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Risks affecting the performance of Ethiopian domestic road construction contractors

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ABSTRACT

The government of Ethiopia (GOE) has been working to enhance the capacity of Ethiopian domestic contractors (EDCs) over the past three decades. This has enabled the development of several private and public construction firms. However, the performance of EDCs is still a matter of concern. The aim of this paper is, therefore, to identify and prioritize risks of EDCs operating in the federal road construction projects. Forty-seven risk events were identified through an in-depth literature review. A questionnaire survey was conducted with professionals from the three main contracting parties (contractors, consultants, and the client) to prioritize the identified risk events in terms of their relative significance. The study outlined the ten most significant risk events namely, shortage of cash, inadequate planning, lack of access to foreign currency, delay in possession of site, frequent breakdown of equipment, delay in delivery of material and equipment, financial failure, inflation, delay in payments and poor commitment and coordination within the contractors' team. This study provides an insight into contractors' risks with a focus on domestic contractors engaged in the road sector. The findings of this study will be helpful to construction firms to develop an appropriate risk management system to effectively mitigate their risks.

KEYWORDS

Ethiopia; risk events; domestic construction companies; road construction

Introduction

Sustainable, affordable, safe and well-maintained road infrastructure is critical to connecting people to goods, services, and advancing social and economic opportunities. It is particularly important for Ethiopia, where the road is the dominant mode of transport accounting for 90 to 95 percent of the motorized inter-urban freight and passenger movements. Nevertheless, the road network of the country in the early 1990s was among the lowest in Africa and other developing nations. Ethiopia's road network density in 1990 was just 0.21 km per 1000 sq. km and 0.43 per 1000 population compare to the African average of 0.50 km per 100 sq. m and 0.61 km per 1000 population (ERA 1996). Further, the condition of the road network was in very poor condition, resulting in high road user costs (ERA 1996; MOFED 2002). What is more, the overall institutional capacity of the sector was a bottleneck in the effort to improve the road conditions of the country (ERA 1996; MOFED 2002).

In recognition of this, the GOE has been implementing a series of road sector development programmes (RSDPs) since 1997 (ERA 2011, 2016). Building the road sector institutional capacity has been one of the core strategic objectives of the RSDP.

In connection with institutional capacity building, the government has been undertaking various activities to attract private sector investment and improve the capacity of existing construction companies. This has enabled the creation of a large number of Ethiopian origin contractors (ERA 2011, 2016) against the handful of low capacity contractors that had existed before the implementation of the RSDP initiatives (MOFED 2002).

Nevertheless, the road construction business of the nation is still dominated by international companies. As detailed in the 19-year RSDP performance assessment report (ERA 2016), 599 road construction contracts were funded from 1997 to 2015 worth Ethiopian Birr (ETB) 180.5 billion (> $20 bl). Among these, 476 (79%) projects were awarded to EDCs with a value of ETB 82.7bl (45% of the total contract amount), while the remaining 123 projects worth ETB 102.8bl (55%) were awarded to foreign contractors. Further, of the 83 different projects, worth ETB 63.65bl, implemented in collaboration with development partners (World Bank, African Development Bank, European Union, China Exim Bank, etc.), only three projects with a total value of ETB 0.60bl (1%) were awarded to EDCs. This coincides with the recent report by the United Nations Economic Commission for Africa (UNECA 2015) that in most African countries domestic sector construction companies have difficulty competing with large international organizations - even in their own markets.

Several factors contribute to the limited participation of domestic contractors in the road sector. The first factor is the poor performance of EDCs to complete projects as specified in contracts (MOFED 2014; ERA 2016; Koshe and Jha 2016; Siraw 2016; Zewdu 2016; AfDB 2018). That is, projects awarded to local contractors are characterized by excessive delays (Koshe and Jha 2016; Zewdu 2016; Siraw 2016), and substantial cost overrun (Nega 2008; Zewdu and Getachew 2015). Since contractors' monthly performance is one of the fundamental qualification criteria in tenders, such low performance appears to be a limiting factor for contractors to participate in bids.

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The other is the overall limited capacity of domestic contractors to meet the bidding requirements in mega road projects. According to Desta (2015), domestic contractors have limited capacity to meet the requirements of development partners, which has severely limited their competitiveness in projects implemented in collaboration with development partners.

Recent studies have shown that risk management is one of the most important but overlooked issues to ensure the success of road construction projects in Ethiopia (Yimam 2011; Ayalew et al. 2016; Zewdu 2016). However, to date, little research has been done to examine Ethiopian contractors' risk management capabilities. Hence, this paper aims to identify and assess the risk events pertinent to the EDCs engaged in federal road construction projects. A detailed literature review was carried out to identify the relevant risk events of the Ethiopian road sector. A questionnaire survey was conducted with the prime contracting parties, namely, contractors, consultants, and the client to determine the magnitude of each risk event and eventually to identify the top ten most critical risk events. Analysing data using appropriate techniques, the results are interpreted in light of previous findings in the literature. The paper concludes by highlighting the novelty and significance of the findings and discussed the limitations of the study.

Literature review

Risk and risk management

Risk has been expressed in different forms. Yet some key attributes, such as uncertainty, probability, effect/impact, and so on, consistently appear in many of these definitions. The ISO definition is one of the frequently referred definitions and stated as '*risk is the effect of uncertainty on objectives*' (ISO 2018). The other common definition is that offered by PMI stated it in association with a project as '*risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives*' (PMI 2013).

Many risks faced by businesses cannot be eliminated (Enshassi et al. 2006; Smith et al. 2006), hence, success is measured in terms of the effectiveness of the risk management (RM) approach adopted (Hillson 2012). RM, according to IRM (2002), is the process in which organisations methodically address the risks attaching to their activities to achieve sustained benefit within each activity and across the portfolio of all activities.

Although different approaches are used to describe RM steps, several of the RM frameworks involve some common basic stages. Upon reviewing the risk management processes provided in diverse literature, Goh and Abdul-Rahman (2013) declared that *risk planning, risk identification, risk analysis, risk response and risk monitoring and control* are the well-accepted steps in the RM process. According to Zhao et al. (2015) and Low et al. (2009), the fundamental stages are *risk identification, risk analysis,* and *risk response*. Hence, this paper focuses on the three risk management steps, namely, the identification, analysis, and evaluation of risk events that may affect the performance of the EDCs.

Risk identification

Risk identification involves finding, recognizing, and recording risks that could affect the achievement of an organization's objectives (BSI 2010; ISO 2018). According to FHWA (2006), risk identification is conducted for two specific objectives: (i) to identify and categorize risks and (ii) to document the identified risks. Yet it is also important to note that, trying to identify all the risks, according to El-Sayegh (2008), is time-consuming and counterproductive. As a result, literature, such as APM (2008), suggests avoiding wasting time and resources on dealing with uncertainties that are of relatively low importance in terms of their effect on objectives. Subsequently, El-Sayegh (2008) and Barkley (2004) have suggested focussing on identifying and dealing with the most significant risk events among all others.

Different tools and techniques are included in the literature to identify risks (APM 2008; BSI 2010; PMI 2013). Brainstorming, scenario planning, and expert interviews are among the many different approaches.

Risk analysis

Once the potential risk events are produced, the risk analysis follows, which examines each identified risk and determines risk scores. A probability – impact matrix is the most common and familiar risk analysis techniques (APM 2008) used to determine the relative risk scores (values) by multiplying the measures of probability and impact of the event (BSI 2010; Elmontsri 2013).

It is also commonly suggested to avoid wasting time and resources on analysis of uncertainties that are of relatively less importance in terms of their impact on the set objectives. The ultimate goal of risk analysis is, therefore, to prioritize risks (APM 2008; Ehsanifar and Hemesy 2019) that helps to extricate risks that matter most. Besides the APM (2008) guideline has outlined two essential reasons for prioritizing risk: (1) to inform stakeholders of the range of outcomes arising from uncertainty, and (2) to prioritize risk responses for the effective management of risks.

Common risk events of construction companies in developing countries

In general, the construction industry is subject to a greater number of risk events with a higher impact on business operations than many other industries (Wang and Chou 2003; Enshassi et al. 2006; El-Sayegh 2008; Abd Karim et al. 2012). As discussed above, on one hand, many of these risks cannot be eliminated (Enshassi et al. 2006; Smith et al. 2006); on the other hand, trying to identify all risks, is time-consuming and counterproductive (El-Sayegh 2008). Hence, as suggested by El-Sayegh (2008) and Barkley (2004), this study tries to identify the most significant risk events involved in the construction sector.

Risks events are commonly extracted from literature and experts' opinions (Ehsanifar and Hemesy 2019). Thus, in a detailed review of 21 relevant studies conducted in 13 developing countries, risks involved in the construction industry were identified. Then, the identified risks were evaluated in the context of Ethiopia's road sector. Ultimately, the 47 risk events summarized in Table 1 were considered relevant for the EDCs involved in federal road construction projects.

As an integral part of risk identification, risk classification attempts to group the identified events (Zou, et al. 2007). A wide range of approaches has been employed for categorizing risk events in the construction industry. PMI (2013), Yoon et al. (2015), and Mishra and Mishra (2016), for instance, categorized risks broadly as internal and external. More detailed and diverse classification approaches have been employed by other scholars as summarized in Table 2.

Taking this into account and through a review of multiple risk taxonomy frameworks, the identified risk events were

Table 1. Summary of risk events.

Identified risk events	Author
Inflation	(Wang and Chou 2003; Wiguna and Scott 2005; Goh and Abdul-Rahman 2013; Helen et al. 2015; Iqbal et al. 2015; Jaber 2015; Yoon et al. 2015; Jayasudha and Vidivelli 2016; Mishra and Mishra 2016; Fernando et al. 2017); (Zou et al. 2007; El-Sayegh 2008; Chileshe and Yirenkyi-Fianko 2011; Emuze and Kadangwe 2014)
Poor/ defective design, including design change	(Wiguna and Scott 2005; ANDI 2006; El-Sayegh 2008; Emuze and Kadangwe 2014; Befrouei and Taghipour 2015; Iqbal et al. 2015; Jaber 2015; Yoon et al. 2015; Jayasudha and Vidivelli 2016; Mishra and Mishra 2016); (Ekung et al. 2015; Mohammed 2016)
Delay in payments	(Wiguna and Scott 2005; ANDI 2006; El-Sayegh 2008; Chileshe and Yirenkyi-Fianko 2011; Emuze and Kadangwe 2014; Goh and Abdul-Rahman 2013; Helen et al. 2015; Iqbal et al. 2015; Yoon et al. 2015; Jayasudha and Vidivelli 2016)
Inadequate project duration	(Zou et al. 2007; El-Sayegh 2008; Goh and Abdul-Rahman 2013; Befrouei and Taghipour 2015; Jayasudha and Vidivelli 2016; Mohammed 2016)
Site safety/accident	(ANDI 2006; Gohar et al. 2012; Ekung et al. 2015; Iqbal et al. 2015; Jaber 2015; Jayasudha and Vidivelli 2016; Mishra and Mishra 2016)
Delay in delivery of material and equipment	(Zou et al. 2007; El-Sayegh 2008; Helen et al. 2015; Iqbal et al. 2015; Yoon et al. 2015; Jayasudha and Vidivelli 2016)
Reworks/ poor workmanship	(Wiguna and Scott 2005; ANDI 2006; Chileshe and Yirenkyi-Fianko 2011; Mahamid 2013; Helen et al. 2015)
Shortage of skilled labour	(Zou et al. 2007; El-Sayegh 2008; Emuze and Kadangwe 2014; Jayasudha and Vidivelli 2016; Mishra and Mishra 2016)
Shortage of unskilled labour	(El-Sayegh 2008; Chileshe and Yirenkyi-Fianko 2011; Mahamid 2013; Jaber 2015; Jayasudha and Vidivelli 2016)
Shortage of cash/ Cash flow problem	(Gohar et al. 2012; Emuze and Kadangwe 2014; Mahamid 2013; Iqbal et al. 2015; Jayasudha and Vidivelli 2016)
Unforeseen ground conditions	(Wiguna and Scott 2005; ANDI 2006; Mahamid 2013; Ekung et al. 2015; Mishra and Mishra 2016)
Delay inspection/ Delay in decision	(Befrouei and Taghipour 2015; Helen et al. 2015; Jaber 2015; Mohammed 2016)
Inadequate planning	(Zou et al. 2007; Goh and Abdul-Rahman 2013; Befrouei and Taghipour 2015; Iqbal et al. 2015; Jaber 2015)
Adverse climatic condition	(Wiguna and Scott 2005; Ekung et al. 2015; Iqbal et al. 2015; Jayasudha and Vidivelli 2016; Mishra and Mishra 2016)
Corruption/bribery	(Wang et al. 2004; Gohar et al. 2012; Ekung et al. 2015; Jaber 2015; Jayasudha and Vidivelli 2016)
Shortage of project managers and construction professionals	(Zou et al. 2007; El-Sayegh 2008; Helen et al. 2015; Mishra and Mishra 2016)
High-interest rate	(Wang, et al. 2004; Iqbal et al. 2015; Jayasudha and Vidivelli 2016; Fernando et al. 2017)
Financial failure	(Chileshe and Yirenkyi-Fianko 2011; Goh and Abdul-Rahman 2013; Mishra and Mishra 2016; Mohammed 2016)
Low margin of profit due to high competition	(Zou et al. 2007; Emuze and Kadangwe 2014; Jayasudha and Vidivelli 2016; Mohammed 2016)
Poor communications among the parties in the contract	(Mahamid 2013; Jayasudha and Vidivelli 2016; Mohammed 2016)
Unfair decision on cost and/ or time claims	(ANDI 2006; Zou et al. 2007; El-Sayegh 2008; Mohammed 2016)
Change in Legislations	(Wang et al. 2004; Ekung et al. 2015; Jaber 2015; Jayasudha and Vidivelli 2016)
Delay in Possession of Site (ROW)	(Wang et al. 2004; Zou et al. 2007; Jayasudha and Vidivelli 2016; Mishra and Mishra 2016)
Variations (inadequately compensated)	(Wiguna and Scott 2005; Zou et al. 2007; Goh and Abdul-Rahman 2013; Jayasudha and Vidivelli 2016)
Inaccurate contract quantities (increase or decrease)	(Zou et al. 2007; Emuze and Kadangwe 2014; Jayasudha and Vidivelli 2016)
Labour dispute and strike	(Wang et al. 2004; Mahamid 2013; Jayasudha and Vidivelli 2016)
Delay in resolving contractual issues (claims and dispute, etc.)	(ANDI 2006; El-Sayegh 2008; Mohammed 2016)
Shortage of material	(Iqbal et al. 2015; Mishra and Mishra 2016; Fernando et al. 2017)
Lack of access to foreign currency	(Emuze and Kadangwe 2014; Jayasudha and Vidivelli 2016; Fernando et al. 2017)
Supply of low quality/defective materials	(ANDI 2006; Helen et al. 2015; Iqbal et al. 2015)
Low labour productivity	(Wiguna and Scott 2005; ANDI 2006; Jayasudha and Vidivelli 2016)
Low equipment productivity	(Wiguna and Scott 2005; ANDI 2006; Mohammed 2016)
Shortage of equipment	(Jayasudha and Vidivelli 2016; Mishra and Mishra 2016)
Frequent breakdown of equipment	(Befrouei and Taghipour 2015; Jayasudha and Vidivelli 2016)
poor commitment and coordination in contractors' teams	(Helen et al. 2015; Mishra and Mishra 2016)
Turnover of Contractor's project management staff	(Jayasudha and and Vidivelli 2016; Mohammed 2016)
Unavailability of local construction materials	(Emuze and Kadangwe 2014; Mahamid 2013)
High competition in the bid	(Mahamid 2013; Jayasudha and Vidivelli 2016)
Vandalism/damage on contractors' properties	(Befrouei and Taghipour 2015; Jayasudha and Vidivelli 2016)
Pollution/contamination	(Zou et al. 2007; Jayasudha and Vidivelli 2016)
Natural disaster (landslide, flood)	(Ekung et al. 2015; Jayasudha and Vidivelli 2016)
Theft	(Befrouei and Taghipour 2015; Jayasudha and Vidivelli 2016)
High tax rate	(Jayasudha and Vidivelli 2016)
Wastage of materials (site)	(Jayasudha and Vidivelli 2016)
Inadequate compensation for costs incurred due to changes in legislation	(Zou et al. 2007)
Stoppage of work by local government	(Mohammed 2016)
Ecological damage	(ANDI 2006)

Table 2. Risk event taxonomy.

Risk categories	Author (s)
Internal and external risks	(PMI 2013; Yoon et al. 2015; Jayasudha and Vidivelli 2016; Mishra and Mishra 2016)
Financial, Time, Physical, Personnel, Design & Technical, contractual, Political & regulatory, and Safety	(Goh and Abdul-Rahman 2013)
contractor, owner, shared and undecided	(ANDI 2006; Iqbal et al. 2015)
External and Site Condition Risk; Economic and Financial Risks; Technical and Contractual Risks; and Managerial Risks	(Wiguna and Scott 2005)
Project characteristic, labour and material related, contractual relationship, project procedures, external environment, clients' related, consultants related and contractors' related factors	(Helen et al. 2015)
Financial, Legal, Management, market, political and security, technical, environmental, and social-related factors.	(Jaber 2015)
Design, physical, logistics, legal, environmental, management, cultural, financial, construction and political	(Kishan et al. 2014)
Cost, time, quality, environment and security	(Befrouei and Taghipour 2015)

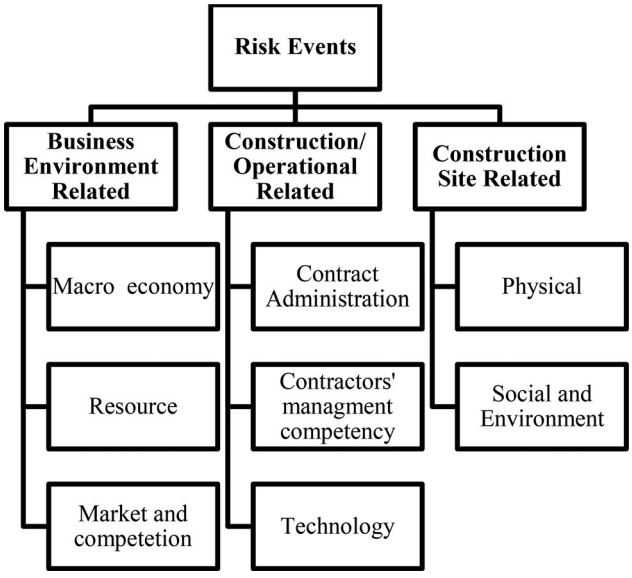

Figure 1. Categories of risk events.

categorised into three main groups, i.e. business environment, construction/operational, and site-related events. These categories were further broken down into subgroups as demonstrated in Figure 1. Accordingly, the 47 risk events were grouped illustrated in Table 3.

Methodology

The research was carried out in five distinct stages illustrated in Figure 2. These are (1) identification and categorization of risk events by a detailed literature review; (2) determination of the probability of occurrence (P) of the identified risk events and their impact (I) using a questionnaire survey; (3) determination of the relative risk scores by combining the measures of probability and impact obtained in 2; (4) prioritization of the risk events based on the values obtained in 3; and (5) discussion of the ten most significant risk events obtained in 4.

As discussed above, 47 risk events were identified and categorized through a detailed literature review. Then, a questionnaire was developed to prioritise the identified risk events. This questionnaire was sent to professionals who have been directly involving in the implementation of federal road construction projects, namely, contractors (CNT), the client (CLT) (Ethiopian Roads Authority), and supervision consultants (CNS). The questionnaire contained two parts. The first part was aimed to gather information on the respondents' profile whereas the second section was designed to evaluate the rates of the probability of occurrence (P) of each risk event and the severity of its impact (I) on the overall performance of domestic contractors. Participants were requested to rate the *P and I* using the five-level Likert scales (i.e. 1 for very low and 5 for very high). The respondents to be approached were obtained from ERA and the questionnaires were distributed by email to a total of 280 employees of these organizations. To get a more reliable date based on their adequate experience, professionals of five years and more experience were approached.

Using the responses received from questionnaires, risk scores, RS^i_j assessed by respondent j for risk event i, were determined using Equation (1).

$$\boldsymbol{RS^i_j = P^i_j \times I^i_j} \tag{1}$$

Where, P^i_j = the probability of occurrence of a risk event i assessed by respondent j; and I^i_j = degree of impact of a risk event i ($i = 1, 2, 3, 4$ or 5), assessed by respondent j.

To determine the relative significance of each risk event, the approach advocated by Shen et al. (2001); El-Sayegh (2008); El-Sayegh and Mansour (2015) was adopted. This risk ranking involves calculating a Relative Importance Index (RII) of each risk event, using Equation (2).

$$\boldsymbol{RII^i = \frac{\sum_{j=1}^{n} RS^i_j}{V*N}} \tag{2}$$

Where, V is the highest possible score available (i.e. $V = 25$, when $P^i_j = I^i_j = 5$) and N is the number of respondents. The above notwithstanding, it should be recognized that risks are dynamic in nature (FHWA 2006). Therefore, risk management is a continuous process, and it is advisable to frequently assess and risk ranks and to revise the mitigation measures accordingly.

A one-way between-group Analysis of Variance (ANOVA) was conducted on the information obtained from the questionnaires to test the hypothesis that there is no significant difference between respondents' perceptions regarding the likelihood of occurrence and severity of risk events in the performance of EDCs. Following Chileshe and Yirenkyi-Fianko (2011), the significance level (p-value) of the analysis was chosen to be 0.05. As suggested in Enshassi et al. (2009), Kendall's coefficient of concordance was also employed to measure the degree of agreement among the three parties, i.e. CNT, CNS, and CLT.

Result and discussion

Responses

As shown in Table 4, fully completed questionnaires were received from 137 participants (a return rate of 55%). This compares favourably with the findings of the study by Baruch and Holtom who attempt to analyse the response rate of 463 different studies performed using questionnaire surveys (Baruch and

Table 3. Risk events by category.

Risk event	Description	Risk event	Description
	1. Business environment events		2.2. Events related to contractors management competence
	1.1. Macro economy related events	RE24	Inadequate planning
RE01	Inflation	RE25	Delay in delivery of material and equipment
RE02	High-interest rate	RE26	Wastage of materials (site)
RE03	Lack of access to foreign currency	RE27	Supply of low quality/ defective materials
RE04	High tax rate	RE28	Frequent breakdown of equipment
	1.2. Resource related events	RE29	poor commitment and coordination within the Contractors' team
RE05	Shortage of project managers and construction professionals	RE30	Turnover of Contractor's project management staff
RE06	Shortage of skilled labor	RE31	Financial failure
RE07	Shortage of equipment		2.3. Technology related events
RE08	Shortage of material	RE32	Reworks/ poor workmanship
RE09	Shortage of cash/ Cash flow problem	RE33	Low labor productivity
	1.3. Market and competition related events	RE34	Low equipment productivity
RE10	High competition in bids		3. Construction Site Condition Related
RE11	Low margin of profit due to high competition		3.. physical related events
	1.4. Laws and regulations related events	RE35	Shortage of unskilled labor
RE12	Change in legislations	RE36	Unavailability of construction materials
RE13	Inadequate compensation for costs incurred due to changes in legislation	RE37	Unforeseen ground conditions
	2. Construction related events	RE38	Adverse climatic condition
	2.1. Contract administration related events	RE39	Site safety/accident
RE14	Delay in Possession of Site (ROW)	RE40	Labor dispute and strike
RE15	Poor communications among the parties in the contract	RE41	Stoppage of work by local government
RE16	Poor/ defective design	RE42	Natural disaster (landslide, flood)
RE17	Inaccurate contract quantities (increase or decrease)	RE43	Corruption/ bribery
RE18	Inadequately compensated variation orders	RE44	Theft
RE19	Inadequate project duration	RE45	Vandalism/ damage on contractors' properties
RE20	Delay inspection/ Poor supervision		3.2. Social and environment related events
RE21	Delay in claims and dispute resolution	RE46	Pollution/ contamination
RE22	Unfair decision on cost and/ or time claims	RE47	Ecological damage
RE23	Delay in payments		

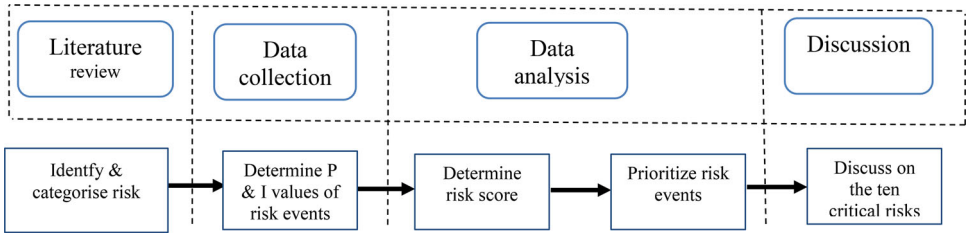

Figure 2. Research Framework [Authors'].

Table 4. Breakdown of responses received.

Respondents group	Number approached	Questionnaires sent	Replies	Return rate
Contractor (CNT)	85	72	31	43.1%
Consultant (CNS)	120	100	59	59.0%
Client (CLT)	83	76	47	61.8%
Total	**288**	**248**	**137**	**55.2%**

Table 5. Respondents by experience.

Experience (years)	5 to 10	10 to 15	15 to 20	>20
Number of respondents	42	57	18	20
Proportion (%)	30.7%	41.6%	13.1%	14.6%

Holtom 2008). The study indicated an average response rate of 53% for studies conducted at the individual level and 37% for those performed at the organizational level.

As shown in Table 5, the highest number of responses (57, i.e. 41.6%) was received from experts with 10-15 years of experience in the road sector and 69.3% (95 of 137) of the partakers had the experience of ten years or more.

In terms of the position of the respondents, as shown in Table 6, the majority of respondents were engaged in decision making positions that would enable them to appreciate risks experienced within EDCs. For instance, of the professionals from the contractors' side, 77.4% were project managers and 9.7% were technical managers who involve in project and company major decisions, respectively. Further, seven general managers and 44 project resident engineers were engaged from consultancy accounting for about 86.7% of the total professional. Similarly, 59.6% of the participants from the client-side were directors (19.2%) and project team leaders (40.4%).

Relative significance and rank of risk events

Risk prioritization enables the identification of risks that matter most (Ehsanifar and Hemesy 2019). *Accordingly, the RII* values of risk events determined based on equation 2 above, are shown in Tables 7 and 8 along with their corresponding ranking. A range of literature (El-Sayegh and Mansour 2015; Iqbal et al. 2015; Jaber 2015) has regarded the first ten ranked risk events as the most critical risks that matter most. Accordingly, the ten top critical events listed in Tables 7 and 8 are discussed herein below.

Shortage of cash/cash flow problem

According to the prioritized results presented in Tables 7 and 8, the most significant risk event is a shortage of finance/cash flow

Table 6. Respondents by position.

Contractor			Consultant			Client		
	No.	%age		No.	%age		No.	%age
Technical Manager	3	9.7%	General Manager	7	11.7%	Director	9	19.2%
Project Manager	24	77.4%	Resident Engineer	44	75.0%	Team Leader	19	40.4%
Claims Expert	4	12.9%	Deputy Resident Engineer	7	11.7%	Project Engineer	19	40.4%
			Claims Expert	1	1.7%			
Total	31	100%		59	100%		37	100%

Table 7. Results of Relative Importance Index (RII) and ranks.

	Contractor		Consultant		Client		Weighted average	
Risk event	RII	Rank	RII	Rank	RII	Rank	RII	Rank
RE09	0.853	4	0.815	1	0.812	1	0.822	1
RE24	0.964	1	0.767	2	0.747	6	0.804	2
RE03	0.860	3	0.759	4	0.771	3	0.785	3
RE14	0.888	2	0.697	7	0.774	2	0.766	4
RE28	0.821	5	0.748	5	0.750	5	0.765	5
RE25	0.751	6	0.724	6	0.770	4	0.746	6
RE31	0.680	11	0.764	3	0.730	7	0.734	7
RE01	0.739	7	0.660	8	0.640	8	0.670	8
RE23	0.655	14	0.633	10	0.616	11	0.632	9
RE29	0.575	23	0.630	12	0.624	10	0.616	10
RE11	0.664	12	0.650	9	0.518	22	0.608	11
RE16	0.699	8	0.589	14	0.570	14	0.607	12
RE17	0.665	11	0.608	13	0.558	15	0.604	13
RE10	0.664	13	0.632	11	0.512	23	0.598	14
R07	0.596	17	0.561	18	0.626	9	0.591	15
RE34	0.572	24	0.578	16	0.610	12	0.588	16
RE33	0.588	20	0.561	17	0.605	13	0.582	17
RE30	0.593	18	0.583	15	0.526	20	0.566	18
R19	0.623	15	0.501	21	0.530	19	0.538	19
RE05	0.577	22	0.511	20	0.535	18	0.534	20
RE32	0.533	26	0.513	19	0.556	16	0.533	21
RE21	0.696	11	0.483	22	0.489	26	0.532	22
RE08	0.589	19	0.474	23	0.551	17	0.526	23
RE15	0.587	21	0.456	25	0.413	31	0.470	24
RE38	0.467	31	0.429	27	0.510	25	0.465	25
RE06	0.497	28	0.396	30	0.519	21	0.461	26
RE20	0.539	25	0.377	34	0.512	24	0.460	27
RE26	0.489	30	0.415	29	0.478	27	0.453	28
RE37	0.441	33	0.462	24	0.414	30	0.441	29
RE22	0.619	16	0.428	28	0.343	40	0.440	30
RE02	0.493	29	0.431	26	0.400	32	0.434	31
RE18	0.525	27	0.390	31	0.350	38	0.406	32
RE27	0.408	36	0.380	33	0.429	33	0.403	33
RE36	0.417	35	0.368	35	0.390	37	0.387	34
RE04	0.432	34	0.340	37	0.380	34	0.374	35
RE43	0.452	32	0.381	32	0.313	41	0.373	36
RE39	0.408	37	0.330	38	0.377	30	0.364	37
RE41	0.355	43	0.299	41	0.424	29	0.354	38
RE47	0.360	42	0.342	36	0.348	39	0.348	39
RE46	0.351	44	0.328	39	0.361	36	0.344	40
RE35	0.392	39	0.249	45	0.358	35	0.318	41
RE44	0.399	38	0.310	40	0.245	47	0.307	42
RE13	0.388	40	0.292	42	0.254	46	0.300	43
RE40	0.363	41	0.275	43	0.277	43	0.295	44
RE42	0.316	47	0.258	44	0.310	42	0.289	45
RE45	0.345	45	0.248	46	0.270	44	0.277	46
RE12	0.329	46	0.243	47	0.263	45	0.269	47

problems (RII = 0.822). While professionals from the contractors ranked it as the fourth, experts both in the consultant and client part made it the first critical event. Since finance is a principal constraint in the construction industry, this finding could not be a surprise. Besides, this concurs with the findings reported by Koshe and Jha (2016) and Mahamid (2013) of the Ethiopian and Palestinian construction industries, respectively. Further Iqbal et al. (2015) indicated that finance was the second significant risk event in Pakistani construction projects, while it was ranked the third critical event in the Ghanaian CI (Chileshe and Yirenkyi-Fianko 2011). Another study by Zewdu and Getachew (2015) as well showed that this event is the fifth major risk event contributing to cost overruns in the Ethiopian CI.

Yet, the unavailability of affordable credit in developing countries reported in the UNECA (2015) indicates that contractors have no alternatives that would enable them to address such financial shortcomings. Hence as suggested in UNECA (2015), to be competitive domestically or internationally, construction firms need to have adequate access to finance.

Inadequate planning

Inadequate planning (RII = 0.804) was ranked as the second most critical risk event. This finding agrees with the study by El-Sayegh and Mansour (2015) that showed that insufficient planning is the most critical risk factor in the UAE highway construction industry. It also supports the findings reported in Zewdu and Getachew (2015) and Nega (2008) of the Ethiopian building sector.

The time overrun experienced in the Ethiopian construction projects ranging from 61 – 80% reported by Ayalew et al. (2016) might also be associated with the impracticability of project schedules. Besides, delay in delivery of materials, ranked as the sixth most critical risk event in this research, would have a direct association with poor planning (see below). The low level of use of planning techniques indicated by Zewdu (2016), may contribute to the growing concern about planning insufficiency.

Lack of access to foreign currency

The third most critical risk event was found to be a lack of access to foreign currency (RII= 0.785) This event has been recognized by the Ethiopian government (NPC 2016) as a critical constraint to the socio-economic development of the nation. Unlike many of their international counterparts, domestic companies find it difficult to earn the foreign exchange needed to import construction equipment and materials. Such unavailability of access to foreign currency will put domestic contractors at a competitive disadvantage.

Delay in possession of the construction site

The fourth-ranked risk event is the delay in possession of the construction site (R = 0.766). In the Ethiopian federal road construction contracts, the responsibility to provide the construction site and burrow pits to the contractor is imposed upon the client. Nevertheless, the RSDP reports and other strategic documents (ERA 2011, 2015; NPC 2016) indicate that delay in removing obstructions from construction sites remains a common challenge for infrastructure development projects, including the road projects.

Whereas time is of the essence for the completion of projects. As a consequence, a delay in the removal of obstructions from construction sites would result in contractual implications among the contracting parties, majorly between the contractor and the

Table 8. Top 10 significant risk events.

	Contractor		Consultant		Client		Weighted aver.	
Risk events	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Shortage of finance/Cash flow problem	0.853	4	0.815	1	0.812	1	0.822	1
Inadequate planning	0.964	1	0.767	2	0.747	6	0.804	2
Lack of access to foreign currency	0.860	3	0.759	4	0.771	3	0.785	3
Delay in Possession of Site (ROW)	0.888	2	0.697	7	0.774	2	0.766	4
Frequent breakdown of equipment	0.821	5	0.748	5	0.750	5	0.765	5
Delay in delivery of material and equipment	0.751	6	0.724	6	0.770	4	0.746	6
Financial failure	0.680	11	0.764	3	0.730	7	0.734	7
Inflation	0.739	7	0.660	8	0.640	8	0.670	8
Delay in payments	0.655	14	0.633	10	0.616	11	0.632	9
Poor commitment and coordination within Contractors' teams	0.575	23	0.630	12	0.624	10	0.616	10

client. Recognizing the impact of the event on the overall infrastructure developments, the National Planning Commission considers resolving the ROW problem amongst the core strategic objectives of the nation (NPC 2016). This study as well suggests that parties, the client, in particular, take corrective measures to mitigate this risk.

Frequent breakdown of equipment

Despite continuous monitoring and preventive equipment maintenance enable better use of available equipment (WEF 2016), frequent breakdown of construction equipment has been identified as the fifth major risk event (RII = 0.765). The major cause of the frequent breakdown of equipment according to Yoon et al. (2015) is associated with poor equipment management. In the Ethiopian context, beyond the internal equipment management capability of firms, contractors' financial capacity, and the availability of hard currency discussed above would also contribute to such problems. This suggests comprehensive and integrated action by the respective stakeholders in the sector.

The above top-five ranked risk events identified from the survey are followed by a delay in delivery of material and equipment (RII= 0.746), financial failure (RII = 0.734), inflation (RII = 0.670), delay in payments (RII = 0.632) and poor commitment and coordination within contracting teams (RII = 0.616). Yet it is important to keep in mind that some risk events that are found less significant in this study were reported as the top critical events in other studies.

Delay in delivery of materials and equipment

Delay in the delivery of materials and equipment/supply constraints is ranked as the sixth significant risk event. This was also recognized as impeding events in studies in Nigeria (Helen et al. 2015) and Ghana (Chileshe and Yirenkyi-Fianko 2011). While effective and efficient supply chain management enhances the construction performance (Gor and Pitroda 2015; Al-Werikat 2017), conversely, delays in supply have a considerable impact on companies' success (Yoon et al. 2015). This suggests that construction companies take supply management as their key strategic tasks.

Financial failure

The risk event ranked seventh from the survey was a financial failure. Financial failure is the case in which a firm goes bankrupt as a consequence of not be able to fulfil its current liabilities (Zeytınoglu and Akarım 2013). Although this event appears to be at the bottom of the top ten risk events, it has been identified as one of the three major risk factors in studies conducted in some other countries. To name a few, a financial failure was reported as the third most important event in the Ghanaian construction industry (Chileshe and Yirenkyi-Fianko 2011). Mohammed (2016) as well reported it the third most significant contractors' related event in the Indian construction projects.

The first significant risk event identified in this study, i.e. shortage of finance, might attribute to such financial distresses. As advocated in (Mbachu 2011) the delay in payment, which is found to be the ninth-most critical risk event in this study (see below), might also contribute to such a problem. This suggests adopting an effective cash flow management strategy to address the risk.

Inflation

While inflation continues to be a major challenge in the country's development (MOFED 2014; NPC 2016), it is perhaps a surprise that it is the eighth-most significant event for EDCs engaged in the road sector. Further, inflation has been reported as one of the major factors for the rise in construction costs in Ethiopia (MOFED 2014). Similar studies in Malaysian (Goh and Abdul-Rahman 2013), Indian (Kishan et al. 2014; Mohammed 2016), Ghanaian (Chileshe and Yirenkyi-Fianko 2011), Indonesian (Wiguna and Scott 2005) and Nigerian (Helen et al. 2015) construction industries reported inflation as the foremost ranked risk event. This may indicate that the price adjustment provisions included in the Ethiopian federal road construction contracts are adequate to compensate for the cost fluctuations that may affect contractors.

Delay in payment

Payment delay was ranked as the ninth significant event while it has been ranked as the most critical event in many other countries. For instance, it was found to be the second most critical event in Pakistan (Iqbal et al. 2015) and Ghana (Chileshe and Yirenkyi-Fianko 2011). Unlike other countries, the client's efforts to give priority in making payments to local contractors may be one of the many reasons why payment delay has fallen into the bottom of the top ten risk events of the road sector.

Lack of proper coordination and commitment within the contractors' team

The tenth-ranked event is the lack of proper coordination and commitment within the contractors' team. This threat has also been found as a critical risk in several other construction industries, including, Ghana (Ofori 2013) and India (Mishra and Mishra 2016). Despite this event appears to be the tenth risk factor, the important message is that there is still a large gap within the contractors' respective team. A well-committed team ensures that they follow-through and stick with their projects to generate momentum and finish the job as intended, hence, contractors

Table 9. ANOVA.

Source of variation	Sum of squares	Df	Mean square	F	P-value	F crit
Between groups	0.14	2	0.07	2.66	0.07	3.06
Within groups	3.60	138	0.03			
Total	3.74	140				

should work to create a sense of commitment and responsibility among employees.

Risks events with category

As can be seen from Tables 2, 7, and 8 of the ten critical risk events, two are related to the business environment (i.e. strategic level) and the other eight to construction (i.e. the operational level) related events. Risk events classified under the third category (site condition related events) were found to be of lower significance. This suggests the need for risk management strategies to focus on strategic and operational risk events.

Significance of between groups

Analysis of Variance (ANOVA) was used to test whether any of the differences between the means are statistically significant. As illustrated in Table 9, the one-way ANOVA test gives $F = 2.66$ which is less than the critical value, Fcrit (3.06) at α of 0.05. Hence, the mean value is the same for all the three groups, i. e., there is no significant difference between the means of the groups and thus, the null hypothesis can be accepted.

Degree of agreement among responding groups

Kendall's coefficient of concordance, W, was determined to measure the level of agreement among the three responding groups, namely contractors, consultants, and the client. And the calculated $W = 0.93$. Since $n = 47$ is too large for the tables of critical values of Kendall's, the chi-square approximation of sample distribution of W is computed with Equation (3).

$$X^2 = m(n-1)W \tag{3}$$

Where, $m =$ number of judges, $n =$ the number of attributes being ranked. From the data of $m = 3$ and $n = 47$, $X^2 = 128.4$ which is greater than the critical chi value from the critical table for $n = 47$ and $\alpha = 0.05$. Hence, the null hypothesis is rejected and the alternative hypothesis is accepted, i.e. there is a significant agreement among the three responding groups (contractors, consultants, and the client) to rank the 47 risk events.

Conclusions and recommendations

The objective of this paper was to identify and rank risk events that have a potential impact on the performance of Ethiopian domestic contractors working on federal road construction projects. From a detailed review of the literature, 47 possible events were identified and categorized into three groups, namely, (i) business environment, (ii) construction, and (iii) site related events. Using a questionnaire survey, this paper sought the perception of three primary parties (the client, contractors, and supervision consultants) that are involved in Ethiopian federal road construction projects. A total of 137 completed responses were received from the 248 distributed questionnaires with a response rate of 55.2%.

A Relative Importance Index (RII) was developed to assess the results of the survey and prioritise the identified risk events. Upon prioritizing the identified risk events in terms of their level of significance, the ten most important risk events were identified. These are cash flow problem, inadequate planning, lack of access to foreign currency, delay in possession of site (ROW), frequent breakdown of equipment, delay in delivery of material and equipment, financial failure, inflation, delay in payments and poor commitment and coordination within the contractors' team. These findings are broadly in agreement with other similar studies conducted in other developing countries, although the survey suggested that delays in payment and inflation risk events were considered to be less important in the Ethiopian context than in other countries. A statistical analysis of the results as well showed that there is no significant difference between the three groups and there is a strong agreement among the parties in ranking risk events.

Since the majority of the significant risk events are related to the business environment and operational issues, this research highlights the need for broad-based measures from all stakeholders in the sector. Of greatest importance, is that the government creates a conducive business environment for local contractors. The client should also work to meet its contractual obligations, including to provide access to site and effect payments in a timely manner. Contractors should strive to adopt and implement appropriate risk management systems to effectively mitigate their risks.

Whilst efforts have been spent on designing and carrying out the research, there are some limitations associated with the study. First, since risks are dynamic, ranking of risks provided herein may vary over time. Furthermore, since the risk identification and analysis was conducted for contractors working in the road sector as a whole, hence, the level of significance of risks may vary from contractor to contractor. Consequently each contractor should regularly assess its own risk and adopt appropriate mitigation measures. Whilst the research has focused on Ethiopia, the findings are relevant to domestic construction firms working in other developing countries, and highlight in particular the challenges and risks that such companies face.

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