

Demand side perception: The mediating role of public procurement regulatory framework in successful road construction implementation

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ABSTRACT

Complexity of implementing construction projects has attracted various approaches in meeting project objectives. Among viable approaches, the purpose of this study considers mediating role of public procurement regulatory framework in successful construction project implementation. A dynamic construction industry requires management to establish viable factors to successfully implement construction projects whereby interplay among factors through mediating role is paramount. Drawing a sample from three public organizations in road construction, this study aimed to establish whether compliance with public procurement regulatory framework mediates the relationship between six compliance factors and public road construction project success. Cross-sectional research design using a structured self-administered questionnaire and Partial Least Square Structural Equation Modelling for mediation in SmartPLS3 was adopted. Findings revealed that compliance significantly mediates the relationship between sanctions, perceived inefficiency and contractors' resistance and public road construction project success. While insignificant with familiarity, monitoring activities and professionalism. The implication of these findings suggest strong mediational effects would ensure government projects are implemented as per designed specifications,

timely schedule and within budget. In addition, these interactive effects could lead to increased quality paved roads, value for money and saving funds necessary for economic development.

KEYWORDS: Mediation · Compliance · Public Procurement · Regulatory Framework · Road construction · Implementation.

INTRODUCTION

Construction industry is a cornerstone for economic development for both developed and developing countries. Several scholars have documented growing importance of implementing construction projects successfully [1-3]. In addition; various compliance studies are undertaken establishing influential factors [4-6]. Despite these studies including those determining project success factors in construction industry, little effort is known considering mediational effect to successfully implement construction projects [7-8]. These studies have considered direct relationships with little attention to mediation effects in the construction. This paper bridges the gap by determining mediating role of compliance with public procurement regulatory framework in construction industry using data from three government entities involved in Uganda's public road procurement and implementation. Growing importance of mediational studies are necessary for complex construction industry to successfully implement construction projects. For example, this study involves establishing underlying criterion explaining how compliance with regulatory framework mediates the relationship between compliance factors and public road construction project success. This is beyond prediction that is concerned with simple relationships [9]. Mediation underpins interrelationships between variables [10] based on assumption that independent variable predicts mediating variable that finally predicts dependent variable in a specified causal order [11]. Declining performance challenging construction



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projects necessitate government to consider mediational effects in rectifying these challenges. Government need to determine mediating role of complying with regulatory framework in implementing public road construction projects since it is vital in service delivery [12]. A lack of compliance with public procurement regulatory framework affects road construction projects characterized with cost and schedule overruns [13].

This study aims to determine the role of compliance with regulatory framework in implementing road construction projects. The study is guided by the following research question; Does compliance with regulatory framework mediate the relationship between compliance factors (Familiarity, monitoring, professionalism, sanctions, perceived inefficiency and contractors' resistance) and project success? A theoretical approach was considered to extract eight factors. These factors are explained in literature review. The factors are grouped as six independent variables (compliance factors), compliance with public procurement regulatory framework (Mediator) and project success (Dependent variable). Mediation test was performed sequentially corresponding to six hypotheses summarized in table 2. Structural Equation Modeling (SEM) mediation approach was followed to perform mediation tests in SmartPLS3 [14]. Both SmartPLS3 and SPSS24 were used for preliminary analysis to determine constructs' reliabilities, validities, diagnostic tests for cleaning and normalising data. This study is structured as follows, introduction, theoretical foundation, study variables, mediation effects, methodology, results, discussions, recommendations, limitations, future research and conclusions.

THEORETICAL FOUNDATION

Theory drives research problem from causal factors and explores possible governance mechanism to solve the problem since sound and relevant research is built from theoretical foundation [15]. A theory is good in formulating knowledge [16]. Institutional theory was adopted to establish eight variables that are further explained in this study.

Institutional theory

Institutional theory consists of formal rules and professional code that are emphasized by organizations through monitoring and enforcement for staff compliance in performing duties [17-18]. Institutions are vital for construction projects since they control human interactions through enforcing laws, regulations, conventions and norms of behavior to achieve set objectives [17]. However, enforcing professionalism and sanctions face resistance from staff. Government derives the legal power from such institutions to influence organizational results through coercion and monitoring employees to influence their compliance level with regulatory framework [19]. Compliance with

regulatory framework is affected by resistance of some players who may find alternative means of successfully accomplishing tasks at their level of knowledge and interest. Similarly in road construction, contractors may resist bad decisions by public officers to successfully implement these projects because compliance with institutional norms varies with specific reasons [20]. Public road construction projects multiple stakeholders are responsible for different obligations of which they have specific interest to fulfill while resisting non-complying staff to successfully implement these projects.

Institutional theory is vital for public road construction projects through cultural cognitive, regulatory and normative elements [21]. Regulatory element deals with rules, laws and sanctions as enforcement mechanism and once complied with for example could lead to successful implementation of public road construction projects. Furthermore, it helps in enforcing legally binding contracts signed between parties for example government and contractors for construction of public road construction project [22]. Cultural cognitive deals with symbols, beliefs and common understanding that defines individual behavior [23]. This guides public road construction project team in doing the right thing and meet Government goals. Normative element defines professionalism, norms and values guiding staff in performing respective duties to meet company goals [23, 24]. Professionalism in public road construction is important and is achieved through formal university education, legitimization of specialized skills and professional networking [24].

Implementing public road construction projects successfully will depend on compliance with required regulatory framework that should be effective in detecting employees deviating from it. Deviating from regulatory framework interferes with government goals. However, such deviations are minimized if regulatory framework is effective with strong sanctions capable of correcting deviant behavior to achieve set objectives [17, 25]. Complying with an effective and efficient regulatory framework governing public road construction projects is crucial in implementing public road construction projects called institutional fit [25]. Public road construction stakeholders' compliance with public procurement regulatory framework enhance Government success through minimized risks, transaction costs and production [17]. Efficient and effective regulatory framework coupled with effective enforcement mechanisms are paramount to improve compliance levels and successful implementation of public road construction project. Relatedly, success depends on effective enforcement, staff skills and knowledge to achieve organizational objectives [18]. Investing in staff competence by improving their professional conduct, skills and knowledge strengthens their professionalism that is paramount in implementing public road construction projects. This is because workforce diversity and structural differentiations are

competitive advantage in organizational success [20]. The theory summarizes by revealing the following study variables; project success, perceived inefficiency of regulatory framework, professionalism of staff, familiarity, compliance with regulatory framework, monitoring, sanctions and contractors' resistance to explore mediating role of compliance with regulatory framework in implementing public road construction projects [22, 26] .

Familiarity with Public Procurement regulatory Framework

Lack of familiarity with organizational structures and governance mechanism causes capacity problems in public sector procurement [27]. For example, Bangladesh failed to meet goals because staff were not familiar with a regulatory framework governing public procurement [28]. In Ugandan context, limited staff knowledge of public procurement process and PPDA Act 2003 affected compliance with procurement system [29].

Complex construction projects bring together different stakeholder with varying perceptions and attitude when implementing different projects [30, 31]. This calls for careful planning right from project initiation stage to completion by making the project well defined and recruiting competent staff to implement these projects [32]. Staff competence is enabled through specified training to enhance their familiarity with project requirements [17, 33]. Continuously enabling staff competence through training is equally important for implementing public road construction projects [34]. This is because poor training account for flawed construction sector [35]. Enabling staff competence ensures accumulated knowledge and expertise in project implementation that creates competitive advantage and enhancing project success [32].

Monitoring activities

Lack of monitoring procurement officials affects compliance with public procurement regulatory framework [36]. Hence, preventing procurement irregularities in public road construction projects requires ongoing monitoring of project implementation [37]. In a public road implementation context, constant monitoring of staff is suggested to support them to discount unethical interest in pursuit of organizational goals [24, 38]. This notion is supported by reports indicating that successful performance of construction projects' relies on regular monitoring of activities undertaken [39-40]. For example, successful performance of United States' construction sector is attributed to effective monitoring and tracking of contractors. Consequently, avoiding shoddy workmanship, cost overruns and corruption [41]. In China, monitoring underground construction projects enhanced successful implementation of these projects [42]. Recent studies emphasize monitoring mechanisms to successfully implement quality construction

projects [35, 43, 44]. These mechanisms encourage total supervision and performance monitoring of construction projects starting with contractors by reducing risks antagonizing successful project implementation [45-46]. Furthermore, effective monitoring of irresponsible construction staff ensures successful implementation of public construction project [47].

Professionalism of staff

Professionalism guide construction professionals based on knowledge and experience to ensure compliance with a regulatory framework [48-49] . However, a lack of professionalism in construction industry is attributed to unethical behaviour and the complex nature of construction projects [50]. Professionalism is inevitable for public road construction projects [51] that requires using staff with competent skills, ethical, experienced and knowledgeable to successfully implement these projects [52]. [53], noted that professional competence is essential for successful performance and it is achieved through training, coaching, mentoring, developing and retaining competent workforce [54-55]. In addition, professional experience is vital for successful construction industry. Interestingly, lack of construction expertise affects quality of construction projects in Australian [56]. Consequently, the Australian's Government recommended to all public agencies handling construction projects to have professionals with required skills and expertise for successful project implementation [57-58]. Such recommendations were meant to minimize pushing risks to contractors and relying on costly external consultants especially in managing capital works [57].

Sanctions

Sanctions are enforcement mechanism used by regulatory bodies to ensure compliance with a regulatory framework [59]. Surprisingly, application of sanctions to achieve compliance with respective regulatory frameworks go with mixed reactions. For example, looking through the lens of agency theory, sanctions make violators/agent ploy how to prevent and conceal detection of wrong doing by the principal [60]. Public road construction projects involve multiple stakeholders and co-funded by multilateral bodies including World Bank, International Monetary Fund (IMF) among others and respective Governments. However, implementing these projects requires strict punitive actions against perpetrators to avoid suspension of funding by respective international bodies [59, 61]. For example in Bangladesh, World Bank suspended funding of fourteen Highway road construction projects as a punitive measure to safeguard public funds [27]. World Bank noted that failure to impose sanctions on public procurement violators account for US\$100 million (AU\$136M) waste annually [62]. To mitigate against these losses and reducing unacceptable practices, Australian

construction sector emphasized enforcing sanctions to successfully implement construction projects [63]. In addition, institutional theory suggests effective sanctions to correct deviant behaviours for successful organization performance [17, 25]. This suggestion is equally inevitable for implementing Uganda's public road construction projects.

Perceived inefficiency

A clear and simple regulatory framework governing complex public road construction projects is inevitable for road subsector players to understand and interpret easily (See Latham and Egan reports) [64]. This is important because it limits unethical manipulators to drive their ambitions progressively [40]. Furthermore, an efficient regulatory framework facilitates a timely road implementation process by eliminating frequent consultation with legal fraternity for interpretation. Such a framework would ensure a clear scope of construction projects that is important for successful implementation [31]. Convincingly, inefficient public procurement regulatory frameworks affect successful implementation of procurement project in East Africa [66]. Further international literature show that inefficient regulatory framework affect construction projects [66-67]. Hence, recommending a proper regulatory framework to govern construction industry with appropriate enforcement mechanism [59]. A pertinent example in Uganda's construction sector show that the sector is challenged with unclear National Construction Standards and regulations [49].

Contractors' resistance

Different public road construction stakeholders come to accomplish specific assignment and as they do so, they may have conflicting interest contrary to project success [68]. This notion is emphasized by institutional theory noting that compliance meets resistance from different players with varying ambitions and means of accomplishing project tasks successfully [69]. Ideally, project success is about teamwork through coordination whereby contractors' commitment and cooperation to fulfil their obligations and resisting bad decision, would lead to successful implementation of construction projects [69]. Interestingly, coordination among construction participants is significant in project success by reducing risks associated with cost estimation [70]. This is in line with Latham 1994 recommending openness, cooperation, trust, honesty, commitment and mutual understanding among team members for a successful construction industry [8]. Accordingly, successful implementation of road construction projects is crucial for contractors. Because they compete for limited Government contracts and yet winning future contracts is tagged on previous performance. International literature reveals that contractors bribe public official by paying 10-20% of contract price to secure public contracts [71]. However, in most cases, substandard works have costed contractors by loosing

future contracts. To mitigate this, compliance with regulatory framework is inevitable. This has prompted contractors' actions against deviant public officers for a successful public procurement [72].

Compliance with public procurement regulatory framework and project success

Lack of compliance in public procurement affects transparency, accountability and leads to unsuccessful implementation of public construction projects [73-74]. In Australia, irrespective of the country's jurisdiction, Government projects lack the implementation of best procurement practices compared to private sector due to procurement irregularities with inefficient procurement processes costing the taxpayer [75, 36]. Complying with a public procurement regulatory framework saves funds; however, it requires an effective enforcement mechanism to ensure compliance and meeting Government targets. Lack of compliance manifested into non-durable construction products are challenging construction projects. For example, approximately 0.25-2.5% of contract value is spent on reworks because of non-compliant products [58]. Particularly, Australian examples show that lack of compliance manifested through cost and schedule overruns accounts for 48% failed public road construction project. These projects include; Sydney cross city tunnel, Brisbane's river city motorway and Sydney's M7 Clem Jones Tunnel [7, 76]. Additional examples in Australia show that Westconnex motorway suffered significant cost increase, Ipswich motorway upgrade 196% cost overrun and Forrest highway peel deviated by over 400% of original budgeted value [77]. Lack of compliance through contract variations and cost overrun is not only reported in Australia and Uganda but also equally reported in Brazil, Hong Kong and Asia transport infrastructure projects [77-78].

Project success is the successful accomplishment of tasks/operations by meeting predetermined objectives including cost, time, performance and safety [31-32]. Pertinent reports show that many construction projects have failed because they do not comply with predetermined objectives including governing regulatory framework. For example in Australia, non-compliant construction products account for 50% unsuccessful project implementation [58]. On average, 48% of infrastructure projects entirely are not completed on time, within estimated cost and expected quality [79]. A lack of compliance is affecting Australian construction industry [32]. Further international reports show that unsuccessful construction projects are caused by cost and schedule overruns [34]. Specifically, overruns endemically challenge transport infrastructure projects [80]. Cost escalation is a pervasive problem in construction industry that has affected public construction projects [44, 77]. Scholars are now calling for strict enforcement of regulatory framework in a transparent manner for successful implementation of construction projects

[44]. Given complexity of construction projects and poor performance of infrastructure projects, require an interwoven of factors to determine their successful implementation [76]. Hence, importance of mediation discussed in the following section.

MEDIATION EFFECTS AND HYPOTHESES

Importance of mediation effects is discussed here and specifically evaluating how compliance with public procurement regulatory framework mediates the relationship between six compliance factors and public road construction projects success. Using data from three government entities representing demand side perception in Uganda, six mediational hypotheses are developed for statistical significance testing. Institutional theory established six compliance factors and were further reviewed. Mediation testing is good since it unveils how variables are associated beyond simple prediction [81-82]. It evaluates the relationship between variables in an underlying phenomenon [83-84]. Mediation, which is upcoming in construction management, follows a specific sequence whereby independent variable predicts mediating variable that predicts the dependent variable [85]. The mediating variable may account for partial or full significant relationship between independent and dependent. With emerging mediation research in construction industry, this study determined the mediating role of compliance with public procurement regulatory framework on the relationship between compliance factors and project success of public road construction projects. Limited mediation literature covering construction industry affected this study by relying on general mediation literature. However, this gap motivated this study as a contribution in construction management and public procurement fields. When testing for mediation, sufficient coefficient of determination (R^2) is used as a predictive power for the mediating variable to influence the relationship between independent and dependent variables [9, 86].

Following Structural Equation Modeling approach in testing mediation, there is a direct and indirect path relationship [87]. Directly, independent variable causes dependent variable. While, indirectly independent variable causes dependent variables through mediating variable. Mediation takes place after satisfying the following steps: Step one, the independent variable should be significantly related to dependent variable. Step two, the independent variable should be significantly related to the mediator. Whereas the mediator is supposed to relate to the dependent variable, it is not a requirement in the preliminary steps for mediation testing [87]. Hence, for mediation to take place, the independent variable (Compliance factors) should be strongly related to both the dependent variable (Project Success) and mediator (Compliance) respectively [87]. The third step is to test for mediation

that may be full or partial and is determined by bootstrap analysis [84]. Under this step, the relationship between independent and dependent variables must be significantly reduced when the mediator is introduced [83]. Notably, when the mediator is introduced and the indirect effect (relationship) is strongly significant while the direct relationship is insignificant, then it is full mediation [84]. However, when both the direct and indirect relationship is significant when the mediator is introduced, it implies partial mediation [84]. These steps were observed when running a bootstrap analysis in SmartPLS3 and examining significance of regression coefficients. This study aimed at both full and partial mediation currently applicable in modern SEM tools of mediation testing. Partial mediation accounts for a portion of total effect size while full mediation accounts for total effect size that renders direct relationship between independent and dependent variables insignificant [88]. Proper arrangement of variables in a conceptual model for cross-sectional research clearly linking the three variable relationship for mediational testing is important [89]. Despite significant direct relationship between independent and dependent variables, indirect path through mediating variable should be significant [83, 90]. Whereas there is lack of statistical evidence on assumptions surrounding mediational tests [92], the study aimed at establishing the direct effect magnitude between compliance factors and project success as well as indirect effect between compliance factors through compliance and Project success [92].

Currently researchers are challenged on selecting Structural Equation Modelling (SEM) approach or Baron and Kenny approach for mediational tests. SEM is based on full mediation and Baron and Kenny on partial mediation. Current literature continue criticizing Baron and Kenny approach as being ancient, lacks a mechanism for testing significance of indirect effects, has low statistical power, does not quantify the magnitude of mediation effect and does not accommodate models with inconsistent mediation [87, 93]. In addition, lack of publicity on State of the Art PLS-SEM mediation guidelines has forced many researchers to opt for Baron and Kenny approach that produce misleading results [87]. Consequently, SEM mediation approach was considered for this study because of its powerfulness in testing mediation using bootstrapping, strong statistical power, offsetting measurement error and clearly linking hypotheses [87]. This leads to summarized mediation hypotheses in table 1.

Table 1: Summary of hypotheses

Number	Hypotheses
H1	Compliance with public procurement regulatory framework mediates the relationship between familiarity with public procurement regulatory framework and project success
H2	Compliance with public procurement regulatory framework mediates the relationship between monitoring activities in public road construction and project success
H3	Compliance with public procurement regulatory framework mediates the relationship between professionalism of staff in public road construction projects and project success
H4	Compliance with public procurement regulatory framework mediates the relationship between sanctions on staff in public road construction projects and project success
H5	Compliance with public procurement regulatory framework mediates the relationship between perceived inefficiency of public procurement regulatory framework and project success.
H6	Compliance with public procurement regulatory framework mediates the relationship between contractors' resistance to non-compliance with public procurement regulatory framework by public officers and project success

METHODOLOGY

A quantitative methodology was adopted due to its ability in testing hypotheses for constructs relationships' direction, strength and variance through statistical technique [94].

Research design

A Cross-sectional study called snapshot, is good one time point study for drawing inferences on an existing phenomenon was adopted to explore relationship effect among variables [95]. This was necessary due to its statistical techniques that are good for accuracy, validity, reliability generalizability and objectivity compared to qualitative [96]. Participants for this study included staff from Directorate of Engineering and Works (DE&W), Directorate of Transport (DT), Procurement and Disposal Unit (PDU), Policy & Planning (P&P) and Finance & Administration (F&A) of Ministry of Works and Transport. Directorate of Performance and Monitoring (DP&M), Directorate of Legal & Investigations (DL&I), Directorate of Operations (DOP), Directorate of Capacity Building & Advisory Services (DCB&AS) and Directorate of Corporate (DCP) of Public Procurement and Disposal of Public Asset Authority. Fund Management Department (FMD) of Uganda Road Fund. A sample of 157 was statistically selected from a population of 257 staff in three public entities following [97]. Stratified proportionate random sampling was used to identify staff in these entities and simple random sampling used to get actual respondents who were given the questionnaires to complete. However, 154 fully usable

questionnaires were collected representing 98.1% response rate. This high response rate is attributed to the following: The right procedure was followed by seeking permission from selected entities and obtaining organizational consent to allow individual respondents for voluntary participation. Furthermore, continuous reminders and follow-up through telephone calls and physical visits. We further used research assistants from respective institutions who also helped in following up with their colleagues to complete the questionnaire. The questionnaire was developed in three steps namely; item generation, purification and validation in line with study objective and hypotheses. The measurement items on the questionnaire were adopted from previous studies (See Table 2) and modified to match current study that was measured on a five-Likert scale ranging from 1-strongly disagree to 5-strongly agree. After piloting the questionnaire among construction contract managers and procurement officers in New South Wales Australia, rewording some questions was done and vague ones removed. The final questionnaire was physically delivered to respective entities where research assistants helped in distributing and collecting completed ones. Extensive literature review was conducted using University of Newcastle catalogue via Scopus, google scholar and science direct search engines. Over 700 journal articles, conference papers and public documents were retrieved and stored in EndNote where they were sorted based on key words to get relevant ones for this study. Mediation was determined using bootstrap analysis in SmartPLS3 following SEM mediation approach [98].

Table 2: Variables and Measurement indicators

Factors and sources	Measurement indicators
Familiarity (Eyaa and Oluka, 2011; Gelderman, Ghijsen and Brugman, 2006; Mwakibinga and Buvik, 2013).	F1. The regulatory framework governing public road construction projects is precisely written for easy interpretation. F3. Only staff who are familiar with implementation of public road construction projects are used. F13. Staff with appropriate academic qualification are employed on applicable road construction projects.
Monitoring activities (Mwakibinga and Buvik, 2013; Rokkan and Buvik, 2009).	M4. Frequent inspections checking on timely recording of project progress. M13. Frequent inspections ensuring timely project completion. M14. Frequent inspections to prevent damage. M15. Frequent inspections to prevent theft.
Professionalism (Basheka and Mugabira, 2008; Eyaa and Oluka, 2011).	PR3. Staff high professional integrity. PR18. Professional judgement during decision making. PR19. Practical experience in road construction. PR20. Required expertise in road construction. PR21. High level of confidentiality.
Sanctions (Mwakibinga and Buvik, 2013; Payan and McFarland, 2005).	S7. Penalties imposed on those found guilty without any warning. S8. Sanctions are implemented in secret. S9. Sanctions with negative consequences are imposed.
Perceived inefficiency (Gelderman, Ghijsen and Schoonen, 2010).	PI1. Ban on negotiation between contractors and public officers during road construction. PI2. Ban on contract extension beyond agreed schedule. PI3. Ban on underperforming contractors.
Contractors' resistance (Gelderman, Ghijsen and Schoonen, 2010; Gelderman, Ghijsen and Brugman, 2006).	CR1. Contractors' readiness to act against bad decisions. CR2. Contractors' knowledge on public road procurement process.
Compliance (Gelderman, Ghijsen and Brugman, 2006; Mwakibinga and Buvik, 2013; Payan and McFarland, 2005).	CP1. Proper authorization of road construction projects. CP2. Timely delivery of road construction projects. CP3. Timely recording of road construction transactions. CP10. Achievable road construction project objective.
Project Success (Pinto & Mantel 1990 and Dvir & Lechler 2004)	PS1. Road construction projects are implemented in accordance with specifications PS2. Road construction projects are completed within schedule PS3. Road construction projects are completed within budget

Validity and reliability

After piloting for clarity, relevance and updating needed for validity and reliability [99], preliminary analysis for further reliability and validity was conducted in Smart-PLS3 software by running PLS-algorithms to get measurement indicators with sufficient factor loadings, Convergent and discriminatory validity. Composite reliability determined construct reliability for internal consistence since it assume more accurate parameter estimation with close approximation than Cronbach alpha with lower bound estimation [100]. Convergent validity that measures indicators' representation in respective constructs was determined through Average Variance Extracted (AVE). This was useful in determining construct validity and model development [101]. Discriminant validity that ensures indicators should measure what they are supposed to measure was determined through recommended Heterotrait-Monotrait ratio (HTMT) currently available in Smart-PLS version 3 [102].

Data processing and analysis

Data screening was necessary to ensure completeness and accuracy before detailed analysis in SmartPLS software for mediation tests. This purification process aimed at solving multi-collinearity, non-normality,

outliers and missing values. Finally, mediation testing was performed in SmartPLS based on PLS-SEM mediation guidelines [98].

RESULTS

This section presents respective results for mediation effect assessment and preliminary assessment for reliability and validity. It further presents bootstrap results. All composite reliability coefficient are above 0.7 and outer loadings are over 0.5 indicating strong internal consistence and reliability respectively see table 3 and 4 [103]. All constructs' AVE values are above 0.5 showing that the latent construct explained more than 50% variance of its indicators depicting sufficient convergent validity see table 3 [103]. HTMT values are all below 0.85 as depicted in table 5 demonstrating good discriminant validity [104]. Skewness and kurtosis statistics for all study variables are respectively within the range of ± 3 and ± 5 falling within acceptable limits and exhibiting fairly normal data distribution as depicted in table 5 [105]. While VIF coefficients are below 2 that is far below recommended threshold of 5 indicating that multicollinearity was not a problem as shown in table 2 [103].

Table 3: Reliability test results

Variable	Composite Reliability (ρ_c)	AVE	VIF	
			Compliance	Project Success
Familiarity	0.819	0.602	1.197	1.198
Monitoring activities	0.863	0.682	1.388	1.388
Professionalism	0.843	0.518	1.382	1.389
Sanctions on staff	0.780	0.552	1.397	1.526
perceived inefficiency	0.799	0.571	1.474	1.551
Contractors' Resistance	0.771	0.629	1.411	1.431
Compliance	0.818	0.604		1.380
Project Success	0.867	0.686		

Table 4: Outer loadings

	Compliance	Contractors' Resistance	Familiarity	Monitoring activities	Perceived Inefficiency	Professionalism	Sanctions	Project success
CP1	0.883							
CP10	0.782							
CP3	0.648							
CR1		0.860						
CR2		0.720						
F1			0.749					
F2			0.718					
F3			0.853					
M13				0.642				
M14				0.914				
M15				0.893				
PI1					0.701			
PI2					0.834			
PI3					0.725			
PR18						0.657		
PR19						0.715		
PR20						0.683		
PR21						0.808		
PR3						0.727		
S10							0.513	
S7							0.806	
S8							0.865	
PS1								0.711
PS2								0.893
PS3								0.869

Table 5: Heterotrait-Monotrait Ratio (HTMT)

	Compliance	Contractors' Resistance	Familiarity	Monitoring activities	Perceived Inefficiency	Professionalism	Sanctions	Project success
Compliance								
Contractors' Resistance	0.550							
Familiarity	0.228	0.476						
Monitoring activities	0.250	0.604	0.355					
Perceived Inefficiency	0.600	0.790	0.394	0.310				
Professionalism	0.182	0.541	0.401	0.580	0.373			
Sanctions	0.567	0.763	0.343	0.512	0.704	0.266		
Project success	0.454	0.810	0.484	0.628	0.539	0.721	0.316	

Table 6: Normality Statistics for skewness and Kurtosis results

[illegible]

Mediation results

According to Table 7, mediation is only possible for sanctions, perceived inefficiency and contractors' resistance since they are respectively related to both project success and compliance [92].

Table 8, demonstrates results for final mediations involving sanctions, perceived inefficiency and contractors' resistance.

Table 7: Mediation steps 1-2

CONSTRUCT	COMPLIANCE		PROJECT SUCCESS	
	Path Coefficient	Sig	Path Coefficient	Sig
Familiarity	0.252	0.141	0.335	0.000
Monitoring	0.246	0.153	0.402	0.000
Professionalism	0.198	0.451	0.544	0.000
Sanctions	0.467	0.000	0.252	0.001
Perceived Inefficiency	-0.427	0.000	-0.456	0.000
Contractors' Resistance	0.330	0.000	0.479	0.000

Table 8: Step 3 Final Mediation Test

Direct effect			Indirect effect			
	Path coefficient	Sig		Path coefficient	Sig	Mediation type
Sanctions> Project success	0.068	0.462	Sanctions>Compliance> Project success	0.187	0.000	Full Mediation
Sanctions> Compliance	0.463	0.000				
Compliance> Project success	0.405	0.000				
Perceived inefficiency> Project success	-0.327	0.000	Perceived inefficiency>Compliance> Project success	-0.124	0.002	Partial Mediation
Perceived inefficiency> Compliance	-0.422	0.000				
Compliance> Project success	0.295	0.000				
Contractors' Resistance> Project success	0.378	0.000	Contractors' Resistance>Compliance> Project success	0.101	0.004	Partial Mediation
Contractors' Resistance> Compliance	0.321	0.000				
Compliance> Project success	0.316	0.000				

DISCUSSION

Compliance with public procurement regulatory framework mediates the relationship between familiarity with public procurement regulatory framework and project success.

Whereas there is a significant relationship between familiarity with public procurement regulatory framework and project success, there is an insignificant relationship between familiarity with public procurement regulatory framework and compliance with this framework since their p-value is above 0.05. Mediation testing is only applicable when a significant relationship exists among three variable [14]. According to table 7 results covering step 1 – 2 this condition is not satisfied since familiarity with public procurement regulatory framework is insignificantly related to compliance with public procurement regulatory framework rendering mediational test impossible. Compliance with public procurement regulatory framework does not mediate the relationship between familiarity with public procurement regulatory framework and success of public road construction projects. Hence, hypothesis (H1) is not supported implying that successful implementation of public road construction projects is not realized when both familiarity with public procurement regulatory framework and compliance with public procurement regulatory framework governing these projects are introduced simultaneously.

Compliance with public procurement regulatory framework mediates the relationship between monitoring activities in public road construction and project success

Despite significant relationship between monitoring activities and project success, there is an insignificant relationship between monitoring activities and compliance with public procurement regulatory framework since their p-value is above 0.05. Mediation testing is only applicable when a significant relationship exists among three variable [14]. According to table 7 results, covering step 1 – 2 this condition is not satisfied since monitoring activities is insignificantly related to compliance with public procurement regulatory framework rendering mediational test invalid. Compliance with public procurement regulatory framework does not mediate the relationship between monitoring activities and success of public road construction projects. Hence, hypothesis (H2) is not supported implying that successful implementation of public road construction projects is not realized when both monitoring activities and compliance with public procurement regulatory framework governing these projects are applied simultaneously.

Compliance with public procurement regulatory framework mediates the relationship between professionalism of staff in public road construction projects and project success

Preliminary mediation step 1-2 are violated since there is an insignificant relationship between professionalism and compliance ($\beta = 0.198$, $p = 0.451$) at 5% significance level. This shows that mediation testing is not possible [92]. Implying that compliance with public procurement regulatory framework measured by proper authorization of road construction projects, timely delivery of road construction projects, timely recording of road construction transactions and achievable project objective does not mediate the relationship between professionalism among staff on public road construction projects and success of public road construction projects. Hence, hypothesis (H3) is not supported. The findings enabled further understanding on how these study variables are related as proposed by construction advocates for mediational studies [106].

Compliance with public procurement regulatory framework mediates the relationship between sanctions in public road construction projects and project success

Sanctions on staff directly predicts public road construction success and also indirectly predicts success of these projects through compliance with public procurement regulatory framework as represented by coefficient of 0.068 and 0.187 respectively. According to bootstrapping results, compliance with public procurement regulatory framework significantly mediates the relationship between sanction on staff involved in public road construction projects and success of these project ($\beta = 0.187$, $p < 0.001$). This is a full mediation since the direct relationship between sanction on staff and project success was significantly reduced when compliance with public procurement regulatory framework was introduced [88]. Hence, hypothesis (H4) is supported significantly implying that successful implementation of public road construction projects is realized when both sanction on staff and compliance with public procurement regulatory framework governing these projects are emphasized simultaneously.

The findings conform to recommendations and guideline of [86]. This enabled further understanding how these variables are associated interactively as proposed by construction advocates for mediational studies [106]. Government should effectively apply sanction and encourage compliance with governing regulatory framework to successfully implement public road construction projects to achieve its goals. Key indicators measuring projects success are project specifications, completion time and project budget should be realized with effective penalties on non-

compliant stakeholders in public road construction projects.

Compliance with public procurement regulatory framework mediates the relationship between perceived inefficiency of public procurement regulatory framework and project success.

Compliance with public procurement regulatory framework measured through proper authorization of road construction projects, timely delivery of road construction projects, timely recording of road construction transactions and achievable project objective, has an inverse significant mediating effect on the relationship between perceived inefficiency of public procurement regulatory framework and success of public road construction projects. Direct effect is represented by coefficient of -0.327 and indirect effect accounts for -0.124. According to bootstrap results, compliance with public procurement regulatory framework significantly mediates this relationship ($\beta = -1.24$, $p = 0.002$). There is a partial mediation since both direct and indirect effects are significant ($\beta = -1.24$, $p = 0.002$, $\beta = -0.327$, $p = 0.000$) [88]. Implying that perceived inefficiency predicts success of public road construction projects directly and indirectly through compliance with public procurement regulatory framework. Hence, H5 is significantly supported statistically. Hence, successful implementation of public road construction projects is realized when perceived inefficiency of public procurement regulatory framework governing public road construction projects and compliance with public procurement regulatory framework governing these projects are applied simultaneously.

Compliance with public procurement regulatory framework mediates the relationship between contractor's resistance to non-compliance and project success

Following successful three mediation steps, compliance with public procurement regulatory framework mediates the relationship between contractors' resistance to non-compliance with public procurement regulatory framework and the success of public road construction projects. Bootstrap results show that the mediation is partial and significant ($\beta = 0.101$, $p < 0.01$). This partial mediation indicate that contractors' resistance to non-compliance with public procurement regulatory framework predicts the success of public road construction projects directly and indirectly through compliance with public procurement regulatory framework (Direct effect: $\beta = 0.378$, $p = 0.000$, Indirect effect: $\beta = 0.101$, $p = 0.004$) [88]. Hence, H6 is supported significantly. This implies that simultaneous application of both contractors' resistance to non-compliance with public procurement regulatory framework and compliance with this regulatory framework governing

these projects is realistic for Government to successfully implement public road construction projects. The findings conform to recommendations and guideline of [88] and enabled understanding how these variables interact [106]. Proper authorization of road construction projects, timely delivery of road construction projects, timely recording of road construction transactions and achievable road construction project objective displays a good interactive effect with contractors' knowledge on public road procurement process and taking action against defiant public officers for successful public road construction projects.

IMPLICATIONS AND CONTRIBUTION

Compliance with public procurement regulatory framework significantly mediates the relationship between sanction on staff, perceived inefficiency of regulatory framework and contractors' resistance to non-compliance and success of public road construction projects. This is a signpost for Government in implementing public road construction projects by considering interplay of these four factors to ensure that these projects are aligned with set objectives. On the other hand, compliance with public procurement regulatory framework does not mediate the relationship between familiarity with public procurement regulatory framework, monitoring activities and professionalism among staff, and success of public road construction projects. Government should pay attention to key indicators measuring these significant factors and explore effective interaction between compliance with public procurement regulatory framework and sanctions, perceived inefficiency as well as contractors' resistance to successfully implement public road construction projects. Careful selection of effective sanctions, strengthening regulatory framework, empowering contractors and strict compliance with regulatory framework demonstrated by mediation results is paramount in implementing these projects. Based on demand perception, strong interactive effect respectively involving sanctions, perceived inefficiency, contractors' resistance and compliance to successfully implement public road construction projects is established as a contribution to construction and procurement literature. Compliance measured through proper authorization of road construction projects, timely delivery of road construction projects, timely recording of road construction transactions and achievable road construction project objective and measurement indicators of sanctions, perceived inefficiency and contractors' resistance provide Government with a foundation to progressively realize public road construction objectives. These strong mediational effects would ensure government projects are implemented as per designed specifications, timely schedule and within budget. In addition, these interactive effects could lead to increased quality paved

roads, value for money and saving funds necessary for economic development.

RECOMMENDATION

For Government to successfully implement public road construction projects, mediating role of public procurement regulatory framework is recommended to catalyse the effect of sanctions on staff involved these projects, perceived inefficiency of public procurement regulatory framework and contractors' resistance to non-compliance with public procurement regulatory framework on success of these projects. Combining these factors has proved significant in implementing public road construction projects. Government should emphasize no deviations from project specifications, scheduled completion time and estimated budget. Additionally, enforcing effective sanctions with negative impact and without warnings, strengthening regulatory framework, encouraging contractors to take actions against bad decisions and empowering them through increasing their knowledge on procurement process of public road construction projects are vital. Furthermore, similar studies using these constructs globally are encouraged for consistence and reliability as a way of expanding mediation studies in both construction industry and public sector procurement.

LIMITATIONS

A cross-section research design was adopted capable of only evaluating responses in a snapshot and yet complex public road construction projects in a dynamic environment are affected by different factors with time. Hence, longitudinal study is inevitable. Limited mediation literature in construction industry challenged this study by failing to compare study findings. Furthermore, the study only considered responses from three public entities believed had information necessary for the study. Other entities were left out that indirectly have a hand in public road construction activities like; Ministry of Finance Economic Planning and Development (MoFEP&D), Inspector General of Government (IGG), Attorney General (AG), President's office among others.

FUTURE RESEARCH

With growing importance of mediational studies globally, complexity of construction industry facing implementation challenges require expanding search of strategies to address such challenges. Mediation is inevitable and as such, extending this study with more factors to other construction sectors including public road construction subsector is encouraged. This can be globally to assist policy makers and researchers

understand interaction effects in construction industry beyond compliance with public procurement regulatory framework and public road construction project success to develop viable solutions capable of promoting the industry.

CONCLUSION

Limited mediation studies in construction industry prompted this study by looking at the mediating role of compliance with public procurement regulatory framework to successfully implement public road construction projects. Taking on demand perception represented by three public entities in Uganda, this study contributes by filling the gap empirically through Partial Least Square Structural Equation Modeling mediation guidelines. The findings proved that compliance with public procurement regulatory framework significantly mediates the relationship between sanctions, perceived inefficiency, contractors' resistance and public road construction project success. While insignificant mediation exists on the relationship involving familiarity, monitoring activities and professionalism. Construction stakeholders are encouraged to pay attention to these significant factors with their respective key measurement indicators established when implementing public road construction projects since they have proved significant interactive effects.

DATA AVAILABILITY STATEMENT

This manuscript is prepared based on the statistical results determined using bootstrap analysis in SmartPLS3 following SEM mediation approach as reflected in the methodology and results sections above. The dataset for the analysis is available and can be submitted on request.

CONFLICT OF INTEREST

All authors have no conflict of interest.

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