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DATA-DRIVEN ANALYSIS OF PUBLIC INFRASTRUCTURE PROJECT PERFORMANCE: THE MODERATING ROLE OF CONTRACT MANAGEMENT PRACTICES IN MALAWI IRRIGATION PROJECTS

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Original research

A B S T R A C T

Project performance problems, like delays, overspending, and low quality, persist in infrastructure development projects, especially in developing nations. This research investigated the impact of contractor, consultant, client, and external factors on the performance of public infrastructure projects in irrigation facilities within Malawi, assessing the moderation effect of contract management. The research design was a quantitative cross-sectional study, employing primary data gathered from 101 construction professionals working on irrigation infrastructure projects in Phalombe, Zomba, and Machinga districts. Multiple regression and moderation analyses were carried out using the Hayes PROCESS macro. The findings show that all four factors affect the projects' performance significantly, but external factors play a dominant role. It was discovered that contract management practices play a critical role in moderating the impact of contractor, consultant, and client factors on project performance, contributing to better coordination and accountability. No moderating effects of external factors on project performance have been demonstrated.

1. INTRODUCTION

Infrastructure development is one of the most important strategies for developing economies to achieve economic growth, food security, and long-term climate resilience (African Development Bank, 2022; Daza, 2023; UNDP, 2017, FAO, 2020; Omokpariola et al., 2025; Tione et al., 2024). In order to successfully achieve these objectives, there is a need for countries to develop a good irrigation infrastructure to support agricultural transformation and adaptation to climate change in Sub-Saharan Africa (FAO, 2016; Shah et al., 2020; Sono et al., 2021). While there is a wide agreement that irrigation infrastructure is crucial in transforming agriculture and building climate resilience, project performance of irrigation infrastructure is often underwhelming due to a variety of issues, such as project delays, cost overruns and poor-quality products (World Bank, 2019; World Bank, 2023; Higginbottom et al., 2021).

Numerous studies have demonstrated that infrastructure projects around the world are prone to poor performance from a variety of reasons including inadequate planning, project scope changes, weak risk management practices, etc. (Flyvbjerg, 2014a; Ansar et al., 2016a). While the aforementioned issues affect developed economies, these same issues are even more severely impacting

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developing countries as they are supported by poor institutional frameworks, procurement challenges, and limited financing (Mohammed and Enke, 2017).

In Sub-Saharan Africa, several studies have indicated that delays in payments to contractors, lack of oversight of contractors, and poor design have been among the major causes of poor project performance (Aibinu & Odeyinka, 2006; Kamanga et al., 2013; Kikwasi, 2012; Muhwezi et al., 2014). Malawi is not unique, as similar issues exist in its irrigation sector as a result of ongoing delays and increased costs of the projects (NPC, 2021; Moursy & Wasfy, 2022; IFAD, 2023). Irrigation infrastructure projects also have additional complexities (compared to other types of projects) due to the nature of irrigation systems being dependent on precise hydraulic fittings, seasonal constraints on irrigation systems, and sensitivity to environmental and macroeconomic shocks (Saysel, 2000; DCAFS & TIPDeP, 2024).

Prior research has analysed how contract management practices impact project performance but has not sufficiently explored how contract management interacts with project performance or how the use of contract management practices can mitigate the negative effects of project risks.

From an engineering management perspective, public infrastructure projects should be considered complex socio-technical systems in which technical execution, organizational capabilities, governance structures, and data-driven decision processes jointly determine project outcomes. Therefore, improving project performance requires more than controlling individual project activities; it requires systematic analysis of interacting factors affecting reliability, efficiency, sustainability, and value delivery. By applying quantitative analytical methods to evaluate stakeholder-related factors and the role of contract management as a governance mechanism, this study contributes to the understanding of how evidence-based management approaches can enhance the performance and resilience of engineering projects in challenging operational environments.

This research addresses this gap, and examines both the determinant factors affecting the performance of projects in the Malawian irrigation sector and the moderating effect of contract management as a practice on those performance determinants. By combining the agency theory and contingency theory, this research attempts to better understand governance performance in complex, risky environments.

2. LITERATURE REVIEW

The literature on infrastructure projects contends that infrastructure project delays, cost overruns, and poor quality are widespread, occur across a range of contexts, and exist across the majority of developed and developing world infrastructure projects (Flyvbjerg et al., 2003; Odeck, 2004). Initially, delays were attributed primarily to inefficiency, both in terms of technical systems and human resources, but more recent research suggests that governance structure and institutions have a significant impact on the performance of projects (Flyvbjerg, 2014a).

While many examples of project inefficiencies exist in developed countries, most researchers attribute these issues to four factors: optimism bias, misrepresentation of project vision and actual current execution of projects; and increasing project complexity (Flyvbjerg, 2014b).

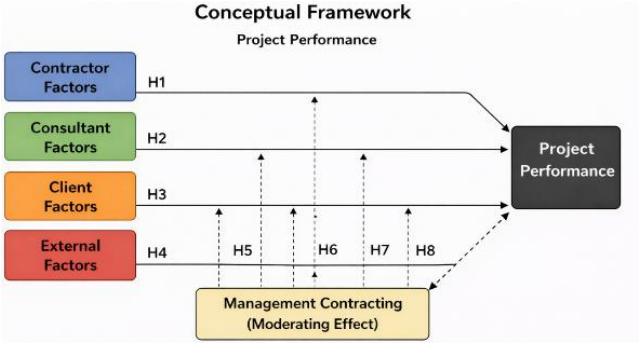

Figure 1. A Conceptual Framework Diagram showcasing interlinkages of actors that affect project completion in irrigation projects in Malawi (Author, 2025)

Despite these limitations, these examples of projects with delayed completion dates, budget overruns, and poor quality are significantly more pronounced in undeveloped nations (Ansar et al., 2016b). A Conceptual Framework for this research is presented in Figure 1.

3. METHODOLOGY

The research took place in three districts of southern Malawi which are Phalombe, Zomba and Machinga because these areas already have public irrigation infrastructure projects. The selected districts represent different agro ecological zones while multiple irrigation schemes funded by government and donor agencies operate within their borders (IFAD, 2023; DCAFS & TIPDeP, 2024). The research used a stratified sampling method to achieve complete stakeholder perspective representation (Kerzner, 2017). The research team selected contractors, consultants, client representatives and supervisors who worked on irrigation projects as their sample. The research received 101 completed questionnaires from 112 targeted respondents which resulted in high response rate across different categories (Ahsan & Gunawan, 2010).

In addition, internal consistency tests were performed via Cronbach's alpha to ensure reliable data, with all constructs exceeding the recommended threshold of .70 (Nunnally & Bernstein, 1994). Construct validity was verified using factor analysis which indicated that the measurement items properly represented the variables being measured (Hayes, 2018). Triangulation (the use of multiple sources of information) was employed to further strengthen the findings (Turner, 2016).

SPSS was used for the analysis of the data (Durdyev et al., 2020). Descriptive statistics were utilized initially to summarize each district's demographic characteristics and project performance results. The second step involved utilizing correlation analyses to test relationships between the variables studied, while the third phase included conducting a multiple regression analysis to determine the predictive influences of contractors', consultants', clients', and outside factor(s)' project performance (Ahsan & Gunawan, 2010). The research team conducted moderation analysis with the Hayes PROCESS macro to evaluate how contract management practices affected the studied relationships (Hayes, 2018).

4. RESULTS

The survey was very successful; 101 contractors, consultants, client representatives and supervisors returned questionnaires, which provided the research with a good deal of valid responses (Ahsan & Gunawan, 2010). Respondents had varying degrees of experience; however, many had been involved in several irrigation projects. The distribution throughout the three sites (Phalombe, Zomba, & Machinga) was fairly evenly distributed and the types of projects that were reported on varied from small-scale to large government-funded projects (IFAD, 2023; DCAFS & TIPDeP, 2024).

Project performance data was assessed, and mean scores for timeliness, cost control, and quality delivery were found to be moderate-low across indicators. These low mean scores suggest there are many challenges in meeting contract obligations and many of the challenges related to contractor-supplied equipment and contractor planning received higher mean scores; likewise, consultant-supplied defects in design and lack of supervision received high mean scores (Kikwasi, 2012; Muhwezi et al., 2014). Additionally, client- related factors such as late payments and indecision contributed to the inefficiencies of the projects (Kamanga & Steyn, 2013; World Bank, 2021a). External factors such as rainfall, flood, inflation and currency fluctuations were perceived to be the most disruptive (World Bank, 2019; World Bank, 2021b; Higginbottom, 2021).

Correlation findings indicated all four factors had a statistically significant positive relationship with project performance, while external factors had the strongest correlation ((Higginbottom et al., 2021). The results of the regression analysis indicate that the regression model explaining 50% or more of the variance in project performance (Ahsan & Gunawan, 2010). The results of the moderation analysis indicate that contract management significantly moderated contractor, consultant, and client factors to strengthen accountability and improve coordination. In addition, contract management cannot mitigate the effect of external influences, revealing a limitation in dealing with environmental or macroeconomic shock (Turner, 2016; Hayes, 2018).

4.1 Response Rate and Demographic Characteristics

Across the three districts of Phalombe, Zomba, and Machinga, the study aimed to enlist 112 participants from 155 total mapped individuals for the study. Table 1 shows the distribution of questionnaires and response rates by respondent type.

Table 1. Response Rate by Respondent Category

Respondent Category	Mapped	Distributed	Returned	Response Rate (%)
Client Representatives	68	49	45	91.8
Contractors	42	30	26	86.7
Consultants	45	33	30	90.9
Total	**155**	**112**	**101**	90.2

Years of experience in irrigation infrastructure projects provide a measure of credibility, the information in Table 2 shows the distribution of respondents by years of experience in developing irrigation projects.

Table 2, Years of Experience in Irrigation Infrastructure Projects

Experience Level	Frequency	Percentage (%)
Less than 5 years	13	12.9%
5–10 years	49	48.5%
11–15 years	16	15.8%
More than 15 years	23	22.8%
Total	**101**	**100%**

The questionnaire requested the respondents to indicate how many public sector irrigation infrastructure projects they had worked on in the past; in order to determine how many different project contexts they had previously been involved with and Table 3 shows the results of the survey.

Table 3. Number of Public Irrigation Projects Involved In

Number of Projects	Frequency	Percentage (%)
1–2 projects	18	17.8%
3–5 projects	36	35.6%
More than 5 projects	47	46.6%
Total	**101**	**100%**

Data was gathered from irrigation project workers in the three study districts to ensure that the sample was representative of different geographic locations. Table 4 displays how many of the respondents were located in each of the three target districts.

Table 4. Distribution of Respondents per District

District	Frequency	Percentage (%)
Phalombe	39	38.6%
Zomba	28	27.7%
Machinga	34	33.7%
Total	**101**	**100%**

All respondents were asked to identify the type of irrigation projects that they had been associated with, and these findings are displayed in Table 5.

Table 5. Type of Irrigation Projects Involved In

Project Type	Frequency	Percentage (%)
Large-scale public irrigation scheme	50	49.5%
Medium-scale scheme	39	38.6%
Small-scale community scheme	12	11.9%
Total	**101**	**100%**

The response rate was very high; out of the 101 contracts returned as completed, all were admissible as these were the ones provided by the respondents; contractors, consultants, client representatives and supervisors - as per the identified target group. As illustrated in Table 1, the overall response rate was more than 90% which showed a representativeness of the sample (Ahsan & Gunawan, 2010). Respondents provided a range of experience with irrigation infrastructure projects as the majority of respondents reported having taken part in multiple schemes through the years (refer to Table 2 and Table 3). A fair distribution of respondents participated from Phalombe, Zomba and Machinga (Table 4), included both smallholder schemes and larger government funded irrigation projects (IFAD, 2023; DCAFS & TIPDeP, 2024) (Table 5). As a result of this information, the dataset contained sufficient variety of viewpoints from professionally engaged in the irrigation development process.

4.2 Project Performance Outcomes

The project performance outcomes were assessed using a range of indicators relating to timeliness, cost containment and quality of service and showed moderate to low mean scores across these indicators.

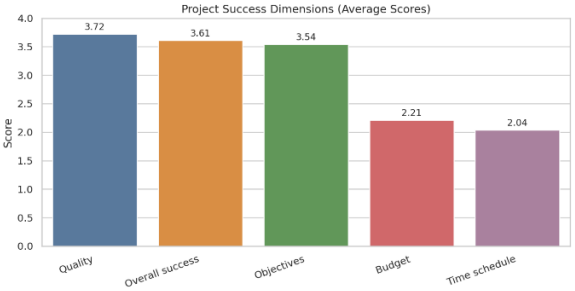

Figure 2. Mean Scores for Project Performance Outcomes

As shown in Figure 2 and in Table 6, many respondents rated the projects below expectations indicating an inability to fulfil contractual obligations and disappointment in the outcome of the projects from a stakeholder, contractor, government representative and consultant standpoint.

Table 6. Descriptive Statistics for Project Performance Outcomes

Statement	N	M	SD
The project was completed within the planned time schedule	101	2.04	0.76
The project was completed within the approved budget	101	2.21	1.23
The quality of completed works met the required standards	101	3.72	1.14
Project objectives were successfully achieved	101	3.54	1.19
Overall, the project can be considered successful	101	3.61	1.24
Composite Mean		**3.02**	

Thus, numerous problems related to delays and inefficiencies in the irrigation industry in Malawi can be noted, consistent with findings in Tanzania and Uganda (Kikwasi, 2012; Muhwezi et al., 2014) and in Malawi's construction sector (Kamanga & Steyn, 2013; Mwamvani et al., 2022; World Bank, 2021a).

4.3 Factor Analysis

Four categories of influences were examined regarding their influence on the implementation of contract management practices:

i. Contractor influences (inadequate equipment, poor planning) (Kikwasi, 2012);
ii. Consultant influences (defective design and insufficient supervision) (Muhwezi et al., 2014);

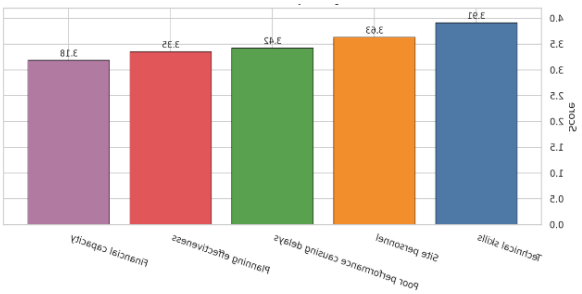

Figure 3. Mean Scores for Contractor-Related Factors

i. Client influences (delayed payment, indecision about scope variations) (Kamanga & Steyn, 2013; Mwamvani et al., 2022; World Bank, 2021a);
ii. External influences (rain, flooding, inflation and currency volatility) (World

Bank, 2019; World Bank, 2021b; Higginbottom et al., 2021).

Figure 3 and Table 7 show that contractor-related factors (inadequate equipment and poor planning) also had relatively high average scores and thus, had a strong impact on project outcomes, as did consultant-related factors (defective design and insufficient supervision) in Figure 4 and Table 8.

Table 7. Descriptive Statistics for Contractor-Related Factors

Statement	N	Mean	Std. Dev.
Contractors possessed adequate technical skills to execute works	101	3.91	1.08
Contractors had sufficient financial capacity to sustain activities	101	3.18	1.31
Contractors effectively planned and scheduled activities	101	3.35	1.28
Contractors deployed adequate and competent site personnel	101	3.63	1.22
Poor contractor performance contributed to project delays	101	3.42	1.18
Composite Mean		**3.50**	

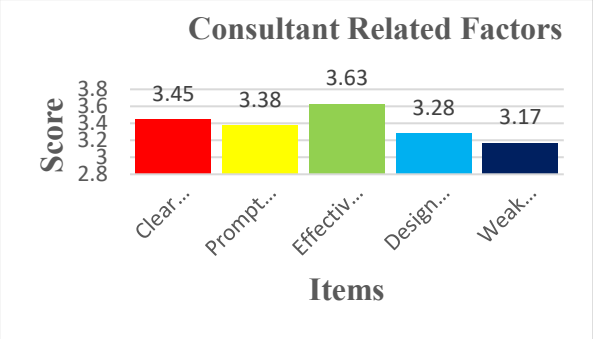

Figure 4. Mean Scores for Consultant-Related Factors

Table 8. Descriptive Statistics for Consultant-Related Factors

Statement	N	Mean	Std. Dev.
Consultants provided clear and complete design documents	101	3.45	1.24
Consultants responded promptly to site queries	101	3.38	1.19
Supervision by consultants was effective throughout implementation	101	3.63	1.11
Design changes by consultants negatively affected project timelines	101	3.28	1.30
Weak contract administration by consultants contributed to delays	101	3.17	1.22
Composite Mean		**3.38**	

Tables 9 and 10 and Figure 5 show that both of these groups of contractor- and client-related factors also had a significant impact on project outcomes. However, among the external factors of rain, flooding, inflation and currency fluctuations, rains were identified as the great external factor contributing to disruptions to project implementation (see Table 10).

Figure 6, Table 11 illustrates that the effectiveness of monitoring, enforcing, and communicating contract management practices were moderately effective. The combination of means by category developed in Table 12 also identified external factors as the greatest predictors of poor project performance.

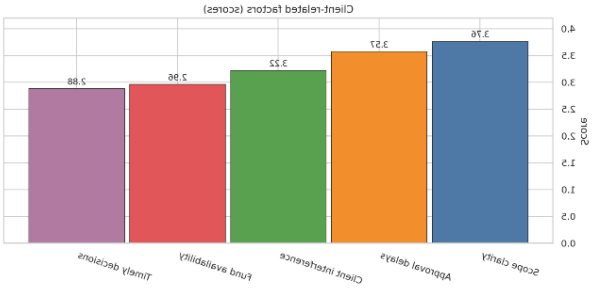

Figure 5. Mean Scores for Client-Related Factors

Table 9. Descriptive Statistics for Client-Related Factors

Statement	N	Mean	Std. Dev.
The client made timely decisions on project-related issues	101	2.88	1.19
The client ensured timely availability of project funds	101	2.96	1.30
Project scope and objectives were clearly defined by the client	101	3.76	1.10
Delays in approvals from the client affected project implementation	101	3.57	1.23
Client interference during implementation contributed to delays	101	3.22	1.21
Composite Mean		**3.28**	

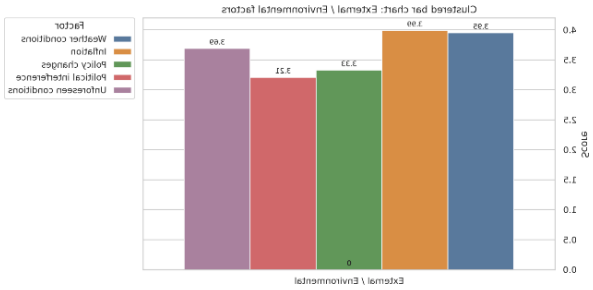

Figure 6. Mean Scores for External Factors

Table 10. Descriptive Statistics for External Factors

Statement	N	Mean	Std. Dev.
Adverse weather conditions affected project implementation schedules	101	3.95	1.08
Inflation and price fluctuations impacted project costs and timelines	101	3.99	1.07
Changes in government policies or regulations caused delays	101	3.33	1.18
Political or community-related interference affected project progress	101	3.21	1.23
Unforeseen environmental conditions disrupted construction activities	101	3.69	1.11
Composite Mean		**3.63**	

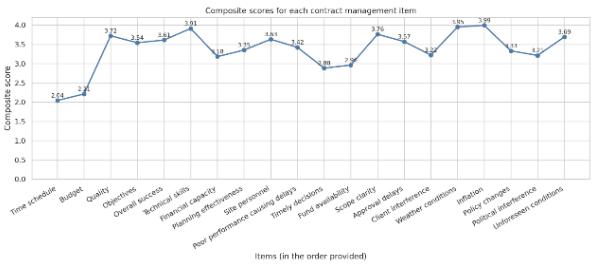

Figure 7. Mean Scores for Contract Management Practices

Table 11. Descriptive Statistics for Contract Management Practices

Statement	N	Mean	Std. Dev.
Contract documents clearly defined roles and responsibilities	101	3.48	1.16
Risk allocation under the contract was fair and well understood	101	3.31	1.15
Contract provisions effectively managed variations and change orders	101	3.28	1.16
Payment procedures under the contract were efficient and timely	101	3.21	1.21
Dispute resolution mechanisms under the contract were effective	101	3.29	1.14
Effective management contracting reduced negative impact of contractor challenges	101	3.62	1.08
Effective management contracting reduced negative impact of consultant challenges	101	3.57	1.09
Effective management contracting reduced negative impact of client challenges	101	3.53	1.13
Effective management contracting reduced negative impact of external factors	101	3.55	1.10
Composite Mean		**3.43**	

Table 12. Summary of Composite Means by Variable Category

Variable Category	Composite Mean	Rank
External Factors	3.63	1
Contractor-Related Factors	3.50	2
Contract Management Practices	3.43	3
Consultant-Related Factors	3.38	4
Client-Related Factors	3.28	5
Project Performance Outcomes	3.02	-

Table 12 and Figure 7 show composite mean scores for all categories of variables, as they relate to perceived influence of the projects being delayed

4.4 Correlation and Regression Analysis

All four categories of factors were shown to have a statistically significant positive correlation with project performance (Table 13; Figure 8) through the correlation analysis. External Factors showed the greatest extent of correlation followed by contractor and consultant-related factors, respectively.

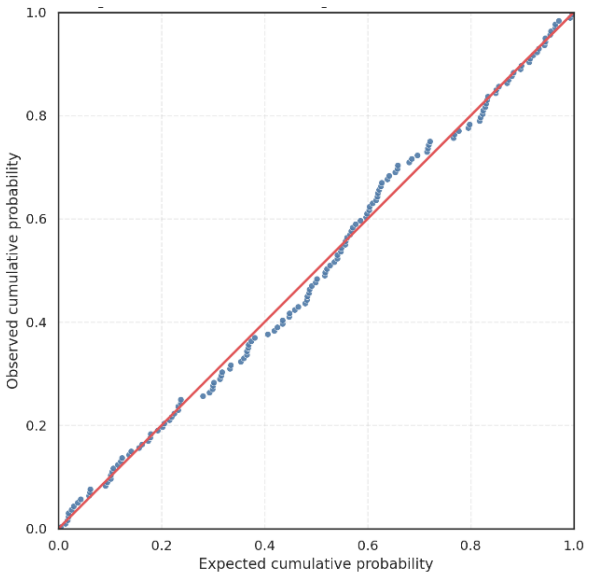

Figure 8. Normal P-P Plot of Regression Standardized Residual

The results of the regression analysis confirmed these same results, as the regression model accounts for more than 50% of the variability in project performance (Tables 15–19), consistent with regression-based findings in project management literature (Ahsan & Gunawan, 2010). (Table 14, Table 15, Table 16). The ANOVA (Table 16) shows that the regression model is statistically significant, and the regression coefficients from the regression analysis (Table 19) identify external factors as the most important predictor of poor project performance. External factors are ranked as the top

predictor of project performance, followed by the contractor factors, then consultant factors, and the client factors respectively (Table 19).

The P-P plot in Figure 8 showing points close to diagonal line, indicating normality

Table 13 Correlation Matrix of Study Variables *Note. N = 101. **p < .01, *p < .05.*

Variable	1	2	3	4	5	6
1. Project Performance	1					
2. Contractor Factors	-0.412** (p < .001)	1				
3. Consultant Factors	-0.387** (p < .001)	0.318** (p = .001)	1			
4. Client Factors	-0.445** (p < .001)	0.291** (p = .003)	0.273** (p = .006)	1		
5. External Factors	-0.503** (p < .001)	0.264** (p = .008)	0.245* (p = .013)	0.306** (p = .002)	1	
6. Contract Management	0.426** (p < .001)	0.352** (p < .001)	0.338** (p = .001)	0.369** (p < .001)	0.312** (p = .002)	1

Table 14 Regression Model Summary

Model	R	R Square (R^2)	Adjusted R Square	Std. Error of the Estimate
1	0.684	0.468	0.446	0.74

Table 15. ANOVA Table

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	15.876	4	3.969	23.46	.000 or p < .001
Residual	18.098	107	0.169		
Total	33.974	111			

Table 16 Effect Size Interpretation Table (Model Summary and ANOVA Interpretation (Model Significance))

Statistic	Value	Interpretation
R	0.684	Strong relationship
R^2	0.468	46.8% variance explained
Adjusted R^2	0.446	Moderate-to-strong explanatory power
F-statistic	23.11	Model is statistically significant

Table 17. Regression Coefficients

Variable	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Hypothesis Testing
	B	Std. Error	Beta (β)		
(Constant)	5.214	0.347		15.03	0.000
Contractor Factors	-0.286	0.078	-0.294	-3.67	0.000
Consultant Factors	-0.194	0.069	-0.211	-2.81	0.006
Client Factors	-0.312	0.084	-0.326	-3.71	0.000
External Factors	-0.378	0.081	-0.391	-4.67	0.000

Table 18. Ranking of Predictor Variables

Rank	Variable	Standardized Beta (β)	Interpretation
1	External Factors	-0.391	Strongest influence on the dependent variable
2	Client Factors	-0.326	Second strongest influence
3	Contractor Factors	-0.294	Moderate influence
4	Consultant Factors	-0.211	Least influence among the predictors

4.5 Moderation Analysis

Moderation analysis was conducted on the effect of contract management practice on the relationship between the determinants and the project performance. The analysis showed that contract management practices did have a significant moderating effect on the contractor, consultant, and client factors (Table 20, 21; Figure 9). The findings suggested that contract management was able to improve accountability and coordination between all stakeholders; however, it did not significantly moderate the external factors, such as weather variability or currency instability (Table 22) consistent with limitations noted in contract management theory (Turner, 2016). The moderation analysis was

conducted using the PROCESS macro (Hayes, 2018), the summary of the moderation hypotheses (Table 22; Figure 10) showed that while contract management was effective at dealing with internal dynamics, its effectiveness was limited with respect to dealing with external shocks.

Table 19. Moderation Analysis - Contractor Factors and Contract Management

Predictor	Coefficient (B)	SE	t	p	95% CI Lower (LLCI)	95% CI Upper (ULCI)
Constant	3.426	0.312	10.98	0.000	2.812	4.040
Contractor Factors (CF)	-0.274	0.076	-3.61	0.000	-0.424	-0.124
Contract Management (CM)	0.318	0.084	3.79	0.000	0.153	0.483
CF × CM (Interaction)	0.142	0.058	2.45	0.016	0.028	0.256

Table 20 Summary of Hypothesis Testing (H1-H4)

Hypothesis	Statement	β	p-value	Decision
H1	Contractor factors have a significant impact on project performance outcome	-0.294	0.000	**Supported**
H2	Consultant factors have a significant impact on project performance outcome	-0.211	0.006	**Supported**
H3	Client factors have a significant impact on project performance outcome	-0.326	0.000	**Supported**
H4	External factors have a significant impact on project performance outcome	-0.391	0.000	**Supported**

Model Summary: $R^2 = 0.512$, $F(3,108) = 18.94$, $p < 0.001$ and ΔR^2 due to interaction: 0.028, $F(1,108) = 6.00$, $p = 0.016$.

A summary of the empirical model of the conjectured relationships illustrates the relationships graphically and shows that contract management has a conditional effect on improving project outcomes.

The moderation analysis results for the relationship between the contractor factors and project performance with the contract management practices as the moderator are presented in Table 19.

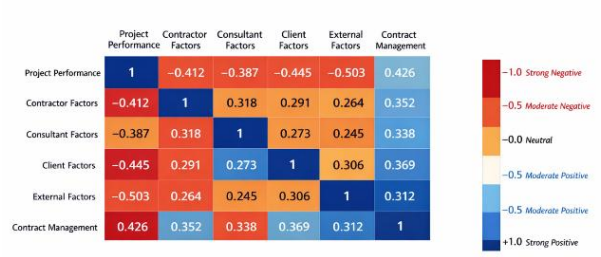

Figure 9. Heatmap of Correlation Matrix

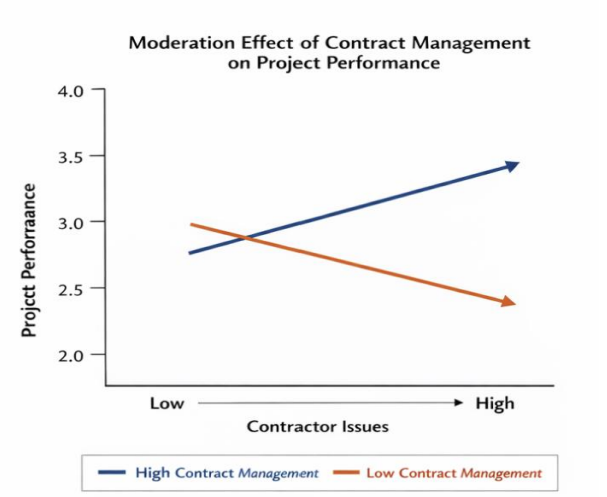

Figure 10. Moderation Effect of Contract Management on the Relationship Between Contractor Factors and Project Performance.

Table 21. Moderation Analysis - External Factors and Contract Management

Predictor	Coefficient (B)	SE	t	p	95% CI Lower (LLCI)	95% CI Upper (ULCI)
Constant	3.398	0.309	11.00	0.000	2.789	4.007
External Factors (EF)	-0.364	0.079	-4.61	0.000	-0.520	-0.208
Contract Management (CM)	0.342	0.086	3.98	0.000	0.172	0.512
EF × CM (Interaction)	0.103	0.054	1.91	0.059	-0.004	0.210

Model Summary: $R^2 = 0.504$, $F(3,108) = 18.23$, $p < 0.001$
ΔR^2 due to interaction: 0.016, $F(1,108) = 3.65$, $p = 0.059$

Table 22. Summary of the Results of Moderation Hypothesis Testing

Hypothesis	Statement	Interaction β	p-value	Decision
H5	Contract management moderates contractor factors–performance relationship	0.142	0.016	**Supported**
H6	Contract management moderates consultant factors–performance relationship	0.118	0.025	**Supported**
H7	Contract management moderates client factors–performance relationship	0.156	0.013	**Supported**
H8	Contract management moderates external factors –performance relationship	0.103	0.059	**Not Supported**

5. DISCUSSION

Overall, the findings provide evidence that project performance in the Malawi irrigation sector is influenced through the combined interactions of contractor, consultant, client and external factors. In line with the previous studies, contractor inefficiencies, design defects and late payments continue to be contributing factors to project underachievement (Kikwasi, 2012; Muhwezi et al., 2014; Kamanga & Steyn, 2013; Mwamvani et al., 2022).

In the Sub-Saharan African countries, systemic barriers impact project performance including limited procurement systems, late payments and lack of technical capacity (Kikwasi, 2012; Muhwezi et al. 2014). Existing literature often examines these determinants in isolation and less emphasis is placed on the interaction of governance mechanisms relative to these factors. In Malawi irrigation projects are subject to increased risk because of the precision based technical requirements of the engineering design and construction of the irrigation system therefore are subject to errors and construction delays (Phiri et al., 2022). Additionally, economic instability especially with regard to fluctuating exchange rates poses financial risk that can lead to interrupted execution of projects and contract renegotiation (Kamanga & Steyn, 2013; World Bank, 2019).

Despite this understanding of these issues there is still a critical gap in understanding the relationship between and the moderating effect of contract management practices within an environment where institutional weakness exists and where external uncertainty exists. This research project is intended to fill this gap by investigating how various governance mechanisms moderate the relationship between key project determinants and performance outcomes.

The conclusions of this research contribute to knowl-edge of empirical evidence of the conti-ngent effect of contract management practices on the performance outcomes of internal project actors, which provide insight into the how contract management can be used to strengthen the relationship between internal project actors and performance outcomes by enhancing the coordination of stakeholders, ac-countability to project deliverables, and compliance with project agreements. Collectively, these findings are consistent with agency theory's emphasis on the need for gov-ernance mechanisms to address opportunistic behaviour and align stakeholder interests (Jensen & Meckling, 1976).

The lack of significant moder-ation by external factors indicates a major limitation of formal governance mechanism. For instance, climate variability and macroeconom-ic instability are external influences on project stakeholders and, therefore, actions taken by contract management cannot help mitigate external influences, limiting the overall effectiveness of the practice of contract management. Therefore, these findings are in support of contingency theory, which states that the effectiveness of management is contingent upon context, and limited in highly uncertain environments (Donaldson, 2001). Overall, these findings indicate that while contract management is an important means of improving the dynamics of an internal project, it cannot be used in isolation to address the broader uncertainties associated with infrastructure projects in developing countries.

6. IMPLICATIONS

The study results present important consequences for public irrigation infrastructure project management in Malawi because they affect policy development and practical operations and theoretical frameworks. The existing policy environment requires organizations to build their institutional capacities and create straightforward procedures for client decision-making. The combination of bureaucratic delays and administrative inefficiencies creates project delays and decreases stakeholder trust. Therefore, policy reform should focus on eliminating bottlenecks in the approvals process, ensuring that funds are disbursed in a timely manner, and providing clear accountability for project activities. Moreover, the ongoing effects of currency volatility highlight the need to develop innovative financial mechanisms, Mwamvani et al. (2022) proposed such initiatives as partial dollarization of contracts or risk-sharing arrangements, in order to stabilize project financing (Kamanga & Steyn, 2013; World Bank, 2019).

On a practical level, the study emphasizes the importance of developing strong contract management systems for all stakeholders involved in the contracting process. Contractors must acquire advanced equipment while they need to enhance their planning capabilities and establish multiple supply channels as a solution to their material

shortage problem. The design process requires consultants to enhance their accuracy while they need to enforce all contractual terms and provide continuous oversight to achieve both quality standards and compliance requirements. The clients must ensure they make payments on schedule while they need to speed up decision-making about scope changes. Coordinated implementation of these strategies will greatly increase the effectiveness of various projects.

On a theoretical level, the study provides additional support for both contingency and agency theories. The data show that while contract management is a useful governance mechanism to control how internal stakeholders behave, it cannot address uncertainties outside of the control of the internal stakeholders. This confirms contingency theory's premise that management is effective depending upon the situation (Donaldson, 2001), as well as showing that agency theory does not apply to environments where the external volatility is very large (Jensen & Meckling, 1976). Therefore, future theoretical frameworks should integrate governance mechanisms and adaptive strategies to assist in mitigating risk from the unknown.

In summary, the study illustrates that a comprehensive range of strategies is required to effectively manage external environmental shocks by providing an integrated approach to managing the various types of internal and external shocks that occur.

7. CONCLUSION

This research revealed that project delivery in Malawi's public irrigation infrastructure is influenced based on how well the internal stakeholder relationship's function and on external environmental conditions. The contract management practice is a key factor in enhancing coordination between project actors, but its ability to reduce external uncertainty through its use is limited.

Consequently, the research shows the need for a two-pronged approach, which will include strengthening contract management systems, to reduce internal inefficiencies, and creating adaptive responses that consider environmental and macroeconomic risk in the project's planning and execution process.

Thus, this research provides empirical evidence from a previously under-researched context, which adds to a more comprehensive understanding of governance effectiveness in very complex project environments, and stresses the necessity of merging formal management practices with adaptive practices.

8. LIMITATIONS AND FUTURE RESEARCH AREAS

The present study provides valuable contributions to academic research. The findings from Phalombe Zomba and Machinga districts restrict their application to other geographical areas and different sectors. The research requires expansion into multiple environmental settings according to its current scope of research. Self-reported data creates potential bias to study results as such the research used methods to establish data reliability and validity (Nunnally & Bernstein, 1994). Future studies need to use objective data sources which include project records and performance audits to build study credibility. The research design which used cross-sectional methods failed to track dynamic changes in project performance which occurred over time. Research which uses longitudinal methods will provide deeper insights into project lifecycle impact factors (Ahsan & Gunawan, 2010). The research study centred on construction activities, but issues may occur at any stage, planning, procurement, and operation. The research requires a complete lifecycle analysis which will provide better understanding of the topic (Turner, 2016). The study identified main factors which affect research outcomes but research needs to examine political interference, community engagement, and technological advancements as additional factors. Therefore, future research needs to expand its study period and use different geographic locations to compare results which will establish more resilient infrastructure systems.

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