevalent, and to ensure that we did not ignore key information relevant to the problem or research question due to non-prevalence, we considered information that was both salient and prevalent within the data, as recommended by Mahmud *et al.* (2021) and Mahmud *et al.* (2022) (see Figure 2). For instance, themes that had statements of emphasis about importance, such as *'this is very serious'*, *'one of the main reasons'* etc. were considered salient and highly important, even if they were not prevalent, and those statements that had frequently occurring codes were identified and regarded as frequent. However, we ignored themes that were neither frequent nor important, in line with the recommendation of Mahmud *et al.* (2021) and Mahmud *et al.* (2022).

Figure I. Coding framework

Adapted from Mahmud *et al.* (2021) and Mahmud *et al.* (2022)

Figure II: Saliency Framework Matrix

Adapted from Mahmud *et al.* (2021) and Mahmud *et al.* (2022)

4. Results and discussion

4.1 Results

The interview data analysis process resulted in the generation of several themes (risk factors). The themes identified indicate that the risk factors evolved from a contextual perspective as prescribed by Mahmud *et al.* (2021). The risk factors (themes) were categorised into technical, political, social and economic factors, as suggested by Mahmud *et al.* (2021). Hence, to avoid missing out on useful information, we considered information representing coded extracts and eventual themes that were not prevalent but were vital to the problem during the process of coding and theme identification, as recommended by Mahmud *et al.* (2021). **Tables III and IV**

present the frequency and saliency of themes, and **Table V** presents the six (6) top risk factors based on the matrix combination shown in Figure II.

4.1.1 Frequently occurring themes

Based on the data analysis process, some themes were identified as having a high frequency of occurrence and other themes were less frequent. **Table III** shows the level of frequency of various themes (risk factors).

Table III. Frequency of occurrence

4.1.2 Salient themes

Using the matrix combination: 1- recurrent and important, 2- important but not recurrent, recurrent and important, 3- recurrent but not important, and 4- not important and not recurrent, as presented in Figure II, the salient themes were identified for all categories of risk factors, as shown in **Table IV**.

Table IV. Salient themes

Note: 1- recurrent and important, 2- important but not recurrent, 3-recurrent but not important, 4- not recurrent and not important.

Key risk factors

From the resultant salient themes presented in **Table IV**, and the frequently occurred themes in **Table III**, the key risk factors were identified by considering the most frequently occurred themes and themes with high saliency, as shown in **Table V**.

Table V. Key risk factors

4.2. Discussion of results

The themes identified suggest that the risk factors evolve from a contextual perspective as prescribed by Mahmud *et al.* (2021). The most significant risk factors (themes) identified based on the data analysis process are discussed below.

4.2.1. Change of government

Change of government is a political risk and is considered from a perspective of Nigeria's political leadership. All of the interviewees identified change in government as a serious type of risk affecting highway infrastructure construction projects in Nigeria. The interview findings show that government-funded projects such as highway construction projects suffer high political risk, as a result of political uncertainty and its influence on ongoing projects. This risk factor is in concordance with previous studies. For instance, Mahmud *et al.* (2021) found that the short time horizon of political leadership in Nigeria, often exacerbated by transition in Government through elections or otherwise, has had a significant impact on the performance of highway infrastructure projects in Nigeria; new political leaderships often prioritise new project proposals and abandon on-going projects in the country. Furthermore, as prescribed by Herrera *et al.* (2020), changes in government in certain countries, specifically developing

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3 countries such as Nigeria, create an environment in which non-performance of projects can
4 flourish. This risk factor has been mentioned by numerous interviewees as highlighted from
5 the following coded data extracts. For instance,
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8 Interviewee CLI_02 put it in this way: *‘Another issue in most of the projects is change of
9 government. Each time a new government comes in to power, it will delay the project as they
10 have to settle down before thinking of commencing any project. Most of the highway projects
11 have witnessed four different regimes; yet they are still on-going. It is one of the major
12 problems.’*
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15 Interviewee CLI_04 mentioned that: *‘They are always delaying project execution during
16 the transition from one government to another.’*
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19 Interviewee CON_01 emphasised that: *‘Once there is a change in government, every
20 project comes to a halt, waiting for the decision of the new government. This is a very serious
21 problem on all public sector financed projects.’*
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24 Interviewee CNT_01 responded that: *‘Whenever there is a change in government, on-going
25 projects will be delayed and, as a consequence, inflation and interest rate fluctuation will
26 follow, resulting in a sharp rise of labour and material costs. This is the experience of most of
27 the on-going projects now.’*
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30 Accordingly, interviewee CNT_04 mentioned that: *‘At the time of general election, most
31 of the works on these projects are temporarily suspended waiting for the new government to
32 settle in office. Thus, it takes some time for construction activities to be normalised.’*
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34 4.2.2. Corruption

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36 The Corruption Perceptions Index (CPI) reported by Transparency International has shown that
37 official public sector corruption is prevalent in Nigeria and it ranks as the 150th most corrupt
38 nation out of 180 countries (Transparency International, 2022). Accordingly, the perceived
39 average CPI score (on a scale of 0 to 100, where 0 means highly corrupt and 100 means very
40 clean) in Nigeria from 2012 to 2022 was found to be 26, attaining a peak of 24 in 2021 and
41 2022 and a record low of 28 in 2016. In May 2016, the then British Prime Minister, David
42 Cameron, was heard to describe Nigeria and Afghanistan as ‘fantastically corrupt’ (Asthana &
43 Grierson, 2016; Ebekoziem, 2020). Although the Nigerian government recognised this fact and
44 has been putting all measures in place to curb corruption in Nigeria, more needs to be done in
45 the fight against corruption, particularly in public sector infrastructure procurement. For
46 instance, the contract for the construction of the East-West highway project in Nigeria was
47 initially awarded in 2006 at a cost of NGN211 billion (\$1.62 billion- 2006 prices), but the cost
48 subsequently increased to NGN726 billion (\$5.58 billion- 2006 prices) due to possible
49 collusion and favouritism of contractors by public sector officials. Compared to less corrupt
50 countries such as Burkina Faso, South Africa, Rwanda and other developing countries,
51 execution of highway infrastructure construction projects in Nigeria is exposed to a high level
52 of corruption risk. This finding is in accordance with the studies reported by Ebekoziem (2020)
53 in Nigeria and Lee *et al.* (2022) in Malaysia. For instance, Ebekoziem (2020) revealed that there
54 is a significant level of corruption in public construction projects in Nigeria, which needs to be
55 curbed in order to enhance successful delivery and performance of public sector financed
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3 highway infrastructure projects. All of the interviewees involved in highway projects across
4 Nigeria recognised the existence of corruption, but some declined to comment further for
5 personal reasons. For instance, the interviewees underscored the persistence of the risk of
6 corruption to public sector projects as highlighted from the following coded data extracts:
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9 Interviewee CNT_03 asserted: *'Corruption is so endemic in Nigeria and is a major
10 problem experienced in most projects.'*

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12 Interviewee CLI_03 mentioned that: *'Most of the projects awarded in 2006 and beyond
13 were deliberately underestimated so that a particular contractor will be given the contract.'*

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15 Interviewee CON_02 concluded that: *'For a contractor to be awarded any contract in
16 Nigeria, particularly highway projects, you have to negotiate with some public sector officials
17 on their own commission. This has an impact on the success of any project.'*

18 19 20 4.2.3. Fluctuation in the cost of construction materials

21 The uncertain nature of the Nigerian economy has really impeded the performance of the
22 construction industry, specifically highway infrastructure projects. Of particular impact is the
23 rate at which the prices of goods (such as cement, reinforcement, bitumen and diesel) often
24 rise, which has been a common trend in Nigeria. In most cases, project implementation periods
25 are extended and this plays a significant role, because the unit rates of the contracts are often
26 rendered obsolete, particularly when inflation sets in, which is peculiar to the Nigerian
27 economy as a result of economic instability. This was noted by El-Maaty *et al.* (2017), who
28 described how contractors in developing countries (including Nigeria) often estimate the prices
29 of materials in the tender based on the contemporary prices at the local markets, and
30 consequently any shock in the price of materials will force the contractors to buy at high prices.
31 This finding aligns with other previous studies on cost overrun risk factors in highway projects.
32 For instance, Kaliba *et al.* (2009) in Zambia and Mansfield *et al.* (1994) in Nigeria. This was
33 highlighted by some of the interviewees identified from the following coded data extracts. For
34 instance:
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40 Interviewee CON_05 explained that: *'Rise in the price of construction materials e.g.
41 bitumen, diesel, had negatively affected the progress of all the projects.'*

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43 Interviewee CNT_05 responded in this way: *'Price of construction materials continues to
44 rise sharply every day and have high negative effect on projects. Because money is not
45 available when needed, it will result in delays and even cost overrun of an entire project.'*

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47 Interviewee CNT_06 highlighted that: *'The problem is that, you see most contractors in a
48 very difficult situation because of the rise in the prices of materials, labour and even spare
49 parts of equipment because they were not as they were when most of the contracts were
50 awarded.'*

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52 Interviewee CLI_05 emphasised that: *'Of course, when construction works are going
53 slowly, the basic cost of materials particularly bitumen, diesel and cement will go up. This is
54 the case in almost all projects financed by the public sector.'*
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4.2.4. Inflation

Inflation is an economic risk which has a substantial impact on the successful delivery of highway construction projects in Nigeria. Nigeria is significantly different from many countries due to its volatile and uncertain economic policies. In a report by CWP Consultants Limited in 2022, the Nigerian inflation rate reached a 65-month high of 18.6% in June 2022. The impact of the soaring inflation is felt in almost all the sectors of the Nigerian economy, including the construction sector (CWP Consultants Limited, 2022). This finding regarding the impact of inflation corresponds with previous studies, for instance, Anigbogu *et al.* (2019) in Nigeria and Kaliba *et al.* (2009) in Zambia. Most of the interviewees mentioned that highway infrastructure construction projects in Nigeria are exposed to high inflation and thus emphasised its impact on their projects, as the price of materials and labour keep on increasing and the contractor will have to request a review of the contract terms. **This risk factor has been mentioned by numerous interviewees as highlighted from the following coded data extracts.** For example:

Interviewee CLI_03 explained that: *'The price of construction materials and cost of labour continued to rise sharply every day and this too had a high negative effect on all the highway projects.'*

Interviewee CNT_05 stated that: *'The inflation which resulted in increase of price of labour and construction material has also led to cost overrun of the projects.'*

Interviewee CON_05 emphasised that: *'The trend in the inflation in Nigeria has been something to worry about in Nigeria and the impact is felt in almost all publicly funded projects where it is almost impossible to say that the inflation rate will be stable for a long time. It keeps varying and the consequence is trickled down to the projects.'*

4.2.5. Project funding issues

The nature of highway projects procurement in Nigeria, which is entirely public sector driven, is dependent on public sector finance (specifically funding from annual budgetary provision), which has proved to be inadequate due to the insufficient and overstretched annual budgetary allocation. For instance, Ayodele and Alabi (2011) and Ihuah and Miebaka (2014) revealed that the issue of project funding, particularly in publicly funded projects such as the Lagos-Ibadan highway project and others, is one of the main reasons why most projects in Nigeria are suspended (and sometimes abandoned). This is in consonance with the affirmation of Odeyinka and Yusif (1997) that, due to the shortfall in funds allocated and released to publicly funded government projects, most projects get suspended during construction regardless of the substantial investment. **This risk factor has been mentioned by numerous interviewees as highlighted from the following coded data extracts. For instance:**

Interviewee CON_01 cited insufficient funds as one of the major risks on highway projects and commented that: *'All the projects are being funded by the federal government, but from the start of the projects, there was insufficient funding allocation which is mainly from the federal budget.'*

Interviewee CLI_02 expressed his view in this way: *'One of the major challenges facing highway projects is inadequate supply of money. There has not been sufficient money dedicated*

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3 *to these projects. Contractors will only work once there is money; but once the flow of cash*
4 *stops, work will be stopped until they are paid again.'*
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7 However, in many instances, project funding challenges emanate from a more political
8 perspective. Projects often initiated by a different government could face the risk of being
9 denied adequate funding, particularly when the political environment is uncertain, and the
10 government determines how projects receive priority funding in different geopolitical zones.
11 This is consistent with the finding of Baloi and Price (2003) that project funding in developing
12 countries seems to be political in nature.
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15 For instance, interviewee CLI_06 cited insufficient funding due to the influence of politics
16 as one of the key risks to projects, and commented that:
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19 *'Most of the highway projects initiated by any previous government face the risk of insufficient*
20 *funds by the successive government mainly because of political differences. This affects the*
21 *chances of projects getting further funding.'*
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23 4.2.6. Construction project delay

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25 Delay in construction projects is regarded as one of the main problems for most highway
26 infrastructure projects in Nigeria and other developing, particularly those projects which are
27 public sector financed. According to Mahmud *et al.* (2021), public sector financed projects are
28 known to be infamous for delays. This finding on construction project delay risk accords with
29 other established studies: for instance, Mahmud *et al.* (2021), Mansfield *et al.* (1994) and
30 Anigbogu *et al.* (2019) in Nigeria, and Kaliba *et al.* (2009) in Zambia. Interviewees recognised
31 and underscored the existence of this risk as highlighted from the following coded data extracts
32 and revealed how this risk occurred. For instance:
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36 Interviewee CON_02 stated that: *'Most of the time projects are suspended mainly because*
37 *of lack of funding which result to time overrun and also contributed to cost overrun.'*
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40 Interviewee CNT_05 indicated that: *'The projects across the country have been on and off*
41 *since their conception which has really impacted on the progress of the projects. For instance,*
42 *if you look at Lagos-Ibadan, Abuja-Lokoja, Kano-Maiduguri highway projects and many more,*
43 *they have been on-going for more than 15 years. It is really unfortunate.'*
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46 Interviewee CLI_04 stated that: *'To be honest with you, the suspension of work on*
47 *construction sites have become a norm. The contractors suspend and abandon their sites on*
48 *many occasions over the years mainly because of lack of adequate cashflow and you know*
49 *money is everything in terms of the success and progress of any project.'*
50

51 5. Theoretical and practical implications

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53 *Theoretically, this study illustrates that risk factors in highway infrastructure projects in Nigeria*
54 *evolve from a distinct contextual perspective. This reinforces the idea that risk identification*
55 *should be treated as context-specific endeavor, rather than relying solely on generalized*
56 *models. Furthermore, by categorizing risks into technical, political, social, and economic*
57 *domains, the study provides a more comprehensive framework for future scholars. It*
58 *encourages a multi-dimensional approach to understanding infrastructure project risks, which*
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3 can be further explored in diverse geopolitical settings. Finally, the introduction of a matrix
4 combination to identify salient themes, which intersect with frequency of occurrence, provides
5 a novel approach to risk identification and prioritization. This could set a precedent for future
6 risk analysis studies, refining how researchers identify key risk factors.
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9 Practically, the study provides tangible insights for practitioners such as Government
10 agencies, built environment professionals, and policy-makers aiming to enhance project
11 success in challenging environments and thus provide an avenue for developing policies and
12 reforms such as effective anti-corruption campaigns, financial policies, and governance
13 reforms.
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16 **6. Conclusion, contributions and limitations**

17 Successful delivery of highway infrastructure projects is key to the socio-economic growth of
18 developing countries, including Nigeria. However, these projects are mostly impacted by
19 numerous risks which impede success and performance, and thus understanding the peculiar
20 risks to the Nigerian context will aid in developing context specific risk mitigation strategies.
21 Previous research on risk identification in developing countries has mostly focused on building
22 projects, general construction projects, specific risk factors such as cost overrun and project
23 delay, or investigated from a positivist perspective, thus disregarding the contextual evolution
24 of these risks. This study was conducted to identify the key risks affecting the successful
25 delivery of highway infrastructure projects in Nigeria from a contextual perspective of key
26 industry stakeholders. Overall, 17 key risks were identified from the data analysis process and
27 6 risks were identified as the most significant, based on the combination of prevalence of
28 occurrence and significance of the coded information. The 6 top risks were in concordance
29 with existing global studies and include: change in government, corruption, cost of construction
30 materials, inflation, project funding issues, and construction project delay.
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37 However, the top two risks are politically related, which is specific and unique to the setting
38 of Nigeria though other countries such as UAE and Singapore faced similar risk albeit from
39 different perspectives. For example, political risks are found to be very low and insignificant
40 in the UAE construction industry, but were given high ranking (5th position) in the Singapore
41 construction industry (Hwang *et al.* 2013). It can be noted that, whereas the UAE is a relatively
42 authoritarian society, Singapore and Nigeria are democracies and thus could be a contributing
43 characteristic. The high political risks in Nigeria will be seen as discouraging indicators that
44 will not attract foreign investors/contractors to Nigeria.
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48 Although, the objective of the study was achieved, there are some limitations. Firstly,
49 though adequate considering similar studies, the sample size was relatively small and may
50 affect generalisation of the findings. Secondly, the study was based on Nigerian highway
51 projects and thus could impact the applicability of the findings to other types of projects and
52 contexts. Thirdly, the study was based on qualitative information and therefore, the findings
53 could be influenced by the subjective opinions of the participants.
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57 Despite the aforementioned limitations, the study addressed the gap related with identifying
58 the key risk factors impacting the performance of highway infrastructure projects peculiar to
59 the context of Nigeria. Its originality lies on adopting a context-based approach in identifying
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3 the peculiar risk factors to Nigeria and utilizing a systematic and structured qualitative data
4 analysis framework informed by case study approach, thematic analysis framework and
5 saliency analysis framework. Further research can increase the sample size, adopt a hybrid data
6 types (qualitative and quantitative) and explore the context specific mitigation strategies.
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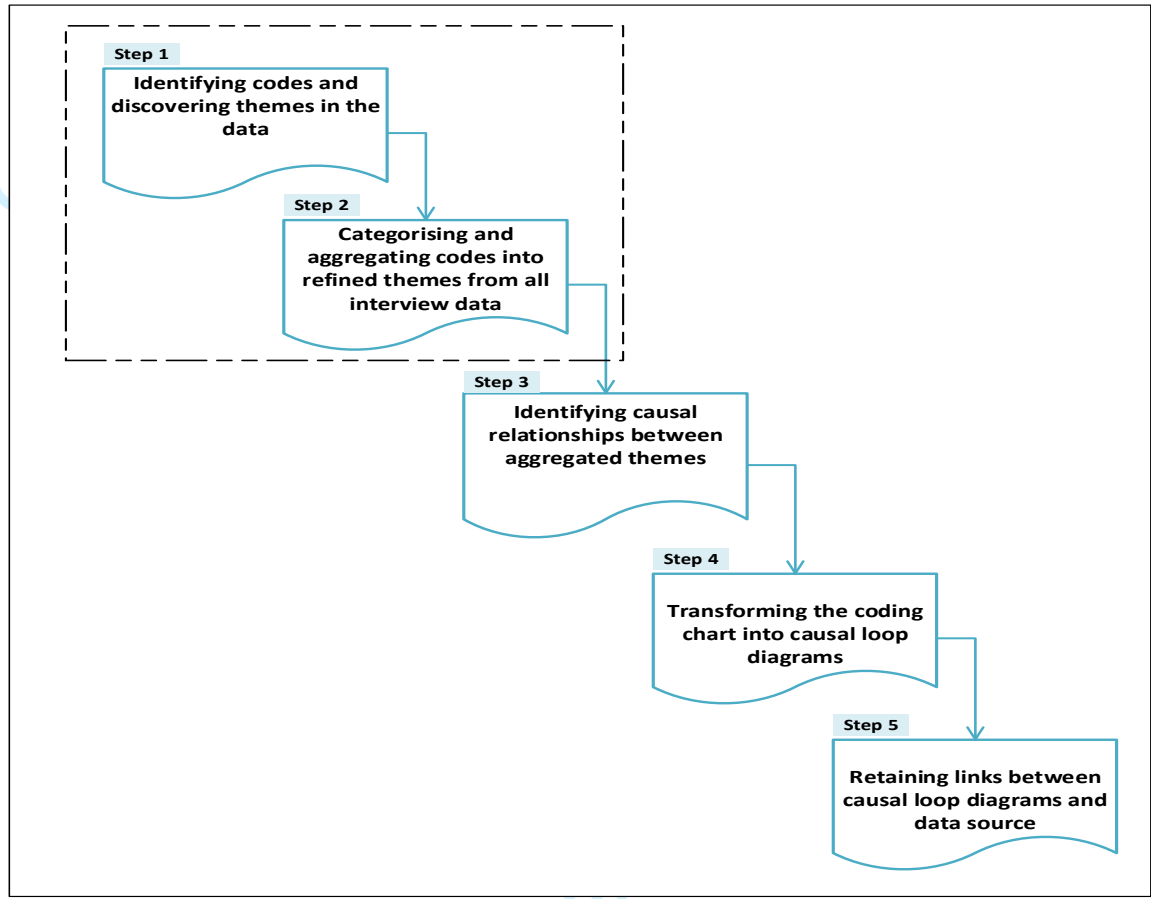


Figure I. Coding framework

Adapted from Mahmud *et al.* (2021) and Mahmud *et al.* (2022).

Facilities Management

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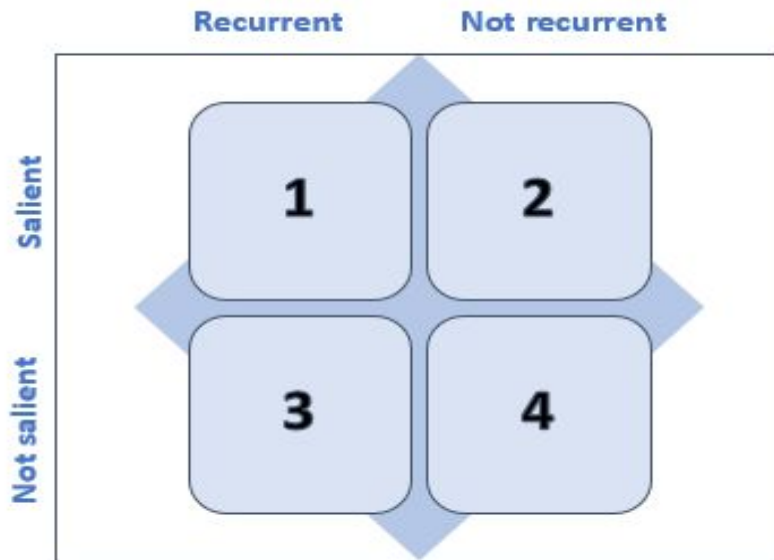


Figure II: Saliency Framework Matrix

Adapted from Mahmud *et al.* (2021) and Mahmud *et al.* (2022)

Table I. Summary of Top Five (5) Risk Factors

S/No	Risk Factors	Sources	Ranking
1	Scope change	(Gkritza and Labi, 2008; Kaliba <i>et al.</i> , 2009; Love <i>et al.</i> , 2015; Creedy <i>et al.</i> , 2010; Verweij <i>et al.</i> , 2015; Leo-Olagbaye and Odeyinka, 2018; Mahmud <i>et al.</i> , 2021; Deep <i>et al.</i> , 2022)	1 st
2	Delay in payment of construction work	(Mansfield <i>et al.</i> , 1994; El-Sayegh and Mansour, 2015; Anigbogu <i>et al.</i> , 2019; Ogbu and Adindu, 2020; Hiyassat <i>et al.</i> , 2020; Mahmud <i>et al.</i> , 2021; Genc, 2021)	2 nd
3	Unforeseen ground condition	(Verweij <i>et al.</i> , 2015; Gkritza and Labi, 2008; Liu <i>et al.</i> , 2016; Anigbogu <i>et al.</i> , 2019; Ogbu and Adindu, 2020)	3 rd
3	Fluctuation of prices of materials	(Mansfield <i>et al.</i> , 1994; Gkritza and Labi, 2008; Anigbogu <i>et al.</i> , 2019; Hiyassat <i>et al.</i> , 2020; Ogbu and Adindu, 2020),	3 rd
3	Error and omission in contract documentation	(Liu <i>et al.</i> , 2016; Verweij <i>et al.</i> , 2015; Love <i>et al.</i> , 2015; Hiyassat <i>et al.</i> , 2020; Deep <i>et al.</i> , 2022)	3 rd
6	Design change	(Anigbogu <i>et al.</i> , 2019; Creedy <i>et al.</i> , 2010; Hiyassat <i>et al.</i> , 2020; Leo-Olagbaye and Odeyinka, 2018)	4 th
7	Poor design	(Ogbu and Adindu, 2020; Leo-Olagbaye and Odeyinka, 2018; El-Sayegh and Mansour, 2015)	5 th
8	Inaccurate cost estimates	(Ogbu and Adindu, 2020; Gkritza and Labi, 2008; Mansfield <i>et al.</i> , 1994)	5 th
9	Inflation	(Kaliba <i>et al.</i> , 2009; Anigbogu <i>et al.</i> , 2019; Genc, 2021)	5 th
10	Project delay	Kaliba <i>et al.</i> , 2009; Gkritza and Labi (2008); Mahmud <i>et al.</i> , 2021)	5 th
11	Adverse weather	(Kaliba <i>et al.</i> , 2009; Leo-Olagbaye and Odeyinka, 2018; Mahmud <i>et al.</i> , 2021)	5 th

Source: Author's own work

Table II. Summary of interviewees' background information

S/No	Type of Organisation	Interviewee Code	Years of Working Experience
01	Contractor	CNT_01	21
02	Contractor	CNT_02	17
03	Contractor	CNT_03	15
04	Contractor	CNT_04	12
05	Contractor	CNT_05	10
06	Contractor	CNT_06	8
07	Client	CLI_01	24
08	Client	CLI_02	22
09	Client	CLI_03	21
10	Client	CLI_04	19
11	Client	CLI_05	17
12	Client	CLI_06	13
13	Consultant	CON_01	21
14	Consultant	CON_02	18
15	Consultant	CON_03	15
16	Consultant	CON_04	13
17	Consultant	CON_05	10

Source: Author's own work

Table III. Frequency of occurrence

Risk factors	Frequency of occurrence	Risk category
Change of government	41	Political
Corruption	37	Political
Fluctuation in the cost of construction materials	35	Economic
Inflation	33	Economic
Project funding issues	31	Technical
Construction project delay	30	Technical
Terrorism	26	Social
Political interference	24	Political
Material quality	23	Technical
Exchange rate fluctuation	20	Economic
Inclement weather	19	Technical
Adverse ground condition	17	Technical
Land acquisition problems	16	Social
Cost of labour	15	Economic
Theft	14	Social
Community restiveness	12	Social
Defective design	10	Technical

Source: Author's own work

Table IV. Salient themes

Risk factors	1	2	3	4
Technical Risk Factors				
Adverse ground condition	✓			
Defective design			✓	
Inclement weather			✓	
Material quality				✓
Project funding issues	✓			
Construction project delay	✓			
Political Risk Factors				
Change of government	✓			
Corruption	✓			
Political interference		✓		
Community restiveness		✓		
Economic Risk Factors				
Fluctuation in the cost of construction materials	✓			
Cost of labour				✓
Exchange rate fluctuation		✓		
Inflation	✓			
Social Risk Factors				
Community restiveness		✓		
Land acquisition problems	✓			
Terrorism				✓
Theft	✓			

Note: 1- recurrent and important, 2- important but not recurrent, 3-recurrent but not important, 4- not recurrent and not important.

Source: Author's own work

Table V. Key risk factors

Risk factors	Frequency of occurrence	Saliency	Significance	Risk ranking	Risk category
Change of government	41	High	1	1 st	Political
Corruption	37	High	2	2 nd	Political
Fluctuation in the cost of construction materials	35	High	3	3 rd	Economic
Inflation	33	High	4	4 th	Economic
Project funding issues	31	High	5	5 th	Technical
Construction project delay	30	High	6	6 th	Technical

Source: Author's own work