

Client-Centric Schedule Controls on Optimal Development of Water Resource Projects

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Abstract

Construction delays remain one of the most critical challenges in water projects delivery, often resulting in cost overruns, schedule slippage, and weakened stakeholder confidence. Traditional time management methods are largely reactive, relying on periodic reporting and fragmented communication across project teams. Different project participants often have different objectives and expectations, and implement different controls aimed at advancing their own interest. This research explores project schedule controls exercised by clients during project design to execution for improved project time performance. To achieve the objective, 185 questionnaire sets successfully formed the sample based on 13 water projects. Data were analyzed inferentially and multiple regression for predicting the relationship. From the findings, project owners (clients) have less power in drafting and planning the scope of the work and time scheduling. Findings showed that regular progress monitoring, deadline management, team communication, and use of shared calendars and digital tools were the effective client time management practices with a combined correlation coefficient ($r = 0.600$, $p < .001$). Moreover, the findings showed that most clients experienced unrealistic timeframes, varying objectives among project stakeholders and bureaucracy as an external factor. The experienced challenges affect clients in managing project schedules negatively ($r = -0.0002$, $p = .098$). These findings imply that client-schedule based controls can be an effective supplement to project delays in public construction projects in Tanzania, particularly for projects requiring project client personalized feedback. The study recommends adoption of digital and Real-Time schedule monitoring tools like Dashboards, and Real-time reporting tools to monitor project progress against approved schedules. Also, establishing early-warning and corrective-action systems for deviation control.

Keywords: Client, Schedule Control, Time Management, Water Projects Performance, Tanzania

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1. Introduction

Sub-Saharan African countries lag significantly behind other emerging economies in infrastructure development, with almost 21% of Gross Domestic Product (GDP) loss (Lu & Wilson, 2024). The estimation by the African Development Bank suggests that an annual estimate of \$130 to \$170 billion can address the Sub-Saharan Africa infrastructure needs, including water projects (African Development Bank, 2021). Nevertheless, financial constraints, governance weaknesses, and institutional incompetencies affect implementation of water sector projects in Africa (Kachenje, 2025). Tanzania sustains project implementation challenges, as evidenced by its low Africa Infrastructure Development Index compared to other African countries (African Development Bank, 2022). According to Mollel and Slawe (2024), financial constraints and corruption hampers water projects development efforts in Tanzania.

Apart from cost constraints, water projects across the globe are affected by schedule performance (Tago, 2020). Bertram et al. (2021) illustrates in their study that more than 60% of water projects globally sustain cost overruns that are more pronounced in developing economies like Tanzania. The cost overruns for projects in Africa are estimated to exceed the global average by at least 10% and double the amount recorded in the European region (Rui et al., 2017). Tanzania also experiences poor schedule performance, which is evidenced by 17 months average schedule delays in most water projects (Kachenje, 2025; Tago, 2020). Performance challenges cause serious economic losses, detriment social welfare, and constrict investments in future hence worsening the existing gaps in water infrastructure (Kachenje, 2025; Etongo et al., 2018).

Time schedule control in project management plays an indispensable role in the successful completion of any

project. Delays in schedule causes devastating implications, including escalation of project costs, loss of stakeholders' confidence, and drop of the project's general value (Okolie & Edo, 2023; Mollel & Slawe, 2024). The contemporary projects' scope and complexity increase the possibility of delays, hence making it an essential area for research in not only project management but also construction engineering (Bahamid et al., 2022). Zhao (2025) concur with Bahamid et al.'s (2022) and Adhan & Mutuku (2023) assertion that comprehension of the triggers of the identified delays and establishment of effective approaches for their prevention has received attention as an essential subject in construction management for numerous years. Multiple factors, including those that technical and operational as well as external impede the planned schedule. Among the contributors of delays in the researched sector include alteration of design, insufficient project planning, and limited resources (Adhan & Mutuku, 2023; Gomez-Cabrera et al., 2024). According to Alkilani and Loosemore (2024), construction projects' increased complexity necessitates upgrade of different stakeholders', including contractors and sub-contractors as well as government agencies and consultants, coordination.

Delays cause serious implications such as cost overruns and project failures in addition to project disputes (Alkilani & Loosemore, 2024). Studies of (Amina, & Ngugi, 2022; Musau & Kirui, 2018; Banzi & Tumuti, 2024) further note that apart from inflating budgets, delays experienced in big construction projects lower the confidence of stakeholders besides eroding the involved firms' reputation and exposing them to legal disputes. Akram, Habib, and Deveci (2023) and Khan et al. (2023) concur with Bongei et al., (2024) by indicating construction projects traditionally use the Earned Value Management (EVM) and others the Critical Path Method (CPM), which are all varied well-established approaches, in analyzing delays or their delay mitigation strategies. The identified methods provide tools that project managers find useful in assessing tasks that influence completion of projects and understanding the implication of delays in the entire timeline. CPM is the preferred technique for comprehending the sequential interaction of activities and determination of essential tasks for management to mitigate project delays (Hegazy, Saad, & Mostafa, 2020). The increased complexity of projects makes the traditional methods ineffective in managing contemporary construction projects' dynamic nature. According to Grzeszczyk et al. (2024) and Gurgun et al. (2024) delay prevention methods that are more proactive are critical in current projects to address delays besides predicting them prior to their occurrence. Using 185 respondents from the client side on 13 major water projects in Mwanza, this research addresses the following questions:

RQ1: How do project clients manage project time schedules?

RQ2: What challenges do project clients face while managing project time schedules?

Grounded in the Triple Constraint Theory, which posits that project success is constrained by the interrelated factors of cost, time, and scope (Atkinson, 1999), this study seeks to answer the overarching question: What is the reciprocal relationship between time schedule variables and water construction projects performance in Tanzania. By demonstrating how client time schedule controls variables are intrinsically linked to projects performance, this research contributes to project management literature in emerging markets while offering useful guides for project managers balancing competing constraints in resource-constrained environments.

The study examines 13 water projects in Nyamagana, Mwanza, Tanzania, using data from 185 client project staff and managers/contractors. By applying canonical correlation analysis, a multivariate statistical technique that identifies and measures associations between two sets of variables, this research reveals complex relationships that might remain hidden using traditional analytical approaches. The findings provide both theoretical contributions to Triple Constraint Theory and practical guidance for infrastructure project management in Tanzania and similar contexts.

2. Literature Review

2.1 Time Schedule Management and Project Performance

Risk registers together with contingency planning have gained attention as a concept for an extensive strategy for identifying potential causes of delay as well as mitigating their implications (Padil et al., 2020). The concept uses past project data in addition to expert opinion in estimating risk in project delays. However, it fails in addressing real-time project data in addition to ever changing environmental conditions. According to Lauria and Azzalin (2024), technological advancement experienced recently has led to development of new delay management tools relating to current data analytics as well as Building Information Modelling (BIM). Apart from revolutionizing detection of project delays, the identified technologies facilitate the management and mitigation of project delays.

As an illustration, Bryde, Broquetas, and Volm (2013) insinuate that Building Information Modeling (BIM) provides an approach that is extensively visual and collaborative for both project planning and implementation that is central in diagnosing possible delays linked to design as well as coordination delays. BIM coordinates the project stakeholders' information through establishment of digital models that enhance accurate planning hence minimize the likelihood of delays caused by miscommunication and in other cases design flaws (Darko et al.,

2020). Internet of Things (IoT) application together with real-time/current data analytics provide new ways of tracing the progress of projects. IoT-enabled sensors incorporated on construction sites together with systems offer constant streams of data regarding project performance, including the productivity of workers, utilization of equipment, and availability of required resources (Radman et al., 2022). The analysis of the real-time/current data using machine learning algorithms along with progressive analytics platforms, increases the ability of the project managers to identify project delays precisely for timely action prior to their escalation (Karamthulla et al., 2024). The construction project management's usage of real-time data has advancement the management of delays, as it provides timely updates regarding the conditions of a site, the progress of a specific project, and status of materials (Yang et al., 2024). The incorporation of real-time data using Power Business Intelligence (Power BI) along with IoT and Application Programming Interface (API), which are reliable data collection approaches, facilitate centralization of data analysis and distribution to different stakeholders to enhance prompt decision-making as well as accountability (Adeniran et al., 2024).

Usage of real-time data analytics equally enhances utilization of predictive models that control historical data to predict possible delays. The application of AI together with machine learning programs in water construction projects enhance forecast of delays premised on multiple causes, including weather patterns, utilization of equipment, productivity of workers (Datta et al., 2024). The predictive potential enables project managers to identify latent risks prior to their occurrence to enhance practical delay management approaches. However, use of technology in managing potential delays involves varied challenges. Small projects experience difficulties in handling upfront costs linked to technological implementations in the contest of using BIM and IoT as well as Artificial Intelligence (AI) tools (Hall et al., 2023). Abdelalim et al. (2024) noted that the complexity of technologies dictates specialized personnel training that trigger not only learning curve, but also additional costs.

The use of advanced technologies in managing project schedule and time equally entails data security challenges. According to Sharma and Barua (2023), reliance on cloud-based platforms in collecting and sharing as well as analysis of real-time data increases the vulnerability of cyber-attacks in addition to data breaches. Sensitive data necessitates advanced protection, as their breach or loss can cause significant financial loss in addition to legal contests. Nevertheless, the pros of advanced technology usage in delay management exceeds the cons. According to Rahaman et al. (2024) the expansion of construction projects demonstrates the usefulness of relying on real-time data and using collaborative platforms together with predictive analytics in timely delivery of projects within budget.

Most key construction projects benefit from notifications they receive relating to early-stage delay in determining and handling possible disruptions to the deadline or timeline of projects (Zhu et al., 2022). Ye et al. (2023) support Zhu et al. (2022) assertion that delay notifications occur throughout the stages of a project to alert personnel about possible or occurred delays that have influence on the timeline and costs of a project. Prompt identification of delays increases the efficiency of mitigation strategies, which is central in reducing the consequences of extended disruptions. However, Alvand et al. (2023) support Sharma and Barua's (2023) claim that identification and notification of delays in a project's early phase is difficult due to the sophistication of construction process, participation of varied stakeholders, and the environment's dynamism.

Varied data analysis techniques contribute significantly to managing the complexity of identification delays in early stages of projects. They include time impact analysis techniques and planned vs as-built technique as well as impact as-planned analysis technique and windows analysis technique. These techniques, however, as subject to limitations linked to integration of real-time/current or actual data. As an illustration, Gurgun et al. (2024) stress Alkass, Mazerolee, and Harris' (1996) claim that the windows analysis technique also referred to as "snapshot technique" entails evaluating delays through periodical update of project schedule at specified stages, which makes it expensive in terms of time and cost. Time Impact Analysis (TIA), a contrast of "snapshot technique", address the consequences of distinct delay events instead of extensive project duration. TIA usage of real-time Critical Path Method makes it reliable in detecting effects of delays during as well as post project implementation (Gutta et al., 2024).

The evaluation of delays by Impact As-Planned technique entails their incorporation into CPM schedule (Guida & Sacco, 2019). The incorporation or insertion of delays is based on their occurrence to enhance determination of their effect on the overall schedule. The As Planned vs As-Built technique or method entails comparison of initial planned schedule with real-time as-built timeline. The technique presents delays as excusable, inexcusable, and concurrent based on the as-built timeline. In this context, the claimant asks for compensation based on the variation planned schedule dates from rea-time completion dates. According to Gutta et al. (2024) and Guida and Sacco (2019), application of both schedules facilitates the identification of critical path as well as general effect

of delay.

The inefficiencies of historical analysis techniques, according to Cevikbas, Okudan, and Isik (2022) influenced the Society of Construction Law (SCL) Protocol together with the AACE International's RP 29R-03 to recommend the TIA as a reliable technique for not only handling delay claims but also analyzing forensic schedules. TIA entails the assessment of change or delay effects on the timeline of a project through incorporation of delays to as-planned schedule prior to recalculation of completion duration. The TIA is lauded for enhancing handling actual issues since it permits not only periodic updates, but also re-evaluation of possible delays during the progress of a project. The technique offers an active and responsive method to the management of project schedule (Yousri et al., 2024).

Schedule Performance Index (SPI) as well as Cost Performance Index (CPI) are reliable value metrics for determining the effect of specified delays experienced in a project's early phases (Lipke et al., 2009; PMI, 2021). Whereas CPI focuses on a project's cost efficiency, SPI assesses the productivity of used time in reference to the planned timeline (Zohoori et al., 2019; PMI, 2021). According to Zohoori et al. (2019) and PMI (2021) inform that SPI and CPI provide insights regarding the impact of early-stage delays on the prediction of duration and cost of a project. SPI value below 1 suggests delay of a project's schedule, which can be utilization along with TIA in evaluating combined implications of delays on the overall timeline and budget of a project. CPI value below 1 equally informs cost overruns that can be associated with the observed early-stage delays to predict their overall implication on the cost of a project.

There are additional five criteria for assessing delays in the construction projects, including Achievability, Relevance, Time-bound, Measurable, and Achievable (Radman et al., 2022). PMI (2021) states Specific and Measurable elements guarantee the preciseness and quantification of delay notifications, which is critical for precise impact analysis. Achievability guarantees the feasibility of the recommended mitigation strategies in the context of project constraints. Whereas Relevance limits the notifications to the project's key aspects, Radman et al. (2022) claims that the Time-bound norm stresses on the usefulness of timely communication. Incorporation of the described SMART measures into TIA enhances accuracy and prompt delivery of early-stage delay alerts or notifications hence lowering the general effect of the construction project. TIA's integration with achieved value metrics and conforming them with SMART measures enable project managers understand the effect of early-stage delays on the entire project scope, facilitating not only proactive decision-making but also accurate prediction of a project's results (PMI, 2021).

2.2 Project Schedule Control Challenges and Project Performance

Although the challenges experienced in water infrastructure projects correlate across the globe, the ones experienced in developing nations are more as evidenced by specific constraints and aggregated by issues relating to performance. Lu and Wilson (2024) further Madaha (2022) argument regarding that majority of the Sub-Saharan Africa nations drag in terms of economic development based on the essential infrastructure development indicators. According to Lu and Wilson (2024), the lagging behind of African nations is evidenced by their loss of about 21% of their annual GDP. Although the African Development Bank (2021) suggests \$130-170 billion as the amount the Sub-Saharan Africa needs to address their infrastructure needs, it fails to acknowledge the effect of the region's rapid urbanization in addition to extensive population growth. Multiple factors impact the developing economies' infrastructural growth, including financial constraints (Kachenje, 2025). Emerging nations require about \$2.0 trillion for infrastructure development compared to the raised \$1.0 trillion (Ochieng & Papadaki, 2020). The identified gap complicates trade-offs, leading to limited allocation of funds to critical infrastructure. Late release of monetary funds by sponsors of projects often disrupts schedules by altering the procurement of workforce and materials.

Institutional weaknesses equally affect completion of projects. Most projects in developing economies within Africa record high-cost overruns and inconsistent performance compared to developed regions. Cost overruns account for 10% in developing economies compared to global average and exceed the European average twice. Limited risk knowledge, inefficient stakeholder involvement, and procurement delays equally have devastating effects on project implementation (Kachenje, 2025). Limited project management potential such as inefficient technical capacity evidenced by some clients' demonstration of low technical knowledge in both scheduling as well as management of project equally impact project implementation (Ogbeifun & Pretorius, 2022). The stakeholders' limited comprehension of project management principles such as resolution for conflicts involving community water projects affect schedule performance.

Governance and rampant corruption have also detrimental effects on schedule management. As an illustration,

political corruption along with interference has direct implication on the duration as well as productivity of projects since they involve procurement manipulation, nepotistic practices, and alteration of resources (Juma & Naom, 2024). Scholars (Tago, 2020; Juma & Naom, 2024) argue that corruption contributes to suboptimal choice of projects, inefficient execution of projects, and deterioration of constructed projects prematurely. Similarly, pressure linked to politics influence alteration of priorities and decisions made in relation to procurement and implementation timeline.

Macroeconomic instability linked to currency devaluation, fluctuation of product prices, and high inflation affect developing economies-affecting prices of materials and total project cost, hence causing cost overruns that equally influence the schedule of water projects (Machado et al., 2022; Ahmed & Arocho, 2021). Additionally, environmental factors such as droughts and floods in addition to terrains influence the movement of materials and construction of projects (Machado et al., 2022). Political instability also affects the environment by causing disruptions that affect the progress as well as planning of projects, including water infrastructure projects (Kativhu et al., 2022). Lack of awareness and poor communication approaches drug the project stakeholders' coordination as well as decision-making.

Mmasa (2023) argue that water construction projects have also become more adverse and complex, posing considerable challenges in the determination and prevention of experienced delays.

According to Mosha (2024), the causes of delays include fragmented data and the stakeholders' inefficient coordination in addition to use of historical manual tracking techniques void of timely responsiveness. Although the integration of actual data and IoT technologies provide the required solutions, Mollé & Slawe, (2024) concur with Mosha (2024), that limited development of existing technologies and scant financial resources management affect the management of project delays.

In the context of Tanzania, the causes of water project delays include payment issues, variation of clients, limited contractor experience, delayed delivery of materials (Tago, 2020). Nevertheless, little has been addressed in the context of client schedule control approaches along with their implications for the performance of water projects. The relationship of project stakeholders' association with schedule performance is poorly understood (Oluseye (2024), particularly in Tanzania. The identified gap can be bridged using canonical correlation analysis in evaluation the customer time schedule control's association with the performance or output of water construction projects in Tanzania.

3. Research Methods

A quantitative cross-sectional research method was utilized to determine the influence of client-centric schedule controls on performance of water projects in Mwanza City, Tanzania (Creswell & Creswell, 2021). A questionnaire survey was utilized to obtain responses from client (individuals) involved in the implementation of water supply projects in Mwanza City, Tanzania, including participants from the management and committee members of the 13 water projects. A total of 207 questionnaires were distributed and 185 (89.4%) was the actual response rate. The questionnaire was adapted and modified to suit the Tanzanian context after a pilot test of 15 participants. The questionnaire comprised of four sections: Section A included questions regarding respondents' demographic information. Section B gathered information regarding the control that the clients had over the time schedule of the construction of the water projects (CT). Section C included questions that helped to gather information regarding the challenges in the time management of these projects (CC). Finally, Section D collected information regarding the performance of water projects (PP). The data was analyzed using multiple regression analysis with SPSS version 27.

4. Findings and Discussion

This report presents the findings of a study that examined the influence of client-centric schedule controls on the performance of water resource projects in Tanzania. The objectives of the study were to determine:

RQ1: How do project clients manage project time schedules?

RQ2: What challenges do project clients face in managing project time schedules?

In undertaking this study, a cross-sectional survey of 185 individuals involved in 13 water projects in the Mwanza region of Tanzania was performed. The data was analyzed using SPSS version 27. The report includes discussions of the demographic profile of the study participants, the reliability of the study instruments, and statistical analyses of the variables related to the objectives of this study.

4.1 Descriptive Statistics

4.1.1 Demographic Profile of Respondents

There were 185 respondents to the study. A summary of the demographics is provided below in Table 1.

Table 1: Demographic Characteristics of Respondents (N=185)

Characteristic	Category	Frequency (f)	Percentage (%)
Gender	Female	92	49.7
	Male	93	50.3
Education Level	Diploma	78	42.2
	Bachelor's Degree	105	56.8
	Master's Degree	2	1.1
	PhD	0	0
Role in Project	Engineering Consultant	66	35.7
	Project Manager/Engineer	47	25.4
	Contractor	31	16.8
	Ministry/Regulator Rep.	21	11.4
	Project Committee Member	20	10.8
Experience	Below 3 years	30	16.2
	3 to 5 years	38	20.5
	6 to 10 years	65	35.1
	Above 10 years	52	28.1

Source: Research Data (2026)

The gender distribution was nearly balanced, with 50.3% male and 49.7% female. Most respondents held bachelor's degree (56.8%), followed by Diploma (42.2%). Engineering Consultants formed the largest professional group (35.7%), followed by Project Managers/Engineers (25.4%). In terms of experience, the largest proportion had 6-10 years of experience (35.1%), with a significant number having above 10 years (28.1%), indicating a generally experienced respondent pool.

4.1.2 Descriptive Statistics for Key Variables

Table 2: Descriptive Statistics for Client Schedule Controls (CT) Items

Clients Time Management Practices	N	Mean	S.D
Schedule clearly defines milestones and deadlines	185	4.22	0.596
We use specific tools (e.g., Gantt charts, critical path, EVM, Digital systems)	185	4.26	0.489
We hold regular progress meetings	185	4.27	0.492
We regularly track actual progress against the planned schedule	185	4.26	0.489
We use time tracking information to adjust resources	185	4.26	0.489
We use delay damages/penalty in contract administration	185	4.26	0.489
Communication about schedule status is timely to stakeholders	185	4.29	0.499

Source: Research Data (2026)

The results indicate that there is a high level of agreement among the clients regarding the survey item. The mean value of each item rates between 4.22 and 4.29 on a 5-point scale. The highest rate among the clients was provided to the item of having timely communication regarding the status of the project (mean = 4.29, standard deviation = 0.499). Following this item, were the items regarding holding regular progress meetings (mean = 4.27, standard deviation = 0.492), implementing scheduling tools (Gantt Charts, Critical Path Method, Earned Value Management) (mean = 4.26, standard deviation = 0.489), and the tracking of the actual progress of the project relative to the planned schedule (mean = 4.26, standard deviation = 0.489). The standard deviation for each item indicates the level of agreement among the clients for each item, with the lowest standard deviation associated with the communication items. Thus, all items had a high level of agreement from the clients regarding their implementation. The exception to this general rule is the item that indicated that the project schedule needs to include milestones and deadlines for the project, which had the lowest mean value of 4.22 (standard deviation = 0.596). Thus, while all items received high levels of agreement among the clients, there was a slight exception to that agreement. However, overall, the clients indicated that they use each of these schedule control techniques as a part of their management of the projects.

Table 3: Descriptive Statistics for Challenges (CC) Items

Challenges Faced by Clients in Managing Schedule	Mean	S. D
Unrealistic timeframes set at project approval	4.58	0.536
Design issues (errors, changes, incomplete documents)	4.63	0.528
Limited use of digital tools or data	4.63	0.528
Delayed procurement	4.63	0.528
Weak planning and scheduling capacity	4.63	0.528
Financial constraints and delayed payments	4.63	0.528
Lack of monitoring and evaluation	4.63	0.527
Poor coordination and communication	4.63	0.527
Governance and administrative issues	4.63	0.527
External factors	5.5	5.763

Source: Research Data (2026)

Participants all agreed strongly with challenges to time management. Mean scores for most items were around 4.63, indicating such agreement. The item on external factors had a high mean and standard deviation ($M=5.50$, $SD=5.76$). Other factors related to time management difficulties included unrealistic timeframes at the project approval stage ($M=4.58$).

Table 4: Descriptive Statistics for Project Performance (PP) Items

Project Performance	Mean	S.D
Water projects completed within planned time	4.52	0.609
Water projects meet expected quality standards	4.55	0.561
Water projects completed within budget	4.55	0.561
Beneficiaries are satisfied with project outcomes	4.55	0.561
Water services have improved in the community	4.55	0.561

Source: Research Data (2026)

Table 4 findings show that most of the items within each of the scales received mean scores between 4.52 and 4.55 on a five-point scale, indicating that most of the respondents strongly agreed with the statements about the effectiveness of the controls. This indicates that, the clients felt that the projects met the performance criteria established.

4.2 Reliability Analysis

Cronbach's Alpha was used to assess the internal consistency of the scales measuring the concepts of Client Schedule Controls (CT), Challenges (CC), and Project Performance (PP).

Table 5: Reliability Statistics

Scale	Cronbach's Alpha	Number of Items
Client schedule Controls (CT)	0.99	7
Schedule management challenges (CC)	0.326	10
Project Performance (PP)	0.997	5

Source: Research Data (2026)

The CT and PP scales both revealed excellent internal consistency ($\alpha = .990$ and $.997$, respectively). These coefficients indicate that the items included in each scale measure the same underlying construct. However, the CC scale revealed poor internal consistency ($\alpha = .326$). This suggests that the items included in this scale may not be measuring a single underlying construct. While this can contribute to the already-low validity of the CC scale, it may be beneficial to reconsider and revise the items in future studies incorporating this scale.

4.3 Correlation Analysis

To establish the relationship between the independent variables (CT and CC scales) and the dependent variable (PP scale), a Pearson's correlation was utilized.

Table 6: Correlation Matrix

		CT-Total	CC – Total	PP-Total
CT-Total	Pearson Correlation	1	0.341**	0.600**
	Sig. (2-tailed)		0.000	0.000
	N	185	185	185
CC - Total	Pearson Correlation	0.341**	1	-0.002
	Sig. (2-tailed)	0.000		0.98
	N	185	185	185
PP-Total	Pearson Correlation	0.600	-0.002	1
	Sig. (2-tailed)	0.000	0.980	
	N	185	185	185

**** Correlation is significant at the 0.01 level (2-tailed)**

Source: Research Data (2026)

The relationship between the variables revealed a moderately strong positive correlation between Client Time Schedule Controls (CT) and Project Performance (PP). The correlation coefficient was .600 with a p-value of <.001, both of which are statistically significant values. In contrast, the relationship between Challenges (CC) and Project Performance (PP) was negligible and non-significant with a correlation coefficient of -.002 and a p-value of .980. While challenging projects are to be expected to exhibit a negative relationship between the variable of challenges and project performance, the surprising finding of a negligible relationship may indicate that the complex nature of the variable of challenges may interact with other variables in projects in ways that cannot be accounted for in a correlation analysis of the two variables alone. Finally, a weak positive correlation was found between Client Schedule Controls (CT) and Challenges (CC) with a correlation coefficient of .341 and a p-value of <.001. While it may be expected that projects with more schedule controls will experience less challenges, such a finding is still supported by the literature indicating that clients who implement more controls into their projects are more likely to be aware of the challenges that their projects experience.

4.4 Normality and Regression Assumptions

4.4.1 Test of Normality

Table 7: Tests of Normality for PP Total

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
PP_Total	0.364	185	0	0.69	185	0

Source: Research Data (2026)

Although the results of the Kolmogorov-Smirnov and Shapiro-Wilk tests are significant ($p < .001$), indicating a deviation from normality, the Central Limit Theorem ensures that the regression analysis is robust to violations of normality with such a large sample size ($N=185$). Furthermore, examination of the Q-Q plot was tested on histogram indicated an approximately normal distribution of the data (Creswell & Creswell, 2022).

3.4.2 Multicollinearity

Table 8: Collinearity Statistics

Model	Tolerance	VIF
CC_Total	0.884	1.132
CT_Total	0.884	1.132

Source: Research Data (2026)

The value of the VIF was well below the threshold of 10 ($VIF = 1.132$), indicating that there was no multicollinearity among the independent variables.

4.4.3 Autocorrelation

The Durbin-Watson statistic for the model was 1.735, which is within the range between 1.5 and 2.5, indicating that there was no autocorrelation among the residuals.

4.5 Multiple Regression Analysis

Multiple linear regression was used to determine the relationship between the Project Performance (PP) and the two independent variables: Client Schedule Controls (CT) and Client Challenges (CC). The F-test for the regression model was significant in determining the relationship between these two variables.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.639a	0.408	0.402	0.43848	1.735

a. Predictors: (Constant), CT-Total, CC-Total

b. Dependent Variable

The model explains 40.8% of the variance in Project Performance ($R^2 = .408$). Thus, the model suggests that the two variables together help to explain a considerable portion of the variation in project performance.

Table 10: ANOVA - Overall Model Fit

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.154	2	12.077	62.813	.000b
	Residual	34.992	183	0.192		
	Total	59.146	185			

a. Dependent Variable: PP-Total

b. Predictors: (Constant), CT-Total, CC-Total

A significant regression model was found, $F(2, 183) = 62.8F$ ($p < .001$). Thus, the combination of these two variables was found to be significantly predictive of project performance.

Table 11: Coefficients - Predictors of Project Performance

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.091	0.308		6.786	0.000
	CC-Total	-0.186	0.048	-0.234	-3.853	0.001
	CT-Total	0.781	0.070	0.680	11.208	0.000

Source: Research Data (2026)

The results of the regression analysis indicated that there were two significant predictors of project performance. The first of these was the variable of client schedule controls (CT), which was the strongest predictor of project performance ($\beta = .680$, $p < .001$). A one-unit increase in the score for client schedule controls was associated with a .781 unit increase in the project performance score. This demonstrates that clients who have good time management and scheduling for their projects that they undertake are more likely to experience improved project performance. This finding is in alignment with previous research within the field of project management in different research contexts (Kachenje, 2025; Amina & Ngugi, 2022; Mogaka et al., 2020). Similarly, the variable of challenges faced by the project client (CC) in managing time schedule had a significant negative effect on project performance ($\beta = -.234$, $p < .001$). A one-unit increase in the number of challenges that were faced in the project was associated with a .186 unit decrease in the project performance score. In relation to RQ2, challenges clearly do impede project outcomes.

5. Discussion

5.1 RQ1: How Clients Manage Time Schedules

The results show that clients in water supply projects apply various schedule control techniques. Routine progress meetings, the use of specific tools (Gantt charts, Critical Path Method, EVM) and rigorous performance tracking are generally accepted and used and mostly accepted as effective. Previous research supports these findings, reporting positive relationships between client schedule control practices and project performance (Lemein & Nyaberi, 2024; Chitongo & Pretorius, 2018). The scholars favored, shared calendars and digital tools together with regular progress meetings. This high level of agreement in these practices supports the reliability of the client time management practices of water projects in Tanzania. The CT relationship with the project success was, however, strong and positive, with a high beta coefficient for CT in the regression analysis, indicating that these practices are not mere administrative forms but are vital to project success. The client's appreciation of the need for timely communication and regular progress monitoring of projects between the client and the contractors in practice with positive effect is aligned with the literature in project management which highlights

effective communication among project teams as a critical success factor of water projects (Lemein & Nyaberi, 2024).

5.2 RQ2: Challenges Faced by Clients in Time Schedule Management

In relation to RQ2, challenges clearly do impede water project outcomes. The findings on infrastructure projects confirmed that unrealistic timelines, design problems, planning capacity weaknesses and external factors like bureaucracy had a negative effect on the delivery of projects. These findings are also confirmed by prior researchers of different conceptualizations and nationalities (Mollel & Slawe, 2024; Tago, 2020; Musau & Kirui, 2018; Mkutano, & Sang, 2018; Chitongo & Pretorius, 2018) who agreed that stakeholders' varying objectives, resources allocation conflicts and impaired communication among project teams hinders client time management of projects. The high mean scores indicate that these barriers are consistently experienced by clients while managing their project time schedule. Interestingly, the reliabilities for the CC scale were very low ($\alpha = .326$), suggesting that the challenges may be varied and not represent a single project. This may imply that the challenges that fall under the "governance issues" and the "external factors" categories are conceptually different and can impact the schedule management differently. The bivariate correlation between CC and PP was not significant ($r = -.002$), but the regression analysis revealed that CC had a significant negative regression ($\beta = -.234$). This figure is most likely due to suppression effects. Challenges affect project performance in ways that are only evident in their presence, after controlling for the effect of schedule controls. This implies that the challenge-performance relationship is not linear and being in a condition of challenge lowers performance to a certain extent, which is covered over or mediated by the presence or absence of effective schedule controls.

5.3 Study Implications

The research findings yield a clear conceptual framework and practical approaches. For RQ1, we concluded that Client time schedule controls is a strong positive predictor of water project performance. For RQ2, challenges were not positively correlated but were strong negative predictors of performance in the model. The negative effect implies that, as client time schedule control increases, the challenges of projects decrease, and performance of water projects is likely to improve. When the positive effects of schedule controls are considered, this renders the negative effects of challenges more apparent (e.g., unrealistic timelines, poor planning, bureaucracy). In fact, although some of the negative effects can be mitigated through client schedule controls, there may be other significant challenges that can impact project performance not included in the model.

These findings suggest that client time schedule controls can be an effective supplement to project delays in public construction projects in Tanzania, particularly for projects requiring project client personalized feedback. This could help narrow down the gap in the traditional control approaches and thus provide better support for decision making among project stakeholders.

6.0 Conclusion

This study examined the influence of client-centric schedule controls on optimal development of water resource projects. The research questions are answered in a conclusive manner: Clients effectively manage time schedules with use of digital tools, regular meetings, time tracking, and communication. These practices are highly correlated with project success in terms of time, cost, quality and satisfaction of the beneficiaries. Secondly, clients experience difficulties such as unrealistic timeframes, bureaucracy and contactors' governance factors in schedule management. These challenges, if not mitigated through adequate project schedule control, can adversely affect water projects' performance. To ensure water projects' success, it is recommended that client organizations strengthen their formal schedule control approaches and proactively face challenges identified during the project design and implementation, especially in the procurement, planning and stakeholder communication aspects.

6.1 Recommendations

First, schedule control interventions should use digital tools like Dashboards and Real-time reporting to monitor project progress against approved schedules to eliminate delays; and build team capacity through enhance planning and scheduling skills. Lastly, project clients should establish rapport risk management plans for external factors (weather, politics, community issues) and improve project governance structure by establishing early-warning and corrective-action systems for deviation controls. But many questions remain unanswered regarding client-contractor joint-schedule engagement to avoid unintended project consequences. Further, inquiry into ethical procurement of contractors and participatory platforms, unlike client-centric-focus, is needed for schedule configuration evolution understanding.

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