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Assessing public sector road construction projects' critical success factors in a developing economy: Definitive stakeholders' perspective

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A B S T R A C T

This study assessed the critical success factors (CSFs) of public-sector road construction projects execution from the perspective of definitive stakeholders associated with such projects by drawing on in-depth semi-structured interviews (16) and surveys (372) in Ghana, thirty-four (34) CSFs were identified. Using Relative Importance Index (RII), Spearman Rank Correlation Coefficients, and Kendall's Coefficient of Concordance and the Chi-square test of significance statistics, the top ten most important factors in descending order are: the absence of political interference, project continuity by successive governments, adequate project funding, support from financial institutions and donor agencies and countries, government commitment to the project, absence of clientelism, absence of nepotism, no political corruption, payments of contractors on time and absence of court injunction or legal suit and land litigations. This study contributes to road construction CSFs in the context of public sector road construction in developing economies.

1. Introduction

Government policies are often translated into programmes and projects and one of the areas in which these programmes and projects are implemented is infrastructure projects within the transport sector (Goodman and Love 1980). In developing countries such as those in Sub-Saharan Africa, a lot of government projects are geared towards road construction due to the concentration of roads as the main source of transportation. Thus, road transport is the main means of the transport system in many developing countries and as such, the need to invest in road infrastructure has been attached to the political fate of the government as they serve as the foundation for other economic growth. This is due to the underdevelopment of other transport systems such as air, water and rail (Bafoil and Ruiwen 2010; Angmor 2012). Road construction projects play socio-economic roles in national development as they improve road transportation (Gachassin et al. 2010; Porter et al. 2012). Roads also allow easy access to urban centres through feeder roads construction and improvement programmes (Asomani-Boateng 2015). Accordingly, road transport infrastructure is most likely to reduce poverty of citizens in aid receiving countries such as those in sub-Saharan Africa (Asomani-Boateng 2015). Road's construction serves as a platform for citizens' socio-economic development as direct and indirect jobs are created through such activities (Porter et al. 2012). Hence, the importance of successful implementation of road construction projects cannot be overemphasised. Given the important role play by road construction projects in the lives of citizens and national development, governments worldwide

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have made conscious efforts through their transport policy initiatives to develop the sector by embarking on numerous road construction projects (Angmor 2012) and Ghana is no exception (Asomani-Boateng 2015; Acheampong et al., 2018).

In response to the significant investment and efforts made by governments across the globe to embark on road construction projects, researchers have devoted extensive research into road construction projects execution (e.g. Gachassin et al. 2010; Angmor 2012); however, the growing literature indicates that much attention has not been devoted to the CSFs of such projects within the public sector in developing countries. For example, Mwelu et al. (2019) researched public sector road construction. modelled the work around seven hypotheses. Based on quantitative analysis of predetermined variables from the literature while our work adopts a mixed methodology. Researchers looking at this study area are predominantly focused on private-public partnership (PPPs) projects. For instance, Chileshe 2020 examined CSF but the focus was on PPP and on infrastructure in general (which included roads) using a quantitative approach. Further, the few studies that have looked at CSFs have done so by focusing on the construction industry as a whole – which may not be applicable within the public sector in developing countries' context. Debela's (2019) work is the closest to the work we are presenting on CSFs in road construction in developing economies like Ethiopia using mixed methods. However, aside from examining different socio-economic space, our work looked more on public sector road construction while they examined PPP in road construction. Owing to this our work presents a unique focus that may have been omitted in the literature on CSF. Thus, since the CSFs are not focused on a public road or private construction project, it's difficult to associate findings to this unique sector. This study, therefore, adds to the growing literature on road infrastructure development projects in developing countries and factors that are critical to their success by soliciting first-hand information from definitive stakeholders associated with these projects. The overarching question that this study seeks to address is: *what are the factors that are critical to the successful implementation of public-sector road construction projects*?

The study's context is of importance due to two major reasons. One, road transport is the main transport system in many developing countries in Africa due to inadequate development of other transport sectors such as air, rail, water (Bafoil and Ruiwen 2010; Chong and Hopkins 2016). This implies that infrastructure development within the sector is an integral part of the national transport development policy. Similarly, it is estimated that road transport in Ghana accounts for 96% of passenger and freight traffic; and 97% of passenger miles (Ghana Investment Promotion Centre 2018). Hence, successive governments have made conscious efforts to develop the sector through policies, programmes, and projects. Following this, annual budgets over the years have devoted a significant amount of funds to this course (Republic of Ghana Budget 2012, 2015, 2019). However, despite the huge capital outlay in road construction projects; evidence suggests that results of such investments have been mixed (Appiah et al., 2017; Acheampong et al., 2018). This suggests that the need to assess the CSFs to improve road construction performance is important since findings would be of guidance to transport policymakers and road transport policy in particular; as well as road construction projects executioners to make informed decisions to enhance successful execution. Two, road accidents in Ghana are at an alarming record (National Safety Commission– Ghana (NSC) 2019). Statistics indicate that in the last decade alone, road accidents have claimed a lot of lives and livelihood; and bad roads have been one of the fundamental reasons for such accidents and fatality (NSC 2019). This study will provide empirical evidence of the factors that are critical to successful road construction; hence, findings could be used as a guide to improving road transport system policies on constructions by the government and other policymakers.

The contribution of this study is in three main folds: academic, practitioners and policy perspective. Academically, it adds to the existing literature on the CSFs on road construction projects by deepening our understanding of CSFs in public-sector road construction projects. In terms of the policy, the study offers policy recommendations to policymakers and road construction project management practitioners in Ghana and other developing countries with similar implementation dynamics. Practitioners delivering public-sector road construction projects will be able to use the findings as a guide to help improve road construction projects success rate. Specifically, by grouping and statistically testing the most important factors considered by the definitive stakeholders as the most important CSFs, practitioners will be able to know the specific CSFs to focus most during road construction projects execution. Further, by assessing the degree of agreements among the definitive stakeholders associated with road construction projects, a broader perspective on the CSFs is unearthed; hence, practitioners and policymakers would be able to identify the specific stakeholders to pay attention to during road construction projects delivery – which could lead to effective stakeholder management.

The next section reviews related literature followed by methodological approaches and data collection strategies used. Section four presents the results, and whilst section five discusses findings. The final section concludes the study by providing the summary and concluding remarks, the limitations and suggestions for further studies.

2. Literature Review

2.1 Transport Systems Infrastructure – Road Construction Projects

Extensive studies have been devoted to the study of road infrastructure projects. Whilst most studies have focused on PPP projects using the built-operate-transfer (BOT) delivery model (Villalba-Romero et al., 2015; Meng & Lu, 2017; Feng et

al., 2018), others have focused on scheduled deviation (Amoatey & Ankrah, 2016; Aziz & Abdel-Hakam, 2016), cost deviation (Chong & Hopkins, 2016), road safety (Glendon & Litherland 2001; Castro-Nuño & Arévalo-Quijada 2018), revenue risks (Singh & Kalidindi 2006), traffic risks (Thomas et al., 2006), among others. However, road construction literature indicates that the use of PPPs models is popular; hence, it has attracted much attention in academic research. Concerning BOT studies on road construction projects in developing countries such as Nigeria, the use of BOT has become very popular with the government in the past decade due to the huge capital outlay required in road constructions (Babatunde & Perera 2017). Despite the popularity, however, the work of Babatunde and Perera (2017) indicates that the use of this model possesses revenue risks to investors due to the traffics in developing countries that are unpredictable. In Similar study in India, Singh and Kalidindi (2006) found that traffic revenue risk is one of the most critical risk factors that impact on the commercial success of road projects that use PPP model. Whilst the use of PPPs has proven to be the preferred choice of many countries, others have not been able to use this approach – due to barriers such as local government adaptation to PPPs approach, exclusion of local contractors, and the complications associated with PPPs contracts (Janssen et al., 2016). With road safety in road construction projects, Castro-Nuño and Arévalo-Quijada (2018) employed multidimensional safety indicators that combine a set of criteria that relate to economics, demographics and sustainable urban transportation to investigate urban road safety performance in fifty (50) Spanish provinces (NUTS-3 regions). They found that the factors that relate to the degree of urban development are the most important to road safety; and as such, factors such as higher urban population and services concentration, and an advanced transport system, and roads network are the main factors that will lead to fewer accidents, hence, safer urban centres.

Regarding cost deviations, Chong and Hopkins (2016) evaluated the cost variability for Millennium Challenge Corporation (MCC) road construction projects in developing countries and found that cost variability within the MCCs has a mean average of 135% between the funding authorisation and final costs of the projects. They further found that the project cost estimates are mostly uncertain during the design phase, where the mean increase between funding authorization and engineers with an estimation of 100% deviation. Those looking at schedule deviations have identified several factors that lead to such setbacks. For instance, Aziz and Abdel-Hakam (2016) identified 293 causes of delay factors in Egyptian road construction projects. The factors related to financing, owner, contractors, labour, design, site, contractual relationship, contract, projects, external, equipment, rules and regulations, consultant, scheduling and controlling, and material. Even though the top and bottom overall twenty of the factors were determined respectively, none of them was deemed to be the fundamental causes and as such, each of the factors and their categorisation is deemed important; hence, the need to take each factor seriously to avert delays during road construction projects delivery. Similarly, Elawi et al. (2016) researched road and bridge construction projects in Saudi Arabia, by focusing on projects in Mecca, and found that the average delays are 39%. However, the factors that account for the delay are ten (10); which relate to land acquisition, contractors' lack of expertise, redesigning, and haphazard underground utilities (line services). Nevertheless, the most severe cause is land acquisition, which is linked to the clients; hence, the majority of the factors stem from the owner's side as compared to contractors, consultants, and other stakeholders associated with such projects.

2.2 Critical Success Factors – Road Construction Projects

Despite the extensive studies devoted to the study of road infrastructure projects, little has been done in relation to CSFs in developing countries in sub-Saharan African. Further, the studies conducted into CSFs in road construction projects have focused extensively on the use of PPPs (Gupta & Narasimham, 1998; Zhang, 2005; Singh & Kalidindi, 2006; Thomas et al., 2006; Chan et al., 2010; Chou et al., 2012; Ng et al., 2012; Babatunde & Perera, 2017; Debela, 2019; Mwelu et al., 2019; Chileshe et al., 2020). The study conducted by Zhang (2005) developed a CSFs package for the improvement of PPP procurement protocol to achieve a win-win relationship. This consists of five categories - favourable investment environment, economic viability, reliable concessionaire consortium with strong technical strength, sound financial package, and appropriate risk allocation via reliable contractual arrangements. Similarly, Ozorhon et al. (2007) investigated the factors that are critical to the success of international construction joint ventures and found that the external environment under which the ventures operate, and the internal project-related factors have a positive effect on the delivery performance. These environmental factors are related to political stability, macroeconomic conditions, the strength of the legal system, and the relations between the venture partners and the host government. On the other hand, the internal project-related factors relate to the availability of resources, the technical complexity of the project, completeness of the design, completeness of the contract documents, project requirements in terms of quality, environment, health and safety. Wang (2015) provides a framework for PPP evolution; which consists of four elements – CSFs for PPP, rising risks due to poorly addressed CSFs, the corresponding risk management to change/improve the CSFs, and consequently changed PPP models. Using American toll road development projects as a confirmatory empirical study from multiple cases analysis of six United States of American toll roads developed in the 1980s, the study found that public institutions' risk management can effectively explain the PPP evolution. Further, Ondari and Gekara (2013) assessed the factors influencing successful road projects completion in Kenya and found that the main factors that are critical to road projects completions are: management support, design specifications, contractor's capacity and supervision capacity influences. Ahmadabadi and Heravi (2019) also, used two cases of highway projects in Iran to assess the effect of CSFs on project success in PPP projects and found that the CSFs have direct effects on project success. However, the private sector capability has a direct effect on project success during the construction period whilst the government capability is effective at the operational phase.

Even though these prior studies paint a picture of the CSFs in road construction projects, they focus mainly on case studies; and are devoted to PPPs model; hence, findings may not apply to the entire road construction projects in a developing country context. Recently, works by Mwelu et al. (2019) and Debela (2019) have provided more compelling evidence by adopting a more detailed cross-sectional and in-depth examination on the CSFs in Uganda and Ethiopia respectively. Indeed, Debela (2019), in considering 26 CSF of PPP in Ethiopian road projects identified the following factors as important: favourable legal framework, transparency in procurement system, stable social and political environment, good governance, enabling environment for PPP and a functioning public. On the other hand, appreciating regulatory frameworks; perceived inefficiency of the regulatory framework and compliance to these regulatory frameworks contributes to the successful implementation of public road construction projects in Uganda. However, the literature on CSF in the road construction remains dynamic, varying with time, locations and continuously centred on PPP with less emphasis on only public sector road construction leaving room for further debate. This is essential to develop more alternative approaches in studying public-sector road construction – to improve the transport system in developing countries.

3. Methodology

A mixed-method research approach was employed in data collation – in-depth semi-structured and questionnaire survey was followed in sequential order respectively. This, therefore, implies that the philosophical foundation of the study is based on interpretivism research philosophy and the social constructionism paradigm; and positivism respectively. Nevertheless, the focus of the study is on the latter whilst the former is used as an exploration study (Crotty, 1998; Bryman, 2012); hence, the main philosophical assumption for the study is positivism. The survey followed well-structured; where the researcher(s) is independent and neither affects nor is affected by the subject of the research; which is within the positivist philosophical tradition (Saunders et al. 2012).

3.1 Data Collection

The data was collected from three key (definitive) stakeholders – project management practitioners (PMPs), contractors, and government officials (clients). The participants were selected from professional bodies and associations that are involved in road construction projects. These include Ghana Association of Managers, Chartered Institute of Project Management; Association of Building and Civil Engineering Contractors of Ghana; and Government Ministries, Departments and Agencies (MDAs). However, it was assumed that it is possible to have a member and/or new members who might not have been involved in public-sector road construction delivery; hence, a snowballing approach was applied to ensure that the individuals being contacted are involved in public-sector road construction projects before. The definitive group was focused because they possess all the three stakeholder attributes (stakeholder salience) espoused by Mitchell et al. (1997). The definitive stakeholders are part of the public-sector's dominant stakeholder coalition in the road construction project delivery, hence, are directly involved in execution processes. As a result, they possess rich knowledge about the factors that are critical to successful delivery. Three pilot interviews (one from each stakeholder group) were conducted to improve the validity of the 'interview question guide' (Foddy 2003).

The full interview consisted of sixteen (16) participants (PMP =8; Contractors = 4; Client (GO) =4). The sample size was determined at the saturation point (Hill et al. 2005; Silverman 2013) and was held between October and December 2018 at participants' homes, offices, sites, restaurants and Skype; lasting between 25 and 60 minutes. Whilst some of them were both audio-recorded with notetaking, others allowed note-taking only. The identified CSFs were used as the variables on the questionnaire on a Five-point Likert Scale; where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree. However, to improve the reliability of the data, a filter question at the beginning of the questionnaire was added, so that individuals who have not been involved in Ghanaian public-sector road construction project delivery could be excluded from the analysis. The questionnaire was sent back to the interviewees to review as to whether the variables reflect their views. This was then given to two professors with over 15 years' experience in a survey to review; which helped in the revision of the survey. The questionnaire had thirty-four (34) variables as presented in Table 2. The sample size of PMPs and contractors were determined by adapting Yamane's formula (Israel 1992) as presented below. At the time of the study, the active professionals working in well-known project management (which included those in road construction companies) firms consisted of 722.

The steps followed are the individual number of people working in active and well-known registered firms = 722 (N = 722). At an acceptable 95% level of confidence, the statistical z value of 2 (z = 2), and with an error limit of 10%.
Adapting the formula:

$$n = N/(1+N\times e^2) = 722/(1+722 \times (0.1)^2) = 722/8.22 = 87,$$

where,
n = required response/Sample Size
e = limit of error
N = Population

However, due to the difficulty in obtaining data in the local setting, there was a need to increase the number over the 87. This was also done to improve the external validity of the data. As a result, 556 questionnaires were distributed face-to-face out of which 273 (PMP=181; contractors=92) usable survey was returned – which is above the threshold recommended by Yamane's formula (Israel, 1992). On the other hand, the clients' sample size could not be determined using Yamane's formula since there was no specific data that showed the size of the public officials that lead road policy and construction projects, hence, all possible individuals associated with the target audience were targeted through snowballing. However, to ensure that an acceptable number for a scientific study is reached (Foddy 1994; Saunders et al. 2012), 259 questionnaires were distributed; and 99 usable were returned.

3.2 Data Analysis

Each interview was transcribed and uploaded unto the NVivo11 at the end of each day and analysed to identify the CSFs that participants cited. Nevertheless, because the interview was meant for the identification of the CSFs, the result is not presented in this study – the text was read through several times to identify the main CSFs cited by the participants. The questionnaire survey data were analysed using statistical techniques which included Relative Importance Index (RII), Spearman Rank Correlation Coefficients, and Kendall's Coefficient of Concordance and the Chi-square test of significance. The purpose was to statistically test the most important CSFs. Further, this was meant to test the homogeneity and degree of agreement among the definitive stakeholders used as the participants on the CSFs.

4. Results

4.1 Background

As indicated in Table 1 below, most of the respondents are males with a significant number of project management experience aged between 20 and 50 and above. Further, all the respondents have a level of education and are spread across all the regions in the country.

Table 1
Background Information of Respondents

Variables	Frequency	Percent
Gender		
Male	258	69.4
Female	114	30.6
Age group		
20-30	103	27.7
31-40	135	36.3
41-50	98	26.3
50 and above	36	9.7
Region		
Greater Accra	160	43
Ashanti	35	9.4
Brong -Ahafo	16	4.3
Eastern	23	6.2
Central	17	4.6
Volta	48	12.9
Western	24	6.5
Upper -East	17	4.6
Upper West	5	1.3
Northern	27	7.3
Highest Level of Education		
High school	66	17.7
HND	90	24.2
Bachelor	50	13.4
Master's degree	142	38.2
Professional qualification	24	6.5

Variables	Fre-	Percent
Years of Experience at Current Position		
less than 1 year	57	15.3
1-5 years	208	55.9
6-10 years	79	21.2
11-15 years	21	5.6
16-20 years	5	1.3
21-25 years	2	0.5
Years of Experience in General		
less than 1 year	29	7.8
1-5yrs	176	47.3
6-10yrs	121	32.5
11-15yrs	32	8.6
16-20yrs	12	3.2
21-25yrs	2	0.5
Position at Work		
Corporate management	10	2.7
Senior management	96	25.8
Junior management	152	40.9
Supervisory	74	19.9
Subordinate	40	10.8
Category of Respondent		
Contractor	92	24.7
Project management practitioner	181	48.7
Govt Official (client)	99	26.6
Total	**372**	**100.0**

4.2 Critical Success Factors (CSFs) of Public-Sector Road Construction Projects Delivery

4.2.1 Ranking the Critical Success Factors

The RII was used to provide a ranking for the thirty-four-item scale. The procedure used to calculate RII is outlined in Eq. (1) (Fagbenle et al., 2004):

$$RII = \frac{\sum_{i=1}^{5} P_i U_i}{N(n)} \tag{1}$$

where RII, P_i, U_i, N, and n are RII, respondent's ranking of the CSFs, frequency of respondents placing identical ranking on the CSFs, sample size, the highest attainable score on the CSFs respectively i= 1,2,3,4, 5. Table 2 below presents the indexes calculated for all respondents as well as separately for contractors, PMPs and the clients.

Table 2
Relative Importance Index and Ranks-Critical Success Factors for Road Constructions

Factors	Contractor		PMP		Govt. Official (Client)		Overall	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Planning	0.78	11	0.722	13	0.764	9	0.747	11
Monitoring	0.715	19	0.669	21	0.701	16	0.689	20
Availability of materials and equipment	0.726	18	0.751	10	0.711	14	0.734	13
Project team	0.65	30	0.633	29	0.624	31	0.635	29
Right project scope	0.639	31	0.669	21	0.566	34	0.634	31
User involvement	0.674	26	0.606	32	0.628	29	0.628	33
Project management technic/framework/models	0.602	33	0.614	30	0.598	32	0.607	34
Government Commitment to project	0.865	3	0.791	7	0.867	3	0.83	5
Project continuity by successive governments	0.874	2	0.878	2	0.865	4	0.867	2
No Scope Change	0.576	34	0.639	27	0.691	18	0.637	28
Transparency in procurement processes	0.676	25	0.61	31	0.657	25	0.639	27
Feasibility studies (government)	0.678	22	0.672	20	0.655	26	0.669	22
Adequate project funding	0.846	5	0.848	3	0.873	2	0.854	3
Communication	0.678	22	0.606	32	0.685	20	0.645	25
Appropriate leadership skills	0.637	32	0.66	25	0.588	33	0.635	29
Appropriate use of road construction Project management Skills & techniques	0.654	29	0.669	21	0.634	27	0.656	24
Supervision	0.678	22	0.71	16	0.675	24	0.693	19
Adhocracy (reduction in bureaucracy)	0.698	20	0.702	18	0.715	13	0.704	18
Support from financial institutions (local)-	0.774	14	0.718	14	0.693	17	0.725	14
Support from financial institutions and donor agencies & countries (International)	0.846	5	0.839	4	0.855	5	0.845	4
Absence of political interference	0.876	1	0.891	1	0.903	1	0.89	1
Transparency in project monitory by consultants	0.772	15	0.703	17	0.691	18	0.717	16
Support from Pressure groups (media, NGOs, political activities etc.)	0.789	10	0.74	12	0.705	15	0.743	12
Use of modern technology and innovation	0.791	9	0.683	19	0.725	12	0.721	15
Good weather/climate	0.728	17	0.583	34	0.634	27	0.633	32
Absence of nepotism	0.811	8	0.792	6	0.814	7	0.803	7
Absence of clientism	0.83	7	0.8	5	0.81	8	0.81	6
Availability of human capacity	0.67	28	0.635	28	0.628	29	0.642	26
Payments of contractors on time	0.85	4	0.781	8	0.741	11	0.787	9
No political corruption	0.778	12	0.78	9	0.826	6	0.792	8
Starting only projects that government can fund	0.689	21	0.64	26	0.683	22	0.663	23
Absence of court injunction or legal suit and land lit-	0.778	12	0.741	11	0.752	10	0.753	10
Absence of Flooding	0.672	27	0.666	24	0.685	20	0.673	21
Cooperation from local community	0.754	16	0.715	15	0.677	23	0.715	17

As presented in Table 2 above, the contractors ranked absence of political interference as the most important CSF in Ghana public-sector road construction project delivery; followed by project continuity by successive governments, government commitment to projects, payments of contractors on time and support from financial institutions and donor agencies and countries. Similarly, the PMPs ranked absence of political interference as the most important CSF; followed by project continuity by successive governments, adequate project funding, support from financial institutions and donor agencies and countries, and absence of clientism in that order. Moreover, like the contractors and PMPs, the clients also ranked absence of political interference as the most important CSF in public-sector road construction project delivery; which is followed by adequate project funding, government commitment to projects, project continuity by successive governments, and support from financial institutions and donor agencies and countries. This means that all sets of participants agreed that the most important critical success factor is the absence of political interference. In the nutshell, they ranked the following as the top ten overall most important CSFs in Ghanaian public-sector road construction project delivery: absence of political interference; project continuity by successive governments; adequate project funding; support from financial institutions and donor agencies and countries; government commitment to the project; absence of clientism; absence of nepotism; no political corruption; payments of contractors on time; and absence of court injunction or legal suit and land litigations

4.2.2 Agreement Analysis

To establish whether the ranks provided by the three sets of participants differ in their opinion, the spearman rank correlations and Kendall's coefficient of concordance were used. This is also in accordance with prior studies that sought to establish the differences in participants' rankings (see Siegel & Castellan, 1988; Zar, 1999). The main purpose was to find out

whether the sets of the participants have different views concerning the factors that are critical to the public-sector road construction projects performance or success. To achieve this, Eq. (2) in the formula below was utilised in the calculation.

$$\rho = 1 - \frac{6\sum_{i=1}^{n} d_i^{\,2}}{n(n^2-1)}, \tag{2}$$

where, *d* and *n* are the difference between the ranks given by any two sets of participants for an individual CSF, and the number of CSFs respectively factors. *i= 1, 2, 3, 4,…, n.* The computational results indicated that the Spearman rank correlation coefficient of 0.808 for contractors and PMP; 0.864 for contractors and government official (Client); and 0.817 for PMP and government official (Clients). This indicates that the coefficients for the three sets of participants are strong and positive; hence, showing a high degree of agreement between the rankings provided by the sets of participants. However, the sets of participants with the highest degree of an agreement are contractors and government official (Clients). The next step was to establish the degree of agreements among the three sets of participants using a single coefficient. To do so, Kendall's W is utilised here; following Kendall's W is calculated from the mean (ρ) of the pairwise Spearman correlations (ρ_s) using equation 3 as presented in Siegel and Castellan (1988, p. 262) and Zar (1999. p. 448):

$$W = \frac{(m-1)\bar{\rho}+1}{m} \tag{3}$$

where n and $\bar{\rho}$ are the number of the sets of participants and the mean of the pairwise spearman correlations respectively. The computed Kendall's W is 0.887 which indicates the existence of a high degree of agreement across the three sets of participants

4.2.3 Test of Significance

After establishing the degree of agreements between the sets of participants, the next was to test whether the degree of agreements is statistically significant. To do this, the Chi-Square test is applied here. The Chi-square test was computed following the work of Frimpong et al. (2003) and Fugar and Agyakwah-Baah (2010) use Eq. (4) below:

$$x^2 = m(n-1)W \tag{4}$$

where, m, n and *W* are the numbers of the sets of participants, the number CSFs, and Kendall's coefficient *W* respectively. The computational result is $x^2 = 87.79$ and using the CSFs table of n=34 and $\alpha = 0.05$ (That is 95% confidence interval), the Chi-square critical ratio=$\chi_{\alpha}^{2(n-1)} = \chi_{0.05}^{2(33)} = 47.4$.

Since the computed Chi-square value (87.79) > Chi-square critical value (47.4), it is concluded that there is a high degree of agreement among the three sets of participants (stakeholders).

4.3 Ranking of the Groupings of the CSFs of Public-Sector Road Construction Projects Delivery

Following the work of previous studies such as Frimpong et al. (2003) and Al-Kharashi and Skimore 2009); the 34 CSFs were classified into five categories based on related themes and/or classifications. They relate to the performing organization, government, external forces, resources and natural forces. The index of each of the five categories was calculated as the average of the relative importance index of the individual CSFs within the category. The computational results of the rankings and the overall rankings are presented in Table 3. As shown in Table 3 above, contractors ranked external forces related factors as the most important CSFs in the Ghanaian public-sector road construction projects success. In a descending order, the remaining are CSFs relating to government, resources, performing organisation and natural forces respectively. On the other hand, both PMPs and clients ranked government-related factors as the most important CSFs, followed by external forces and resources related factors respectively. However, they (PMPs and Clients) differed in their fourth and fifth most important CSFs. Thus, the PMPs ranked natural forces as fourth and performing organisation related factors as the fifth most important CSFs, the client ranked performing organisation as fourth and ranked natural forces as the fifth most important CSFs. Further, the overall rankings across the three sets of participants indicate that the most important CSFs relate to the government factors. In descending order, the remainder of the most important CSFs are factors that relate to external forces, resources, performing organisation, and natural forces.

Table 3
Relative Importance Index and Ranks of Group of Factors

Factors	Contractor		PMP		Govt. Official (Client)		Over-all
	RII	Rank	RII	Rank	RII	Rank	Rank
1. Performing Organisation	**0.673**	**5**	**0.656**	**4**	**0.657**	**5**	**4**
Administrative	***0.688***		***0.658***		***0.666***		
Planning	0.780		0.722		0.764		
Monitoring	0.715		0.669		0.701		
Project team	0.650		0.633		0.624		
User involvement	0.674		0.606		0.628		
Communication	0.678		0.606		0.685		
Appropriate leadership skills	0.637		0.660		0.588		
Supervision	0.678		0.710		0.675		
Technical	***0.653***		***0.655***		***0.643***		
Right project scope	0.639		0.669		0.566		
Project management technic/framework/models	0.602		0.614		0.598		
No Scope Change	0.576		0.639		0.691		
Appropriate use of road construction Project management Skills & techniques	0.654		0.669		0.634		
Use of modern technology and innovation	0.791		0.683		0.725		
2. Government	**0.783**	**2**	**0.753**	**1**	**0.769**	**1**	**1**
Political	***0.851***		***0.830***		***0.852***		
Government Commitment to project	0.865		0.791		0.867		
Project continuity by successive governments	0.874		0.878		0.865		
Absence of political interference	0.876		0.891		0.903		
Absence of nepotism	0.811		0.792		0.814		
Absence of clientism	0.830		0.800		0.810		
Administrative	***0.734***		***0.698***		***0.710***		
Transparency in procurement processes	0.676		0.610		0.657		
Feasibility studies (government)	0.678		0.672		0.655		
Adhocracy (reduction in bureaucracy)	0.698		0.702		0.715		
Transparency in project monitory by consultants	0.772		0.703		0.691		
Payments of contractors on time	0.850		0.781		0.741		
No political corruption	0.778		0.780		0.826		
Starting only projects that government can fund	0.689		0.640		0.683		
3. External Factors	**0.788**	**1**	**0.751**	**2**	**0.736**	**2**	**2**
Local	**0.774**		**0.729**		**0.707**		
Support from financial institutions (local)	0.774		0.718		0.693		
Support from Pressure groups (media, NGOs, political activities etc.)	0.789		0.740		0.705		
Absence of court injunction or legal suit and land litigations	0.778		0.741		0.752		
Cooperation from local community	0.754		0.715		0.677		
International	***0.846***		***0.839***		***0.855***		
Support from financial institutions and donor agencies & countries (International)	0.846		0.839		0.855		
4. Resources	**0.747**	**3**	**0.745**	**3**	**0.737**	**3**	**3**
Financial	***0.846***		***0.848***		***0.873***		
Adequate project funding	0.846		0.848		0.873		
Material	***0.698***		***0.693***		***0.670***		
Availability of materials and equipment	0.726		0.751		0.711		
Availability of human capacity	0.670		0.635		0.628		
5. Natural forces	**0.700**	**4**	**0.625**	**5**	**0.660**	**4**	**5**
Good weather/climate	0.728		0.583		0.634		
Absence of Flooding	0.672		0.666		0.685		

5. Discussions

The study revealed that the top ten most important CSFs, as well as the overall most important factors of Ghanaian public-sector road construction projects success, are government-related factors. These government-related CSFs are in two-categories – political and administration. Like most developing countries, Ghana has weak public administration and institutional systems mainly due to greater control from the executive arms of government and higher levels of bureaucracies and administrative bottlenecks (Amoako & Lyon, 2014). Hence, for public-sector road construction projects to be successful, there must be less government intervention. Even though politically related factors have been cited as factors that influence public sector projects failure (Asunka, 2015; Damoah & Akwei, 2017), they have not been considered as CSFs in road construction projects. On the other hand, factors that relate to administration practices have often been cited concerning factors inherent in the performing organisation (Ruuska & Teigland, 2009; Hwang & Ng 2013). Therefore, by identifying administration practices as CSFs relative to governments adds different dimensions to the administrative practices and projects performance. The implication is that performing organisations need to garner the necessary political and administrative skills in dealing with the government related factors to successfully deliver public sector road construction projects. Further, policymakers need to make Acts that will reduce government interference. However, this may be difficult in developing

countries – where the separation of powers is not strong in practice (Bob-Milliar, 2012); hence, it is recommended that there should be a bi-partisan approach to the aspects of road construction projects which requires government and/or political involvement.

The study revealed that external forces are critical factors for public-sector road construction projects delivery. However, the external factor that relates to 'international' is not surprising in the context of the study. Evidence suggests that Ghana relies on external sources of support in the form of grants, loans, human capacity and materials and equipment for project delivery (Republic of Ghana Budget 2012, 2019); and as such the continual support from this external support indicates that success is external resources dependent. Here, resource dependency theory (RDT) is evidenced (Pfeffer & Salackcik 1978; Hillman et al. 2009). In view of this, it is recommended that the Ghanaian government and developing countries must improve on their local sources of resource-based for road construction projects by looking for other means to generate funds rather than depending on external sources of resources. Similarly, external factors that relate to the 'local' community and pressure groups are important stakeholders capable of rallying citizens' support to influence road projects delivery. Even though these stakeholders may not possess the power to influence decisions, they can appeal to the government through their social contracts (Mitchell et al., 1997). The implication is that external factors that relate to local contexts cannot be by-passed if the government wants to successfully deliver road construction projects. Therefore, the government must satisfy their needs during road construction implementation. The study revealed that resources related factors include the availability of materials and equipment, human and financial resources. As indicated in earlier, Ghana relies on external financial and material resources for public sector projects delivery and as such availability of these is critical to successfully road construction project execution. This finding is consistent with prior studies in projects management that have identified resources as a factor that influence projects performance (Sambasian & Soon, 2007; Ruuska & Teigland, 2009). However, prior studies did not look at road construction projects delivery in developing countries. It is, therefore, suggested that developing countries undertaking road construction projects should make resources readily available before the commencements of such projects.

The findings also revealed a significant number of CSFs that relates to performing organisations. Even though public-sector road constructions are initiated and led by the government, the execution is carried out by private contractors, and factors relating to the contracting firm may impact on the success. These are management practices related. These findings are not surprising as evidence suggests that these factors are often associated with project performance (Goldfinch, 2007; Sambasian & Soon, 2007). However, prior studies often cite these factors as factors that lead to project failure. Therefore, this study espouses these factors in the context of CSFs. However, being fourth in the overall ranking is quite surprising since these are directly linked to the implementation phase of the project's lifecycle. This finding indicates that CSFs that are within the conception and definition phases (which are associated with the policy phase) are more important than those that are associated with the executions phase. This may not be the case in private sector projects – which have less political and/or governance-related issues. This could also be attributed to the context of the study - a developing country context; where public-sector road construction projects are highly ''political'' in their execution (Damoah & Akwei, 2017). This means that practitioners will not only have to develop technical and management skills that relate to road construction projects management techniques, frameworks, methodologies but also there is the need to develop different skill-sets that are more political. This will help practitioners to engage political leaders associated with such a project.

Finally, the study revealed that natural factors such as weather conditions and absence of flooding are critical to road construction projects successful delivery. However, this was not considered to be of high importance. Even though these CSFs were not considered to be of high importance, practitioners, contractors and policymakers should not ignore the impact that these CSFs could have on road construction projects performance since policymakers and practitioners do not have control over them. Further, policymakers and PMPs can put in place mitigation measures to reduce the effects of flooding and weather conditions when they occur. Weather conditions, for instance, could be mitigated through the provision of shades to reduce the effects of heatwaves on workers' body conditions.

6. Conclusions

Road construction studies have focused extensively on the use of PPP execution mode – with fewer studies devoted to the CSFs in a developing country's context in sub-Saharan Africa. Further, despite the dynamics of public-sector road construction, their political nature in implementation processes, and the implications for transport policy directions in developing countries, little is known about factors that are critical to successful execution, hence, the need to focus on a developing country's context. This study assessed the CSFs of public-sector road construction projects execution from the perspective of definitive stakeholders associated with such projects in Ghana. Using a mixed-method approach – in-depth interviews and questionnaire surveys in sequential order from 16 and 372 definitive stakeholders respectively, 34 factors were identified as the CSFs of Ghanaian public sector road construction project. Overall, the top ten most important factors in the order of importance: absence of political interference, project continuity by successive governments, adequate project funding, support from financial institutions and donor agencies and countries, government commitment to project, absence of clientism, absence of nepotism, no political corruption, payments of contractors on time and absence of court injunction or legal suit and land litigations. These factors relate to the government, external forces, resources, performing organisation,

and natural. However, despite the variation in rankings of the factors by the three sets of stakeholders, there are high degrees of agreements on the most important CSFs.

Overall, government-related factors are deemed to be the most important CSFs, which is followed by external forces, resources, performing organisation, and natural forces related factors respectively. Given that most of the CSFs in the top ten most important factors and the number one on the group ranking are government-related, it is recommended that an Act should be made that will involve a bi-partisan approach to the aspects of road policy and construction execution that involves government.

The study is limited by an inability to know the exact number of clients upon which the sample size could be determined. However, this was compensated by targeting all the possible audience and distributing several questionnaires that are acceptable by authors. Further, since the study used random and snowballing sampling together as the sampling techniques, carefulness needs to be taken in the generalisation of the findings. This study, therefore, should provide an exploratory study upon which further studies could be conducted within the local context and beyond by looking at how these factors impact on performance from multiple performance indicators.

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