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Evaluation of Key Performance Factors of Public Building Construction Projects under the Force Account Method

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Abstract

This study aimed to evaluate key performance factors influencing the effective implementation of public building construction projects using the Force Account Method (FAM) in Tanzania. A case study and descriptive survey design were employed to investigate projects implemented under the Ministry of Education, Science and Technology (MoEST). The target population included 128 stakeholders comprising engineers, consultants, contractors, local fundi, project coordinators, and regulatory officers, selected using stratified and purposive sampling. Data were collected through semi-structured questionnaires and document reviews, with quantitative analysis conducted using SPSS and Smart PLS, and thematic analysis for qualitative responses. Instrument validity was ensured through triangulation and pilot testing, while reliability was confirmed by Cronbach's Alpha values ranging from 0.83 to 0.973. Ethical considerations included informed consent, anonymity, and data integrity.

Findings revealed that six interdependent factors which are; effective planning, effective design, procurement management, construction supervision, adequacy and competence of project participants, and effective leadership and government support are the critical factors for FAM success. Structural model results confirmed strong positive relationships among these factors, with institutional support significantly influencing all other components. The study concludes that FAM can be a cost-effective and efficient method when managed through an integrated, systemic approach. Key recommendations include revising FAM guidelines to reflect modern practices, implementing certified training programs, adopting digital tools for project management, and developing a unified implementation framework aligned with the construction lifecycle. These findings offer practical and policy-level insights for improving public construction delivery in Tanzania.

Keywords: *Key Performance Factors, Force Account Method, Public Construction Projects, Effective Implementation*

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1.0 INTRODUCTION

The construction industry is globally recognized as a key driver of economic development, significantly contributing to infrastructure, employment creation, poverty reduction, and boosting living standards (Giang & Sui Pheng, 2011; Anugwo, Shakantu, Saidu, &Adam, 2018). In developing countries, the sector is closely tied to macroeconomic growth, with evidence showing its influence on Gross Domestic Product and industrial transformation (Tesha, Luvara, Samizi, & Lukansola, 2017; Boadu, Wang, & Sunindijo, 2020). According to Sears, Clough, and Sears (2021), construction projects are intricate and time-consuming endeavours that require a variety of resources, such as labour, plants, equipment, and materials, to achieve productivity and adequate performance. According to Bako (2016) the success or failure of a construction project hinges on selecting an appropriate procurement method for its delivery. The chosen procurement method determines crucial issues such as client requirements, stakeholders' inputs, risk assessment, responsibilities of collaborating entities and how challenges will be addressed during the project implementation.

FAM refers to the approach in which public or semi-public departments or agencies conduct work utilizing their staff and resources, or in partnership with other public or private organizations (Public Procurement Regulatory Authority (PPRA), 2020). In 1975, the World Bank started to finance construction projects in developing countries using labour-based methods, specifically through departmental force account units (World Bank, 1999). By 2011, the World Bank had introduced specific conditions under which FAM could be applied, such as for small, remote, or emergency works that qualified construction firms are unlikely to bid at a reasonable price (Matto, (2021).

Globally, FAM, also known as direct labour, in-house construction, or labour-based method, is applied in diverse contexts, particularly where private sector engagement is limited or costly. In Asia, especially in countries like India and Nepal, FAM is widely used for rural infrastructure, disaster recovery, and employment programs which rely on community labour but face supervision and quality challenges. In Europe, its use is mostly limited to local government services, maintenance, and emergency tasks, with countries like Germany and Nordic nations maintaining small internal units, while the UK saw a decline in direct labour due to competitive outsourcing (Boyne, 1998; Sørensen, 2007). In North America, particularly the U.S., FAM is primarily used in transportation and emergency infrastructure under strict regulatory conditions, though bureaucratic requirements remain a challenge (FHWA, 2018). These global experiences highlight FAM's adaptability across regions, serving developmental goals in Asia, cost-effective maintenance in Europe, and emergency utility in North America.

In East Africa, particularly in Uganda and Kenya, the FAM has become a popular and cost-effective way to implement construction projects. Uganda adopted FAM in 2014 through procurement reforms, leading to faster project execution and skill development, yet it struggles with equipment availability and procurement delays (Butegeine, 2016; Asaph, 2012). In Kenya, FAM was introduced to address budget constraints and youth unemployment, especially in rural areas, where it promoted local participation and cost control but was undermined by poor technical supervision, funding delays, and limited procurement and technical capacity (Gwaya et al., 2014; Mwangi & Kwasira, 2019; Wafula & Ng'ang'a, 2021). Across the region, while FAM supports local empowerment and infrastructure development, its success is frequently constrained by capacity and operational challenges.

In Tanzania, FAM has been widely adopted since 2016 in the implementation of public construction projects to enhance value for money (Matto, 2021; Nsimbila, Matto, & Ame, 2021). The use of FAM in public construction projects in Tanzania has shown significant benefits, such as enhanced value for money by reducing costs and improving project quality while fostering transparency, empowering local authorities and promote community involvement, facilitates timely project completions, increases resource efficiency, and creates both direct and indirect employment opportunities (Matto 2021;, Tekka 2019;, Chungu & Arthur, 2024). Despite its potential, challenges persist in the practical implementation of FAM. National Audit Office (2021) reports reveal irregular procurement practices, inadequate supervision, cost mismanagement, and a lack of skilled personnel. Studies have also pointed to weak planning, non-compliance with procurement procedures, and limited stakeholder understanding of FAM protocols as key barriers to its success (Matto, 2021).

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However, several recommendations have been made to improve the implementation of public construction projects using FAM, such as capacity building for staff, strengthening monitoring systems, adhering to procurement laws, and ensuring timely fund disbursement. Measures taken include initiatives by MoEST, PPRA, and development partners for capacity building (Ngowi and Mhando, 2019) and direct fund transfers to improve financial flows for educational projects (Chaligha and Mbele, 2021). Additionally, some districts have started using digital monitoring tools for better oversight (Mashamba and Kihwelo, 2020).

While the FAM is widely adopted in Tanzania and supported by regulatory frameworks, empirical studies focusing on the key performance factors influencing its effectiveness, particularly for public building construction, remain limited. Existing studies tend to be descriptive or audit-based, lacking analytical models that relate performance outcomes to specific factors such as planning, design, procurement, supervision, human resource management, and effective leadership and support from the government. Moreover, there is insufficient integration of local and global perspectives on how performance indicators under FAM influence project success, especially in the Tanzanian public sector context.

This study evaluates key performance factors for the effective implementation of public construction projects using FAM. It evaluates the extent to which critical performance factors in various phases of construction projects, including planning, design, procurement, and construction supervision, influence the effectiveness of public construction projects using FAM. It further evaluated the significance of moderating factors, including adequacy and competence of the project participants, and effective leadership and support from the government influenced those phases. The findings will provide a basis for developing a robust implementation framework to guide public institutions in managing FAM projects efficiently. Moreover, the study contributes to the academic discourse by integrating global best practices with local realities, thereby enhancing the body of knowledge on alternative procurement methods in developing economies.

2.0 THEORETICAL LITERATURE REVIEW

The theoretical framework of this study was grounded in the System Theory and the Key Performance Indicators (KPI) Model. This multidimensional approach facilitated a comprehensive understanding of the interplay between system dynamics, project management processes, and the measurement of performance outcomes.

2.1 System Theory

System Theory, initially developed by Ludwig von Bertalanffy in 1968, has been widely applied in project management. This theory suggests that all components of a system are interconnected, and the overall success of the system relies on the effective interaction of its parts. A system is defined as a collection of interconnected elements that work together to achieve a common objective, which includes inputs, processes, outputs, and feedback mechanisms. According to Kerzner (2017), System Theory is particularly relevant in construction project management because it highlights the interdependence of functions such as planning, design, procurement, human resource management, communication, and supervision. The theory asserts that any weakness or delay in one subsystem (for example, procurement) can disrupt the entire project system, thereby impacting cost, quality, and timelines.

Forrester (1994) and Checkland (1999) further emphasize that projects should be viewed as dynamic systems that include both technical and social components, which continuously interact with each other and their surrounding environment. In the public sector, construction projects are complex endeavors that require effective coordination among various functional units.

2.2 Key Performance Indicators Model

According to Vukomanovic et al., (2010) the performance indicators are defined as factors that have a major influence on the success or failure of a construction project and should be identified in order to improve the project performance. The criteria in which project success or failure has been assessed have also been called Key Performance Indicators (KPIs). According to Chan and Chan (2004), KPIs in construction projects are designed to measure both project outcomes (such as cost, time, and quality) and process performance (such as stakeholders' satisfaction, communication, and safety). Parmenter (2015) emphasizes that effective KPIs

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should be SMART (Specific, Measurable, Achievable, Relevant, and Time-bound), aligned with strategic objectives, and consistently monitored to facilitate ongoing improvement.

In their influential study, Bassioni et al., (2004) introduced a KPI model that integrates input, process, output, and outcome indicators, allowing organizations to track performance from resource mobilization to final service delivery. The model was developed specifically for the use in construction industry to provide a comprehensive, structured approach to performance measurements. This research study's evaluation addressed the level of significance of critical factors for the success of each phase or subsystem of construction project. The study utilized critical factors for the success of planning, design, procurement, and supervision phases.

2.3 Empirical Literature Review

Empirical studies have extensively examined factors that hinder the effective performance of public construction projects using FAM. A thorough review of empirical studies identified six most significant factors and key performance indicators for each factor. Studies revealed effective planning as the first most significant factors influence the effective performance of public construction projects using FAM. Project planning is crucial for identifying and assessing risks related to project objectives, scope, and execution strategies. Matto (2023) found that many FAM projects were executed without feasibility studies, while Mchopa (2020) indicated they often lacked cost-benefit analyses at the start.

Sayi & Monko (2022) noted that insufficient supervision budgets hinder achieving value for money in these projects. Additionally, Mtana et al. (2023) highlighted that poor planning contributes to delays in Tanzanian construction projects, partly due to inadequate planning skills. Effective planning is vital for timely completion, cost control, and high-quality results. Wanjau et al. (2024) emphasize that good cost planning leads to better budget estimates, informed decision-making, and effective stakeholder management. These studies conclude that adequate project planning requires a feasibility study, preparation of a procurement plan, budgeting, and risk analysis for the successful implementation of public construction projects FAM.

Other studies revealed the influence of adequate design on the effective implementation of public construction projects using FAM. Adequate design defines plans, parameters, specifications, costs, activities, processes, and how and what should be done within the legal, political, social, environmental, safety, and economic constraints in achieving project objectives(Azar et al., 2018).Research indicates that the design phase in public construction projects using FAM received insufficient attention, leading to inadequate surveys and specifications, which resulted in incomplete designs. This caused numerous changes, delays, and unfinished projects.

A NAOT (2021) report highlighted missing technical specifications for materials at several schools, with ten out of 22 projects failing to meet completion deadlines. Poor design significantly contributes to delays in public building projects by local authorities (Mtango & Sumuni, 2023). These studies suggest that high-quality design documents including client requirements, environmental and safety considerations, topographical survey considerations, budget considerations, architectural design, structural design, engineering estimates, and risk assessment could significantly influence the performance of construction projects using the force account method.

The third most significant factor was procurement management. Mchopa (2020) found that construction projects using FAM often fail to comply with PPRA guidelines. Changalima et al. (2022) noted a significant positive relationship between procurement regulatory compliance and value for money. Tekka (2023) reported that supply chain management enhances construction project performance. Additionally, research by Israel (2023) identified critical issues in Tanzania's construction projects, such as bureaucratic bidding, contractual non-compliance, and ineffective procurement methods. Matto (2021) highlighted that records management significantly impacts procurement performance in Tanzania. These studies suggest that awareness of procurement procedures, procurement planning, regulatory compliance, supply chain management, and record management are the most significant indicators of successful procurement management in construction projects. Addressing these key procurement management factors could lead to the effective performance of construction projects using FAM.

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Another most significant factor was effective construction supervision. Mchopa (2020) revealed inadequate quality control, a lack of inspection reports, and a lack of a quality assurance plan on the application of FAM in the procurement of works in Tanzania. Matto (2023) found similar deficiencies in cost, quality, and time control for construction projects in the education sector. Stephen (2021) identified poor communication as a major factor causing delays in Mbeya's projects using this method. Ndunguru et al. (2020) pointed out that inadequate communication and coordination can lead to time and cost overruns. Tekka (2019) highlighted the importance of coordination among project committees and on-site meetings for resolving issues and assessing progress.These studies underscore the need for adequate communication, effective coordination, effective decision-making, safety and quality control, monitoring and evaluation for the effective supervision of public construction projects that are implemented using FAM.

Additionally, empirical review revealed adequacy and competence of the project participants, and effective leaderships and support from the government as factors that influence the effectiveness of planning, design, procurement, and supervision phases. A study by Sayi and Monko (2022) realized that neither seminars nor training were given to the ones supervising FAM. Tekka (2019) identified training among participants as one of the crucial determinants of the smooth running of the project implemented using FAM. Another study by Tekka and Msangi (2020), found that strong government support affects the performance of construction projects through increased construction quality, fighting against malpractices, society satisfaction, and timely payment. These studies suggested transparency, accountability, commitment, training, timely payments as key performance indicators for the effectiveness of planning, design, procurement and supervision.

3.0 METHODOLOGY

3.1 Research Design

This study employed a case study and a descriptive survey design to evaluate key performance factors for the effective implementation of public construction projects using FAM. The case study design enabled in-depth analysis of selected projects, allowing the researcher to explore contextual and causal relationships that are difficult to quantify, aligning with Yin's (2003) concept of studying bounded phenomena. It facilitated the collection of comprehensive project-level data. The descriptive survey design, as defined by Creswell (2009), was used to gather quantitative data on stakeholders' opinions, experiences, and attitudes, including those of contractors, consultants, local fundi, and regulatory officers. This design allowed for structured data collection and generalization of findings, as successfully applied by Oyewobi et al. (2011) and Tabish and Jha (2011) in similar construction studies. The combination of both designs ensured a robust analysis of FAM implementation by integrating contextual insights with measurable stakeholder perspectives.

3.2 Population and Sampling

The study population comprised key stakeholders involved in the planning, design, procurement, supervision, and regulation of public construction projects implemented using the FAM under MoEST in Tanzania. It included project implementers, consultants, contractors, local fundi, and regulatory officials from institutions such as PPRA, ERB, CRB, NCC, AQRB, and NAOT. The sample was drawn using both probability and non-probability sampling techniques. Stratified random sampling was employed to select five educational institutions across three national programmes—ESPJ, EP4R, and the COVID-19 Response Project—based on geographic and project-level criteria. Regulatory participants were purposively selected for their expertise in FAM implementation. In total, 128 individuals were involved. Selected projects experienced delays due to issues such as inadequate planning, poor design, funding disbursement delays, and limited awareness of FAM. Their remote locations and implementation challenges made them relevant for examining key performance factors in FAM-based projects, ensuring rich insights and diverse stakeholder representation.

3.3 Data Collection Instrument

This research employed a methodology that integrated both primary and secondary data collection techniques, incorporating semi-structured questionnaires and document analysis. The

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questionnaire was meticulously designed in accordance with the study's objectives, featuring a combination of closed-ended questions aimed at evaluating key performance indicators and open-ended inquiries intended to elicit recommendations. A pilot test involving 30 participants was conducted to enhance the instrument's clarity and conciseness. The questionnaire was disseminated online via Google Forms, facilitating efficient data collection throughout Tanzania. In addition, a comprehensive systematic literature review was performed utilizing reputable academic databases to identify and assess the performance factors pertinent to FAM-based public construction projects.

3.4 Reliability and Validity

In this study, the validity of findings was established through triangulation, which, according to Creswell and Creswell (2018), enhances credibility by comparing data from multiple sources or methods. The researcher collected data from diverse stakeholders, including FAM project team members, contractors, consultants, local fundi, and regulatory officials, using a uniform questionnaire. The consistency of responses across these groups reinforced the validity of the findings. Additionally, a systematic literature review was conducted, and its outcomes aligned with the questionnaire results, further strengthening validity. To ensure reliability, the study employed Cronbach's Alpha to assess internal consistency. The coefficient was 0.83 for items on stakeholder awareness and 0.973 for items related to effective FAM implementation. According to Nunnally and Bernstein (1994), a Cronbach's Alpha of 0.7 or higher is acceptable, indicating that the instrument used was highly reliable. These results affirm that the data collection methods produced consistent, credible, and replicable findings, enhancing the trustworthiness of the study's conclusions.

3.5 Techniques of Data Analysis

This The study included 128 participants, with a significant male majority (89.8%), which reflects the gender imbalance often seen in FAM projects and aligns with national trends in STEM enrollment and findings from earlier research. The majority of respondents (56.8%) were aged 35 to 44, which corresponds with national employment trends in the construction sector, and 69.2% had more than nine years of work experience, suggesting that their responses are credible. The representation among institutions comprised regulatory bodies (32.0%), implementing agencies (28.9%), contractors/local fundi (28.9%), and consultants (10.2%), providing a comprehensive range of viewpoints from different stakeholders. In terms of job titles, civil engineers (18%), project team members (18%), and local fundi (14.1%) were the most prevalent, reflecting the technical and community-oriented aspects of FAM projects.research utilized a combination of quantitative and qualitative data analysis methods. The quantitative data, gathered via Likert-scale questionnaires, was analyzed with IBM SPSS version 27. Descriptive statistics, including means and standard deviations, were used to summarize stakeholders' views on essential performance factors like planning, design, procurement, competence, and leadership. SMART PLC was also used for quantitative data.

Qualitative data from open-ended responses and document reviews were analyzed thematically using Braun and Clarke's (2006) six-phase approach. The researcher familiarized with the data, coded responses, organized them into themes, refined and defined the themes, and used supporting quotations to present findings. This method allowed the identification of patterns and insights related to FAM performance factors, contributing to a comprehensive understanding of stakeholder perspectives and reinforcing the study's mixed-methods approach.

3.6 Ethical Considerations

The researcher obtained informed consent and gatekeeper permissions before data collection, ensuring participant autonomy. Confidentiality was maintained by avoiding personal identifiers and using data solely for academic purposes. Objectivity was upheld throughout analysis and reporting, with no falsification or suppression of data. These ethical measures protected participants' rights and enhanced the study's transparency, validity, and reliability, reinforcing the credibility of both the research process and its findings.

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4.0 RESULTS AND DISCUSSIONS

This section presents the study's finding and their discussion related to its objective. The findings are compared with previous empirical studies and relevant theoretical frameworks to provide context, validate patterns, or highlight deviations.

4.1 Demographic characteristics

The study included 128 respondents, with a significant male majority (89.8%), which highlighting gender disparity in FAM projects and aligns with national trends in STEM enrollment and findings from earlier research. Most respondents (56.8%) were aged 35 to 44, which corresponds with national employment trends in the construction sector, and 69.2% had more than nine years of work experience, suggesting that their responses are credible. The representation among institutions comprised regulatory bodies (32.0%), implementing agencies (28.9%), contractors/local fundi (28.9%), and consultants (10.2%), providing a comprehensive range of viewpoints from different stakeholders. In terms of their designations, civil engineers (18%), project team members (18%), and local fundi (14.1%) were the most prevalent, reflecting the technical and community-oriented aspects of FAM projects (see Table 1).

Table 1. Demographic characteristics of the respondents

S/N	Type	Profile	Frequency	Percentage
1	Sex	Male	115	89.8%
		Female	13	10.2%
2	Age	18-24 years	14	10.6%
		25-34 years	33	25.4%
		35-44 years	73	56.8%
		45 and above years	9	7.2%
3	Work experience	1-4 years	14	10.8%
		5-8 years	26	20.0%
		9-12 years	52	40.8%
		13 and above	36	28.4%
4	Institutional category	Implementing agency	37	28.9%
		Contractor/Local fundi	37	28/9%
		Consultant	13	10.2%
		Regulatory body/Authority	41	32.0%
5	Designation	Accounting Officer	7	5.5%
		Procurement Officer/Storekeeper	11	8.6%
		Civil Engineer	23	18.0%
		Quantity Surveyor	7	5.5%
		Service Engineer	1	0.8%
		Architect	8	6.3%
		Project Manager	1	0.8%
		Technician	4	3.1%
		Member of Project Implementation Team	23	18.0%
		Regulatory Officer	6	4.7%%
		Local Fundi	18	14.1%
		Site Engineer	3	2.3%
		Accountant	4	3.1%
		Other	12	9.4%

4.2 Descriptive analysis of factors for effective implementation of FAM

The descriptive analysis indicates that all evaluated factors encompassing effective planning, design, procurement management, construction supervision, adequacy and competence of the project participants, and effective leadership and support from the government are highly significant for the successful implementation of public construction projects using FAM (see Table 2). Key indicators of effective planning, including precise budget estimation (M =

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4.30) and comprehensive risk assessment (M = 4.21), emphasize the necessity of thorough preparation. Furthermore, effective design indicators such as architectural design (M = 4.38) and structural design (M = 4.32) underscore the vital role that accurate technical drawings play in reducing construction errors. Procurement indicators, including record management (M = 4.32) and compliance, highlight the essential need for transparency and adherence to procedural guidelines in alignment with the PPRA (2020) regulations.

Supervision aspects received particularly high ratings, with effective decision-making (M = 4.44) and monitoring (M = 4.37) confirming the critical importance of active oversight during project execution. Additionally, enabling factors such as stakeholder transparency (M = 4.34) and timely disbursement of funds (M = 4.27) illustrate the significant influence of governance and institutional competence on both planning and execution processes.

Table 2. Descriptive analysis of key performance factors and their indicators

Key factor	Code	Indicator	Mean	Std. Dev.
Effective planning (P)	P1	Adequate feasibility study	3.96	1.038
	P2	Adequately prepared procurement plan	4.19	1.025
	P3	Accurate budget estimations, including costs for project supervision	4.30	1.038
	P4	Identification and assessment of risks associated with the project objectives, scope, size, location, and execution strategies	4.21	1.070
Effective design (D)	D1	Adequate consideration of client requirements	4.22	0.996
	D2	Adequate architectural design	4.38	0.896
	D3	Adequate structural design	4.32	0.930
	D4	Topographical survey considerations	4.14	1.017
	D5	Adequate engineering estimates	4.27	1.054
	D6	Environmental and safety considerations	4.16	1.041
Procurement management (PR)	PR1	Awareness of the procurement procedures	4.17	.973
	PR2	Effective procurement planning	4.22	1.011
	PR3	Regulatory compliance	4.16	0.926
	PR4	Supply chain management	4.09	0.931
	PR5	Record management	4.32	0.869
Construction supervision (CR)	CR1	Adequate and effective communication among stakeholders	4.26	0.907
	CR2	Effective coordination among stakeholders	4.26	0.872
	CR3	Effective decision making	4.44	0.849
	CR4	Safety and quality control	4.33	0.897
	CR5	Effective monitoring and evaluation	4.37	0.877
Adequacy and competence of participants, and effective leadership and government support (INT)	INT1	Adequate and competent staff for planning, design, procurement management, and construction supervision	4.20	0.950
	INT2	Transparency and accountability among project stakeholders	4.34	0.890
	INT3	Capacity building for the project staff in all phases of the project implementation	4.16	1.038
	INT4	Commitment among project stakeholders	4.30	0.874
	INT5	Timely fund disbursement	4.27	1.025
	INT6	Avoidance of bureaucracy and political interference	4.23	0.998

4.3 Measurement Model Assessment

The assessment of the measurement model was done to ensure the quality criteria before proceeding to the structural model assessment. The first procedure involved testing the internal consistency and reliability of the variables based on the relationship between the observed (construct) and Cronbach's Alpha. Convergent validity was analysed utilizing composite

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reliability (CR) and average variance extracted (AVE). All variables' Cronbach's Alpha values exceeded the threshold of 0.7, indicating adequate consistency and reliability of the measures. Furthermore, for each variable, CR is expected to have a value greater than 0.7 and an AVE value greater than 0.5. All variables achieved the threshold indices, indicating satisfactory convergent validity (see Table 3).

Table 3. Construct reliability and validity

Patent variable	Cronbach's alpha	Composite reliability (CR) value	AVE
CR	0.954	0.957	0.845
D	0.938	0.938	0.764
INT	0.927	0.932	0.733
P	0.885	0.886	0.744
PR	0.942	0.943	0.811

All constructs underwent discriminant validation as part of the second procedure of the measurement model evaluation process. Discriminant validity tests particularly determine whether or not the different constructs are dissimilar. To achieve this goal, the Fornell-Lacker criterion was applied to evaluate the distinctiveness and independence of the model indicators by comparing the square root of AVE in relation to the correlation of the patent variables. The results show that the square of the AVE of each construct exceeded the correlation with other constructs, hence establishing discriminant validity (see Table 4).

Table 4. The discriminant validity measure (Fornell-Lacker criterion)

	CR	D	INT	P	PR
CR	0.919				
D	0.709	0.874			
INT	0.787	0.752	0.856		
P	0.728	0.791	0.717	0.862	
PR	0.708	0.666	0.693	0.651	0.901

4.4 Structural Model

Following the assessment of the measurement model, the structural model assessment was employed to test the relationships among the constructs. The constructs were tested using 10,000 bootstrapping subsamples in order to find the beta values (β), sample mean (M), t-statistics, and P-values (see Table 4).

Table 5. Result of the direct relationship of the constructs

Patent variables	Original sample (O)	Sample mean (M)	T statistics (|O/STDEV|)	P values
D -> PR	0.333	0.333	3.447	0.001
INT -> CR	0.570	0.574	5.349	0.000
INT -> D	0.381	0.387	3.754	0.000
INT -> P	0.717	0.717	10.390	0.000
INT -> PR	0.443	0.442	4.407	0.000
P -> D	0.518	0.511	4.827	0.000
PR -> CR	0.313	0.306	2.700	0.007

The results of the direct relationships among the constructs reveal statistically significant and meaningful path coefficients, indicating strong interdependencies among the factors influencing the effective implementation of public construction projects using FAM. All path relationships have p-values less than 0.01, confirming their statistical significance at the 99%

confidence level. The strongest relationship is observed between INT and P, with a path coefficient of 0.717 and a high t-statistic of 10.390, suggesting that robust institutional frameworks and leadership support substantially enhance effective project planning, consistent with Creswell (2014), who emphasises the foundational role of governance in public project execution. Additionally, INT significantly influences D (β = 0.381), PR (β = 0.443), and CR (β = 0.570), reinforcing the view of scholars such as the World Bank (2020) and Turner (2016) that institutional factors serve as catalysts for coordination, resource mobilisation, and procedural compliance. The paths from planning to design (β = 0.518) and from design to procurement (β = 0.333) demonstrate the sequential and reinforcing nature of project phases, aligning with project lifecycle management models (PMI, 2017). Overall, the model confirms a systemic and interrelated structure among FAM implementation factors, with institutional support and planning emerging as central drivers of project success.

The R^2 values for the constructs, effective planning, effective design, procurement management, and effective construction supervision were found as 0.514, 0.696, 0.529 and 0.669, respectively. Thus, effective planning explains 51.4% variance, effective design explains 69.6%, effective procurement management explains 52.9%, and effective construction supervision explains 66.9%. The value of $R2 < 0.19$ reflects intolerable level of determination, $0.19 < R2 < 0.33$ shows weak or small level of determination, $0.33 < R2 < 0.67$ shows a moderate level of determination, and $R2 > 0.67$ shows a substantial level of determination(Chin W.W., 1998). Hence, these constructs reflect moderate and substantial levels of determination. The above components are interlinked in a sequential and feedback-based model that illustrates the flow of influence from planning to execution and oversight.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study concludes that the successful implementation of public construction projects using FAM in Tanzania depends on the integration of six key factors: effective planning, design, procurement management, supervision, adequacy and competence of project participants, and effective leadership and government support. These factors are interdependent, and failure in one affects others, highlighting the need for a systemic and coordinated project approach. However, there are some key indicators for the success of each factor. The strong correlation among them underscores their collective influence on project success. FAM remains a viable strategy when supported by clear frameworks, qualified consultants, and institutional commitment, offering cost-effective, timely, and quality outcomes for public construction initiatives.

5.2 Recommendations

To improve the effectiveness and sustainability of FAM-based public construction projects, this study recommends revising FAM guidelines to reflect modern management practices and ensure clarity in scope, costing, supervision, and benchmarks. Regular, certified training for all project personnel, including technical and managerial staff, is essential to maintain competence. Additionally, further research should explore how digital tools can enhance planning, design, procurement, supervision, and accountability in FAM implementation. Finally, a unified framework integrating the six key success factors across all construction phases should be developed to ensure systematic execution, defined responsibilities, quality control, and consistent project evaluation.

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