

The Influence of Quality Control Mechanism Implemented by Consultants on Quality Assurance of Road Projects: A Case of Dar es Salaam Metropolitan Development Projects, Tanzania

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ABSTRACT

This paper aimed to examine the influence of quality control mechanisms (evaluation of work executed, supervision of work, advising on proper execution of work and inspection of work executed) implemented by consultants on quality assurance of road projects in Tanzania so as to provide a comprehensive understanding of the relationship between quality control mechanisms and quality assurance, which stakeholders can make informed decisions to improve project outcomes and enhance overall infrastructure quality. This study was guided by agency theory. The study employed a case study research design that utilized a quantitative research approach, involving 122 respondents from the population of 175 randomly selected in the 50 road projects under Dar es Salaam Metropolitan Development Project (DMDP), but valid responses were 110. The data was collected using self-administered questionnaire, and the collected data were analyzed by factor analysis and multiple regression analysis. From the analysis, the findings demonstrated that the evaluation has a negative relationship (-1.680, $p < .022$), implying that lower evaluation of work executed scores correspond to lower project quality. Conversely, both supervision of work (1.375, $p < .001$) and advising on proper execution of work (1.151, $p < .026$) show positive relationships with project quality, implying that higher levels of supervision and effective advising contribute to enhanced outcomes of the projects. Inspection of work executed failed to serve as a significant predictor (0.011, $p > .949$) which shows that its effectiveness on quality assurance did not show up as expectations compared to other mechanisms. The research reveals consultants' application of evaluation procedures and supervisory techniques together with advising practices to uphold road construction quality standards. The research finds that evaluation, supervision, and advising serve as essential quality control tools used by consultants but recognizes the need to enhance inspection practices for better process effectiveness. Consultants should prioritize rigorous supervision practices to make sure construction activities comply with specifications while adhering to safety regulations and quality standards. Adequate quality assurance requires full-time supervision through regular site visits and progress reviews combined with stakeholder coordination.

Keywords: Quality, Quality Control, Quality Control Mechanism, Quality Assurance

I. INTRODUCTION

Road construction works play an essential role in boosting economic growth and integrating a nation closer (World Bank, 2019). Developing countries like Tanzania require good-quality road infrastructure most as it facilitates trade, reduces the cost of movement, and boosts access to essential services such as health and education (African Development Bank Group, 2021). However, road construction project quality assurance remains a significant challenge due to inherent complications in the construction process, finite resources, and the involvement of multiple stakeholders (Kimzanye, 2021). Consultants thus become critical stakeholders who oversee and guarantee the supply of quality road infrastructure through technical expertise, management of projects, and adherence to international standards (Dwiaryanti et al., 2021).

Dar es Salaam Metropolitan Development Project (DMDP) is an emblematic programme to address the urban infrastructure requirements of Tanzania. Being a megacity urban development project, the DMDP will improve road infrastructure, drainage infrastructure, and other urban infrastructure to cater to the growing population and economic activities in the city (United Nations Habitat, 2022). The contribution of the consultants in such a project is significant as they provide professional advice, exert quality control procedures, and maintain adherence of the construction process to the specifications of the project and the required regulations (Asiedu et al., 2024). Consultants facilitate communication between clients and contractors during business by maintaining coordination and making parties answerable throughout the duration of the project (Masengesho et al., 2021).

One of the most important roles of consultants is present in their recruitment processes. There should be merit-based and clear hiring procedures employed to guarantee that qualified professionals are assigned with the

mandate of monitoring road construction project quality assurance (Niazi & Painting, 2017). Another central role of consultants is implementing quality control measures. These include frequent visits to sites, material testing, adherence to engineering designs, and evaluation of the contractor's performance (Park & Kim, 2024). By so doing, consultants minimize risks of faulty workmanship, cost overruns, and delay, thereby enhancing the general quality of road construction activities (Singh & Tiwari, 2020). The relationship between the clients, contractors, and consultants is equally a determining element of project success. Effective communication and coordination between them are pivotal to conflict resolution, successful decision-making, as well as achievement of the desired quality levels (Giménez et al., 2019).

Despite consultants being known to be quite significant in road construction, hardly any research has been conducted to explore their unique roles in ensuring quality assurance during Tanzanian infrastructure development (Israel, 2023). This study attempts to address the above by researching how effective the quality control mechanisms they undertake are towards quality assurance. By focusing on the DMDP, this research seeks to provide significant information for enhancing the consultancy function in road construction projects in a way that it assists in contributing to sustainable infrastructure development in Tanzania.

1.1 Statement of Problem

Despite the importance and struggle to affirm quality assurance in road construction projects in Tanzania, there is still a lack of consensus on the most effective ways to utilize consultants in this process in metropolitan development projects in Tanzania (Israel, 2023; Kimzanye, 2021). This may be due to various factors, including inadequate training and resources, a lack of standardization, or inadequate oversight and monitoring (Dwiaryanti et al., 2021). As a result, there is a need to identify best practices for utilizing consultants in quality assurance in these contexts to ensure the safety and integrity of the constructed road.

Most of the existing literature in this topic has concentrated even further on project risks and cost overruns in other construction projects, e.g., Nyakala et al. (2019) and Siayor (2019), whereas scant research has concentrated on specifically examining how quality control mechanism employed by consultants impacts road construction projects' quality assurance in Tanzania (Evarist et al., 2023). However, this paper introduced new insight on the role of consultants on quality assurance, specifically in the road construction projects in Tanzania, to fill the gap by examining the effect of quality control mechanisms implemented by consultants on quality assurance of road construction projects.

1.2 Research Objective

The purpose of this study is to examine the influence of quality control mechanisms (evaluation of work executed, supervision of work, advising on proper execution of work and inspection of work executed) implemented by consultants on quality assurance of road construction projects in Tanzania.

II. LITERATURE REVIEW

2.1 Theoretical Review

This part presents the theory that guides the study on the influence of quality control mechanisms implemented by consultants on the quality assurance of road projects.

2.1.1 Agency Theory

This study was guided by Agency theory. The agency theory is a sociological theory that describes the way relationships among individuals or institutions are structured based on the concept of agency, or the ability to act and make decisions. The theory was first proposed by Fama and Jensen (2015), who were of the view that the agency concept was central to relationship understanding among individuals or institutions. According to Vargas-Hernández and Teodoro Cruz (2018), an agency relationship is present when one party, known as the agent, acts on behalf of the other party, known as the principal.

One of the agency theory assumptions is that the principals and agents may have conflicting goals and incentives and that there can be a conflict of interest because of this. In the context of the research title, it means that consultants may have their own goals and incentives that may not always align with those of their clients and that conflict of interest can happen. One of the most prominent aspects of agency theory is that it constitutes a good analytical framework for understanding the dynamics between agents and principals and how probable there is going to be any conflict of interest or misalignment of objective (Hendrastuti & Harahap, 2023). However, there are some traps as well as agency theory. It is not always feasible to align the goals of principals and agents fully, and interest conflicts may still exist even when they are tried to be minimized (Mersni & Can, 2022). Agency theory is also not

always successful in explaining richness in reality relationships and may not always work for all relationships (Widhiadnyana & Dwi Ratnadi, 2019).

Agency theory may be utilized in understanding how agency relationships among clients and consultants may be installed with quality control measures. Based on understanding the possibilities of conflict of interest, quality control mechanisms can be developed efficiently to connect both parties' interests. For example, the consultant may be incentivized to identify and report issues, while the client may be incentivized to minimize costs and delays. By designing quality control mechanisms that effectively balance these interests, improving road projects' quality assurance is possible. Agency theory suggests that the principal must establish robust monitoring and reporting systems to evaluate the agent's performance. Under the tenets of agency theory, this study assessed and evaluated quality control mechanisms implemented by the client in monitoring consultants' performance.

2.2 Empirical Review

Nyakala et al. (2019) explore South African construction project deliveries to local communities built by small and medium enterprise (SME) contractors. The study aimed to explore construction project delivery practices within the construction sector to develop a road quality assurance measurement tool specifically for construction organizations. The paper concludes by showing that the SME construction project lacks strategic planning and poor quality of construction project delivery. The findings suggest that SME construction organizations would benefit from adopting a product quality program to construct long-term relationships with local authorities and communities. Further developing SME construction organizations' road quality assurance process also helps with community flexibility and overall continuous process improvement.

Njeri and Were (2019) studied the determinants of project performance in non-governmental organizations in Kenya, specifically looking to establish the influence of top management support, project culture, project scheduling, and project team commitment on project performance in NGOs in Kenya. The study revealed that the selection and follow-up phase of procurement of consultancy services was widely practiced in the public sector. Moreover, the study revealed that technical aspects of design, project execution/action plan, and individual experience of key project personnel were significant challenges in the procurement of consultancy services.

In the selection process of consultants, the question of whether respondents' organizations have good knowledge of acceptable consulting prices was ranked as the most important. However, whether organizations have good knowledge of the consulting firms' market and their specific competencies was ranked last. Whether the respondent's organization creates a genuine competitive situation in selecting consultants was ranked third, followed by the attention paid to analyzing received proposals for consultancy services. Surprisingly, most respondents agreed that their organizations thoroughly considered various selection criteria and ranked first. The study provides unique insights into how consulting services are procured in public financial institutions.

Siayor (2019) assessed the effectiveness of quality management practices in Ghana's construction projects. This study was conducted in Ghana and aimed to assess the effectiveness of quality management practices in construction projects in this country. The methodology used in this study was a combination of qualitative and quantitative data collection methods, including interviews, focus groups, and surveys. The study's findings indicated that implementing quality management practices was significantly related to improved construction project outcomes in terms of cost, time, and customer satisfaction.

Velumani et al. (2021) conducted a comparative analysis of construction project quality in India. This study was conducted in India and the United States and aimed to compare construction project quality in these two countries. The methodology used in this study was a combination of qualitative and quantitative data collection methods, including interviews, focus groups, and surveys. The study's findings indicated that construction project quality in India was generally lower than in the United States, with factors such as project planning, project team communication, and project team leadership being identified as key contributors to this difference.

Brooks et al. (2021) carried out a study on construction quality defects; in the context, the study examined the extent of regulatory decoupling and its impact on the effectiveness of the implementation of the ISO 9001 QMS in 3 case study construction organizations. 34 interviews are undertaken across three case study organizations and analyzed using an abductive grounded theory approach. In all three case study organizations, regulatory decoupling between the operation of the companies and their ISO 9001 system is taking place. Disconnection of the QMS to quality "on the ground" is evident. A model showing factors that foster regulatory decoupling is produced. The picture of compliance is complex and continually evolving.

The system dynamics model shows that the decoupling processes are complex and interlinked. The three driving factors that foster decoupling have been identified as the prevailing company culture relating to the motivation for acceptance of the QMS; site managers' desire for autonomy, which may conflict with company control; and the operation of and support given to audits, from top management to site operatives. QM systems can be recoupled to

practice on the ground in construction operations through less emphasis on performance and a shared organizational approach to apply the essence of the system to drive quality construction on the ground”.

Evarist et al. (2023) identified the key constrains factors impacting recruitment and selection practice of building contractors in Dar es Salaam, Tanzania, and propose advocated solutions. Convergence concurrent mixed methods approach comprising questionnaire and semi structured interview was used data collection. Stratified simple random sampling with 42 responses and purposive sampling with 8 responses were used. The quantitative data were analyzed using descriptive statistics and inferential statistics (one sample t-tests). Directed content analysis method was employed for the qualitative data.

The quantitative results showed that, ‘location of site’, ‘lack of experienced laborer’s, ‘lack of policy to govern recruitment and selection process’ and ‘Low skill levels of construction workers as the highly ranked constrains factors. The qualitative results revealed ‘Location of site’ and ‘Payment differences between one company and another’ as the major constrains factors’. The advocated solutions were human resources and strategic management in nature and included provision of training, skills recognition and impartment, early preparation of recruitment plan, development of recruitment and selection policy, and motivation. The study provides some useful insights into the constraints of recruitment and selection practices and proposes appropriate solutions. The implications drawn from the study are that building contractors are put in a better position to comprehend the constraint factors and their associated practical solutions.

III. METHODOLOGY

3.1 Research Design

Research design is the setup or conditions for data collection and analysis that aim to balance procedural economy with relevance to the study goal (Ridder, 2017). The designing of a study helps the researcher to plan and implement the study in a way that enables the researcher to obtain the intended results. A case study research design was applied in this investigation because it centers on one area to obtain detailed information. This design is also a good choice because it keeps the study focused and manageable due to the restriction of time and financial resources to do large-scale research.

3.2 Sample size and Sampling Procedure

3.2.1 Sample Size

The study population consists of 175 stakeholders, which were used to determine the sample of 122 respondents, as shown in Table 1. The sample size was possible using a 95% confidence level and $\pm 5\%$ margin of error to provide reasonably reliable results for this study. This 95% confidence level and 5% margin of error strike a balance between accuracy and practicality, providing reliable results while keeping the sample size within a level that can be collected efficiently. The formula adopted was:

$$n = N / (1 + N(e^2)) \dots\dots\dots (1)$$

Where;

n is the sample size

N is the population = 175

e is the marginal of error = 5%

1 is the constant

$$n = \frac{175}{1 + 175(0.05^2)}$$

Sample size is 121.74 $\approx$ 122

Table 1

Sample Size

Stakeholders	Population	Sample size
Management	15	10
Engineers	76	53
Consultants	20	14
Administration	42	29
PMU	8	6
Project managers	14	10
Total	175	122

3.2.2 Sampling Technique

The study employed a simple random sampling technique to select 122 respondents from the management, engineers, consultants, administration, PMU, and project managers. In this case, the researcher obtained a list of 175 individuals from the human resources department at DMDP, particularly those who are working in the mentioned departments. The researcher then wrote the names of these respondents on pieces of paper, cut them into small pieces, and mixed them. Afterward, someone was asked to randomly select 122 pieces of paper from the 175 papers for the collection of quantitative data (Pace, 2021).

3.3 Data Collection Methods

The study utilized a questionnaire to collect data from 122 respondents who are engaged in the 50 roads construction projects under DMDP including management, engineers, project managers, consultants, administration, and PMU. The questionnaire was designed with structured questions aimed at gathering specific information related to the study's objective. It was available in both English and Swahili to accommodate the language preferences of the participants, ensuring clarity and accurate responses. Once the questionnaires were completed, the researcher reviewed and organized the responses. The purpose of the questionnaire was to compare the reviewers' comments and the authors' perceptions of the problems. The questionnaire focuses on meeting the study objective (Aithal & Aithal, 2020).

3.5 Data Analysis Techniques

Factor analysis was conducted using SPSS software to assess quality control mechanisms influencing quality assurance in road construction projects. The data, collected through structured questionnaires and validated records, were first standardized to ensure comparability. Varimax rotation was applied to enhance the interpretability of factor loadings. Variables with loading values above 0.6 were retained for further analysis, representing significant contributions to the components.

Factor analysis was chosen for its ability to reduce dimensionality while preserving key information, enabling the identification of critical quality control mechanisms like supervision, advising, evaluation, and inspection. By highlighting the most influential factors, Factor analysis provided a structured framework for understanding the mechanisms impacting quality assurance in road construction, facilitating targeted recommendations and strategic improvements in project management.

Multiple regression was employed following the conduct of correlation. Multiple regression analysis was suitable since the dependent variable is continuous and normally distributed. The goal of the study was to predict a continuous outcome. It was employed to set the projection of independent and dependent variables (Pallant, 2020). The regression model was derived as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \Sigma \dots \dots \dots (2)$$

Whereby: β_0 is the regression intercept, β_1 - β_4 are the regression coefficients, Y is the dependent variable (quality assurance of road projects), X_1 is Evaluation, X_2 is Supervision, X_3 is Advising, and X_4 is Inspection. The researcher used the statistical package for social sciences (SPSS) to code, enter, and compute the measurements of the multiple regressions for undertaking this particular study.

3.6 Ethical Consideration

The ethical issues of this study were addressed following the guideline provided by this journal (African Journal of Empirical Research). Informed consent in written form was sought from all subjects prior to questionnaire, duly informing them that the data sought would be solely used for the purpose of this paper. Participants also were fully notified of their rights while undertaking the consent form.

IV. FINDINGS & DISCUSSION

4.1 Response Rate

This part covers the data analysis and findings on the influence of quality control mechanism implemented by consultants on the quality assurance of road projects, using factor analysis on the four aspects of quality control mechanisms, including evaluation, supervision, advising and inspection, and multiple regression to establish the statistical relationship between those quality control mechanisms and quality assurance of road projects.

4.1.1 Factor Analysis

The findings under this study elucidate the efficacy and impact of quality control mechanisms in ensuring the high standards and reliability of road construction projects. The data were analyzed using factor analysis to simplify the complexity of high-dimensional data while retaining trends and patterns. Factor analysis achieves this by

transforming the original variables into a new set of uncorrelated variables, called principal components, which are linear combinations of the original variables. Under this objective, four latent variables known as project valuation, advisory services, supervising, and project inspections with 10 to 12 sub-indicators were all extracted to determine the sub-variable with a high loading value (Table 2-5).

4.1.2 Project Evaluation

The Rotation was performed to extract variables with high variance. In this context, rotations were calculated based on raw data and rescaled data for different extraction methods, such as Extraction 1 and Extraction 2. Variables with a high score above 0.6 are typically retained for further analysis, while those with low communalities are discarded. The findings from Table 3, indicate the results of Principal Component Analysis (PCA) for project evaluation, whereas variables with loading values above 0.6 were retained for further analysis while below 0.6 were rejected (Kothari & Garg, 2013).

Table 2
Project Evaluation

Statement	Rescaled		
	Extraction 1	Extraction 2	Status
Quality assurance procedures are applied to describe monitoring evaluations of survey implementation in actual settings	.443	.583	Not retained
Evaluation of the quality assurance process is visible throughout the project implementations	.784	.796	Retained
Quality control evaluations of road construction are conducted	.766	.842	Retained
Defective work is reworked or improved prior to approval by the consultants	.716	.777	Retained
Contractor quality system the consultants always undertake evaluation/audit	.244	.372	Not Retained
Performance analysis is implemented in our road projects	.800	.817	Retained
Conformance verification is implemented in our road projects	.828	.889	Retained
Running cost evaluation	.464	.658	Retained
Finance control and monitoring are implemented in our road projects	.615	.760	Retained
Program and planning are implemented in our road projects	.504	.721	Retained
Budgetary analysis is implemented in our road projects	.588	.746	Retained
Site evaluation is implemented in our road projects	.554	.784	Retained

The PCA outcomes, as indicated in Table 2, picked those variables whose loading is above 0.6 and retained them for analysis. The rest below 0.6 were discarded because they are less contributing to the overall variance of the project appraisal.

These are the retained variables: "Quality assurance process evaluation," "Quality control evaluations," "Defective work rework," "Performance analysis," "Conformance verification," among others, which have good relevance and direct influence on the project evaluation framework. These are the variables which will ensure that the quality assurance, monitoring, and financial control mechanisms in the project are appropriately implemented and measurable.

On the other hand, the lower-loading variables such as "Quality assurance procedures applied," "Contractor quality system," and others were considered to be of less importance for further analysis. This would imply that these factors are less important in determining the effectiveness or outcome of the project. In general, analysis determines the most critical variables to utilize for project evaluation so that the evaluation process is more accurate and robust.

4.1.3 Advisory Services

Variables with a high score above 0.6 are typically retained for further analysis, while those with low communalities are discarded. The findings from Table 3, indicate the results of Principal Component Analysis (PCA) for project evaluation, whereas variables with loading value above 0.6 were retained for further analysis while below 0.6 were rejected.

Table 3
Advisory Services

Statement	Rescaled		
	Extraction 1	Extraction 2	Status
Consultants advise on quality assurance processes for road construction	.536	.943	Retained
Consultants provide insight on the design of road construction to ensure formally reviewed	.782	.807	Retained
Consultants advise the contractors to have technology advancement to improve quality	.917	.902	Retained
Consultants advise provide recommendations to involve all stakeholders to receive the project document during the planning phase	.372	.908	Retained
Consultants recommended on project scope to be designed to adopt technology relating to road construction	.683	.620	Retained
Consultants advise on Payments or processing time for tax exemption are correctly completed according to the initial agreement	.850	.924	Retained
Consultants advise on the implementation of Quality assurance processes as part of the project vision	.774	.813	Retained
Consultants advise contractors to create quality awareness among employees	.833	.905	Retained
Contractor quality system surveillance	.439	.930	Retained

The findings of Table 3, advisory services proved the main advisory services of consultants, which were identified using Principal Component Analysis. From the analysis, the variables with a loading score of greater than 0.6 have been retained, indicating that their contribution is outstanding to the quality assurance and improvement activity of the project.

Among the most important advisory services are technology advancement suggestions towards quality improvement, advisory services concerning quality assurance processes according to the project vision, and the inclusion of stakeholders in the planning process. All these constant variables point to the critical role played by consultants as far as advising on all aspects of the project, ranging from design and incorporation of technology to implementation of quality assurance procedures.

In addition, the consultants' recommendations on payment and processing for tax exemption, quality awareness of contractor employees, and oversight of the contractor's quality system all emerged as prominent factors in maintaining that the project was up to standards of quality and compliance. Overall, PCA analysis underscores the key importance of consultant advisory services in shaping the project's quality management processes, by placing emphasis on technology, stakeholders' involvement, and sound quality assurance procedures as the core ingredients of success.

4.1.4 Supervision

Table 4, PCA results on project supervision variables, a cut-off value of loading more than 0.6 was selected for analysis and less than 0.6 was omitted. By doing so, only the most influential factors, i.e., those that significantly contribute to the evaluation process, will be retained in further analysis.

By determining high-loading variables, the research condenses the key factors that are driving project outcomes and hence provides a clearer concept of what the most significant areas for overseeing project success are. This helps in confining the supervising process in a bid to allocate resources and attention to only the variables with the greatest possibility of affecting project performance and efficiency.

Table 4
Supervision

Statement	Rescaled		
	Extraction 2	Extraction 2	Status
The workforce has been given the schedules for projects	.671	.817	Retained
The quality of the road is defined, established, and controlled at both strategic and process/operational levels	.514	.922	Retained
Consultants ensure Planning, leading, and control are facilitated effectively to ensure successful implementation of tasks	.448	.832	Retained
Consultants ensure the planning and control project progress to attain quality assurance	.514	.922	Retained
Consultants ensure all stakeholders receive the project document during the planning phase	.753	.753	Retained
Consultants ensure every stakeholder becomes involved during the planning process	.846	.874	Retained
Consultants ensure there is a work breakdown detail to minimize delays	.881	.935	Retained
Consultants ensure their formal system of record-keeping is used for projects	.760	.861	Retained
Consultants ensure the organizational structure is aligned with quality assurance processes	.764	.857	Retained
Consultants ensure Quality assurance review	.626	.972	Retained
Consultants monitor Contract documentation	.626	.972	Retained

The findings in Table 4, presenting the output of Principal Component Analysis (PCA) for road project supervisory factors, reveal the influential variables for successful management of projects. Kept for analysis are variables with loading scores above 0.6, reflecting strong correlation with, and significance in, project supervision and quality assurance.

These retained elements underscore the importance of well-established project schedules, effective planning and control, stakeholders' involvement, and adequate documentation in ensuring successful delivery of road construction projects. The consultants' role in tracking work quality, monitoring progress, and ensuring conformity to quality assurance processes is also underscored, identifying their primary role in maintaining project standards and averting delays. With a focus on these crucial factors, the analysis identifies best practices that fall within the realm of making road construction projects effective and successful.

4.1.5 Inspection

The findings from Table 5, indicate the results of Principal Component Analysis (PCA) for project evaluation, whereas variables with loading value above 0.6 were retained for further analysis while below 0.6 were rejected.

Table 5
Inspection

Statement	Rescaled		
	Extraction	Extraction	Status
Consultants inspect the project to ensure conformance to the TOR	.914	.935	Retained
Quality of equipment and raw materials in project tested by consultants before used	.809	.913	Retained
Quality assessment system meeting is assessed several by consultants	.690	.917	Retained
The quality of the road is defined, established and controlled at both strategic a process/operational levels	.897	.871	Retained
Design management	.989	.953	Retained
consultants test and observe the road defective before approval	1.101	.987	Retained
Performance testing	1.502	.941	Retained
All equipment's are tested in front of the consultants before used	.944	.950	Retained
Operation & maintenance testing	.635	.889	Retained

The findings in Table 5, present the results of Principal Component Analysis (PCA) on the inspection phase of road projects. As all variables with a loading value above 0.6 were retained for further analysis, their importance in the general project inspection process is hence realized. High loading values indicate strong correlations with those variables and quality control measures, which are very vital to successful project completion.

Key practices, such as consulting the project, have been well set to be an integral part in ensuring that it meets the required standards with regards to TOR, quality of materials, equipment, and conducting performance testing. Regular assessment of road quality and the testing of materials before their application in the works ensure defects are recognized and rectified at an early stage. These retained variables indicate the holistic role of a consultant in keeping a strict oversight on the importance of continuing testing and quality assessment through the project life cycle. All these factors contribute to ensuring that the constructed road will be durable and safe. In this regard, it cannot be overemphasized the very important role that stringent inspection plays in upholding project quality.

4.2 Multiple Regression Analysis

Regression analysis was performed to assess the impact of quality control mechanisms on road construction quality assurance. This statistical method was chosen because it allows for the examination of the relationship between multiple independent variables, such as inspection, supervision, advising, and evaluation (quality control mechanisms), and a dependent variable, in this case, quality assurance (Table 6).

Table 6
Regression Coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.895	2.524		1.543	.126
	Evaluation	-1.680	.720	-2.423	-2.334	.022
	Supervision	1.375	.231	1.784	5.956	.000
	Advising	1.151	.509	1.582	2.261	.026
	Inspection	.011	.175	.014	.064	.949

a. Dependent Variable: Quality of constructed roads projects

Table 6 depicts the list of variables for a model examining the impact of quality control mechanisms on road construction project quality assurance. Notably, evaluation has a negative correlation (-1.680, $p = .022$), suggesting a lower evaluation rating would contribute to the decline in road project quality. Conversely, supervision posits a positive relationship (1.375, $p < .001$), indicating that high levels of supervision relate to high project quality. Similarly, advising also indicates a positive relationship (1.151, $p = .026$), indicating that effective advising contributes to good project results. Inspection does not prove to be a significant predictor ($p = .949$). The constant is 3.895 ($p = .126$). Employing the method, the regression is;

$$\text{Quality assurance} = 3.895 - 2.423\text{Evaluation} + 1.784\text{Supervision} + 1.582\text{Advsing} + 0.014\text{Inspection} + 2.524$$

In general, the results of regression analysis imply that the effectiveness of the quality control processes is an important consideration in ensuring the quality of road construction projects. As evident in Table 6, the negative coefficient for evaluation implies that decreasing the quality of evaluation is associated with the decline of the general quality of the project, necessitating stringent evaluation processes.

Supervision and advising, by contrast, are positively associated with project quality, emphasizing that good supervision and sound advising are key factors to have in place to facilitate successful project results. That Inspection did not emerge as a significant predictor suggests that inspection alone, in this context, is perhaps not the secret to assuring road project quality, and may point to the need for more comprehensive or integrated measures. The intercept shows a background level of project quality, though not statistically significant, which suggests the possibility of other unmeasured effects on project outcomes. Cumulatively, these results point to the supervening role played by supervision and advising in securing heightened levels of quality in road construction projects.

4.3 Discussion

Quality control procedures followed by consultants in construction projects nowadays are inevitable and are given priority over all construction projects. As evident from the evidence in section 4.1 above, it is apparent that this study emphasizes the importance of careful evaluation, monitoring, and advising in ensuring the quality of road construction projects. With the insight into the fine distinction between quality control and quality assurance mechanisms, the stakeholders can take conscious efforts towards improving project outcomes and overall quality of infrastructure. The findings reflect that there are some positives such as supervision, advisory, and inspection of the quality control mechanisms being implemented by the consultant; there are certain areas where improvement can be made to render the overall process more efficient.

The revelations made herein align with the work of Siayor (2019), that the construction industry has been having challenges with the institution of quality control measures, the cost could fairly be minimized if the industry could hold on to the concept of quality assurance with achievement. However, there have been some case studies and

efforts by Kumar et al. (2018), Kimzanye (2021), and Nyakala et al. (2019) that have been able to bring quality assurance on a small scale to the construction industry. However, together, companies have largely neglected it. The construction industry is unique; therefore, the implementation of quality assurance in the industry needs to be done. The application of quality control tools such as assessment, supervision, advisory and inspection to the construction industry requires that a tailored solution is sought that addresses the unique challenges of this industry, including the heterogeneity of projects, site conditions, and stakeholder dynamics.

In contrast to manufacturing, where processes can be standardized and controlled, construction projects often involve heterogeneous teams, changing environmental conditions, and complex logistic demands, which impede the stable application of quality assurance (Kumar et al., 2018). Despite these challenges, the use of formal quality assurance systems such as ISO 9001 or Total Quality Management (TQM) can significantly enhance project outcomes by consistency, reduction of errors, and creating a culture of continuous improvement (Brooks et al., 2021). In addition, the application of technology-enabled solutions such as Building Information Modelling (BIM) and real-time monitoring systems can enable the simplification of quality assurance processes, which can support well-informed decision-making and increased accountability across the lifecycle of construction projects.

The findings conform to agency theory principles; along these lines, quality control procedures implemented by consultants can be understood as mechanisms in response to mitigating agency problems, such as moral hazard and adverse selection (Fama & Jensen, 1983). The high similarity of mechanisms of quality control (advising, supervision, assessment) with project quality assurance, as suggested by the regression analysis, demonstrates the mechanisms to be playing a vital role in ensuring that the consultants' (agents') interests are aligned with their clients' (principals') interests.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

In general, the study concludes that evaluation, advisory services, supervising, and inspection are significant variables in project assessment. Results indicate that evaluation, advisory services, supervision, and inspections significantly affect the quality assurance of road projects. The high correlation between these quality control instruments and the quality of road project construction, i.e., evaluation, supervision, and advising significantly affect project quality, while inspection is not a significant predictor. Additionally, visual inspections recognize infrastructure issues such as exposed water pipes, water pooling, road curvature, and improper drainage, highlighting the importance of efficient quality control procedures in addressing such issues in an attempt to support road safety and integrity.

5.2 Recommendations

In fact, based on the findings, quality control activities such as supervision, advisory, and inspection by consultants have a positive impact on quality assurance in road works under DMDP, it was thus recommended that, consultants should give priority to effective quality control activities such as supervision practices; ensuring construction work is in accordance with specifications, safety regulations, and quality standards. Full-time supervision, like regular site visits, progress checking, and coordination with stakeholders, are main components of appropriate quality assurance of the DMDP's construction work.

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