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# PROJECT DESIGN AND PERFORMANCE OF URBAN ROAD PROJECTS IN KENYA

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## ABSTRACT

**Background:** The construction industry is inherently complex as it involves multiple countries such as customers, contractors, consultants, stakeholders, shareholders and regulators. Urban road projects show poor performance in terms of late completion, high costs and low quality. This paper sought to determine the relationship between project design and the performance of urban road projects in Kenya.

**Methodology:** The study adopted descriptive survey research, while target population was 408 construction registered professionals within Kenya urban roads authority projects. A sample size of 202 was used. Primary data was be collected through the administration of questionnaires.

**Results:** The results revealed that project design had a positive and significant influence on the performance of urban road projects in Kenya.

**Conclusions and Recommendations:** The study concluded that project design significantly contributes towards enhanced performance of urban road projects in Kenya. The study recommended that construction firms management need to strengthen their project design. In particular, the management should focus on enhancing the following project design aspects: model development, model optimization, model visualization and technology integration.

**Keywords:** *Project Design, Performance, Urban Road Projects*

## INTRODUCTION

Road projects are key to economic growth. It helps to reduce and eradicate poverty in nations through the enhancement of competition, facilitates trade and integration of international community. The issue of lack of sustainability of road projects in Kenya should be addressed through outlining the project planning management techniques of Project Cost Management, Project quality management, project Timeline Management, Project Deliverables Management, and project evaluation management that ensure long-term sustainability of road construction projects in Kenya and would reduce accidents drastically as required on effective project planning management that augments sustainability as explained by (Winston, 2013).

Brown and Adams (2011) observed that most road projects locally are not completed within the initial set targets of time due to a number of factors that negatively impact the performance of these road projects for example availability of capital, management skills, organizational culture and technical skills among other factors. Road projects are complex in nature since they involve many parties. These include the Government which is a regular customer, road contractors, stakeholders, shareholders and regulators.

Project design involves the flow of information and generates value for clients by fulfilling their requirements. Meeting these requirements requires effective front-end planning because of its large impact on project performance (Hamilton & Gibson, 2016). Design development is a major sub-process of front-end planning. Williamson and Johnson (2014) suggested that design failure can be due to unprecedented technical causes or known causes overlooked in the design process. A design development process starts with a brief from the project owners. Othman et al. (2015) advocate the need for better brief development for clients' satisfaction and project success. Yu et al. (2010) observes that lack of comprehensive brief from the clients creates conflicts and disputes during project implementation.

In Europe, the road construction project mainly relies on financially focused performance at the project level which leads to creation of philosophies; for example, concurrent construction and lean production. Other non-financial indicators considered include: Just in Time (JIT), Total Quality Management (TQM), and Total Productive Maintenance (TPM) (Yu, Kim, Jung, & Chin, 2007). Ghalayini and Noble (2011) argues that financial metrics are historical in nature and do not reflect the current status of performance of a project. Scholars such as Kagioglou et al. (2011) contend that financial measures do not have a strategic focus and are unable to provide quality data; they lack responsiveness and flexibility. Kagioglou et al. (2001) note that project performance is a way of accomplishing cost and time objectives while adhering to the product specifications.

In developing countries, road infrastructure projects are often not financed adequately. Governments are increasingly seeking financial and technical support from the private sector to aid construction and maintenance of road infrastructure (Matindi, 2010). Evidence from KPMG report (2014) indicated that about 68 percent of the road projects in Africa constructed by local firms experienced cost and time overruns. In addition, most of the roads did not meet the expected quality standards and were full of pot holes in less than five years. A number of them were contracted to other firms to construct them again (Elias & Kagwathi, 2012). It was also noted by Harrison (2014) that financial constraints and lack of modern construction equipment to a great extent compromised the quality of infrastructure projects.

KPMG report (2014) noted that the quality of Kenyan road construction projects generally needed to be addressed. It indicated that local construction firms faced more challenges than foreign firms in delivering quality roads. Furthermore, weaknesses in supervising construction contracts and rampant corruption compromised the quality of the projects constructed. With the establishment of the Kenya Roads Board, it was hoped that the quality of road projects by local construction firms would improve and match the standards of those constructed by most foreign construction firms (Gitenya & Ngugi, 2014).

Kenya's road sub-sector accounts for over 80 percent of the country's total traffic and 76 percent of the freight leaving a small portion to water, rail and air transport (Nachu, 2011). This sector played a very significant role in the "Economic Recovery Strategy for Wealth and Employment Creation 2003-2007". Simulations suggest that if Kenya's road infrastructure could be improved to the level of African leader; Mauritius, annual per capital growth rates would be 3.3 percent higher than they are at present (Anderson & Glen, 2013).

## STATEMENT OF THE PROBLEM

A government report by the Department of Roads and Public Works (PC, 2016) identified eight main reasons for the failure of government projects: poor planning; inadequate management support; failure to engage effectively with key stakeholders; lack of technical skills; poor project monitoring and review; inadequate initial project appraisal; poor networking skills; and the failure to integrate the diverse countries necessary for project success. Approximately 14.4% of classified roads (9,100 km) and 2.2% (2,500 km) of unclassified roads have a paved road network, while the rest are gravel or crushed stone. It is estimated that about 18% of the road network is classified as in good condition, 27% in good condition, 49% in poor condition and 6% in very poor condition. Currently, most of the repairs and reconstruction are underway, with around 55% of roads still in poor condition (Mailu, 2015).

Kenya has a very large traffic growth of 8.2% per year, population growth of 4.1% per year and economic growth of 6% per year; this cannot be compared to the construction of a road network, which causes congestion and persistent conflicts between different modes of transport, costing the economy about 0.9% of GDP per year (World Bank, 2013). According to a study by the World Bank (2013) in Kenya, counties have implemented successful projects over a period of about 3 years, with counties such as Machakos, Meru and Kericho reporting an annual positive project implementation rate of up to 12%, but some of the 47 counties failing due to poor practice. Prevailing Project planning along with other factors like wrong priority of development projects, lack of financial resources, political interference, corruption, low level of technology, poor infrastructure, lack of community involvement, poor management support and many more.

Idoko (2018) observed that many road projects in Kenya face significant time and cost overruns, fail to realize the expected benefits or are even completely suspended and abandoned before or after completion. The World Bank (2010) points to project planning as the most important influence in achieving project success, which equates to achieving project objectives. Cooke-Davies, (2010) consistently show that well-trained teams provide more project management benefits than less-trained teams, as they reduce project risk by carefully selecting the most appropriate technology, employing the most accessible consultants and experienced, and uses sophisticated methodologies. Planning practices to ensure functional success. Therefore, this study

sought to determine the relationship between project design and performance of Kenya urban roads authority projects to address the knowledge gaps left by previous scholars.

## THEORETICAL FRAMEWORK

The concepts of the systems theory originate from the general thinking of Bertalanffy (1969) with regard to system functionality. One of the most important concepts in systems theory according to this proponent is the notion of interdependence between systems or sub-systems. It is argued that systems rarely exist in isolation (Stichweh, 2000). According to Stichweh (2000) social systems are in a relationship with either the external non-social environments or the internal environment of other social systems (psychic, biological, cultural environments). They also differ in terms of reference to time: either they are oriented towards future realizations or to present satisfactions.

According to Parsons (1977) there are four chances for systems formation: first, there are systems which are adaptive (combining external reference and future orientation, for instance the economy), secondly systems which are goal-attainment specialize (internal orientation), thirdly systems focused on system elements integration (internal orientation, present time, e.g. the society conceived as a community), fourthly systems which are responsible for long-term patterns maintenance (external reference, present time, e.g. cultural institutions in society).

The use of this theory could be applicable in describing groups, families, or welfare service unit/organizations. The theory has further been interrogated by Friedman and Allen (2011) and most recently applied in the works of Segev, Levinger and Hochman (2018); Cárdenas-Robledo, and Peña-Ayala (2019), and Struthers and Strachan (2019). In its application, it mostly focused at understanding dynamics of relationships in families; establishing a self-regulated learning model and examining gender roles in business.

Since the main principle of systems theory is that individuals/objects are influenced by systems in their immediate social setting for adequate life, success of any health sector projects depends on such systems. Policy makers however can fail to attain their anticipated goals of better health outcomes due to problematic interactions and poor implementation of proposed projects. This theory underpins the project design with regard to implementation of the projects.

## EMPIRICAL REVIEW

A study by Milner, Salazar, Bhopal, Brentani, Britto, Dua and Kirkwood (2019) explored the contextual choices of design and partnerships for modelling early projects development of children in Bangladesh. This was a desktop review of the literature and mixed-method participatory of projects evaluation. About 39 projects were evaluated where 63% were achieved through health and 84% focused on Early Learning (RCEL) and Responsive Caregiving. Multilevel leadership, partnerships and targeted analysis that is situational were critical to adaptation and design.

In Canada, Simmavong, Hillier and Petrella (2019) undertook an evaluation process for assessment of Health-Steps feasibility implementation in community-based and primary care settings across the country. Obstacles were related to the challenges of administration such as booking personnel changeovers, space, and participants scheduling. Results out of this analysis brought out insights on delivery of the project, design, and site champions significance. The main lessons learned focused on two areas: project implementation and infrastructure support.

According to the study by Bernard (2012) devolution of healthcare system in Ghana faced performance challenges. It was established that there was no overarching strategy. Many stakeholders had minimal understanding of the plans of the government and process goals in terms of decentralization, deconcentrating (central organization transfers some of its responsibilities to lower-level units within its jurisdiction) and responsibilities' devolution to sub-national levels.

A study by Kiberu, Mars, and Scott (2017) employed a structured literature review of e-Health in Uganda and complemented with manual searching and a review of the document of grey literature in the form of policy reports and documents obtained online or from the Ministry of Health's Resource Centre, identified a total of 293 resources of which 48 articles described e-Health implementation in Uganda. From their findings, most were funded by donors, operated in silos and lacked sustainability. Evidence showed that implementations of e-Health in Uganda didn't have prior stages of planning that the literature notes as important, for example need readiness and strategy assessment. Regardless of the strategy presence to guide implementation, or need that is based on evidence, if the setting is not 'ready' to use these new ways, they will not succeed (Khoja, Scott, & Gilani, 2008). This implies that assessment of readiness in relation to infrastructure that is physical, user and skills of managers, equipment of technology, guidelines, policies and regulations should be undertaken just before implementation of any project.

## RESEARCH METHODOLOGY

The study adopted descriptive survey research while its target population was 408 construction registered professionals within Kenya urban roads authority projects. A sample size of 202 was used. Data collection procedures was started by obtaining permission from relevant authorities. Primary data was collected through the administration of questionnaires to the relevant construction professionals in the Kenya urban roads authority. In this study, qualitative data was analyzed using content analysis and quantitative data was analyzed using descriptive and inferential statistics.

## RESULTS AND DISCUSSION

This section provides descriptive and regression analysis results.

### Descriptive statistics on Project design

The respondents indicated their level of agreement with statements regarding project design. From the findings in Table 1, the respondents agreed that using project design gives a more accurate and realistic design and that using project planning for design highlights construction and operational risks that would not be noticed using the traditional design method as indicated by means of 4.1 and 3.9 respectively. Respondents further agreed that projects designed in project planning have better visualization which helps to better capture client requirements; that project planning makes it easy to sample different design options and identify the pros and cons for each and settling on the most suitable option; that using project design helps to resolve most of the risks in the early stages of the project and that. Projects designed using project planning software have fewer design errors as shown by means of 3.9 and 4.1 respectively.

**Table 1: Statements on project design**

| Statements on project design | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agreed | Mean |
|---|---|---|---|---|---|---|
| Using project design gives a more accurate and realistic design | 1% | 6% | 15% | 41% | 37% | 4.1 |
| Using project planning for design highlights construction and operational risks that would not be noticed using the traditional design method | 2% | 5% | 23% | 35% | 35% | 3.9 |
| Projects designed in project planning have better visualization which helps to better capture client requirements | 1% | 7% | 21% | 42% | 29% | 3.9 |
| Project planning makes it easy to sample different design options and identify the pros and cons for each and settling on the most suitable option | 1% | 1% | 23% | 37% | 38% | 4.1 |
| Using project design helps to resolve most of the risks in the early stages of the project | 1% | 7% | 21% | 42% | 29% | 3.9 |
| Projects designed using project planning software have fewer design errors | 0% | 12% | 17% | 43% | 28% | 3.9 |

The study sought to find out whether organization embraced project design on the performance of urban road construction projects. From the findings in Figure 1,61% of the respondents indicated that they embraced project design on the performance of urban road construction projects while 39% indicated that they didn't embrace project design.

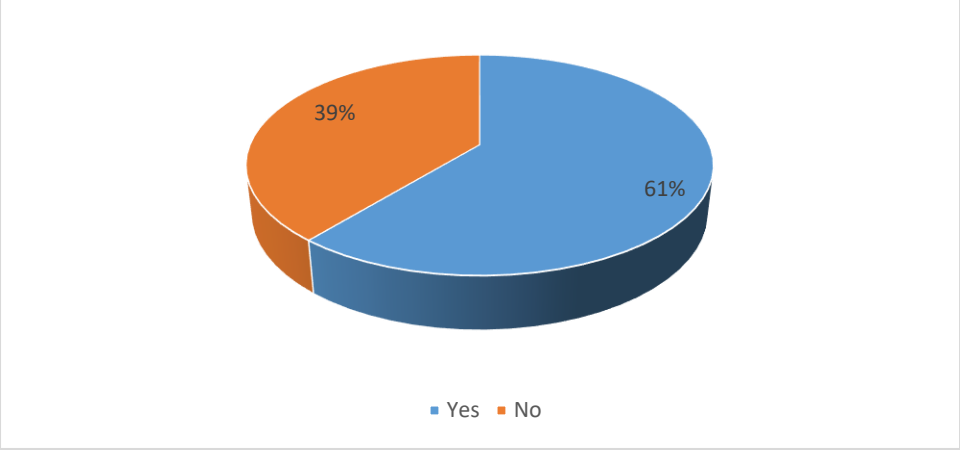


**Figure 1: Embracing the application of project design on the performance of urban road construction projects**

### Descriptive statistics on Performance of Urban Road Projects

The study sought to find out the level of agreement with statements Performance of Urban Road Projects in Kenya. From the findings in Table 2, the respondents agreed that the breakdown of many of the urban road projects is due to the breakdown in the industry; that performance is

associated with several factors such as time, cost, quality, client satisfaction, productivity and safety; that Other grounds affecting projects performance are poor management and guidance; inapt participants; poor relations and coordination, and that lack of motivation, insufficient infrastructure, political problems, cultural problems and economic conditions as indicated by 3.7,4.0,4.5,4.0,4.3 and 4.6 respectively.

**Table 2: Statements on performance of Urban Road Projects**

| Statements on performance of road projects | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agreed | Mean |
|---|---|---|---|---|---|---|
| The breakdown of many of the urban road projects is due to the breakdown in the industry. | 2.4% | 5.5% | 31.7% | 36.6% | 23.8% | 3.7 |
| Performance is associated with several factors such as time, cost, quality, client satisfaction, productivity and safety. | 0.6% | 3.0% | 21.3% | 35.5% | 39.6% | 4.0 |
| Other grounds affecting projects performance are poor. | 1.8% | 1.2% | 7.9% | 41.5% | 47.6% | 4.5 |
| management and guidance; inapt participants; poor relations and | 1.8% | 14.6% | 14.0% | 34.8% | 34.8% | 4.0 |
| coordination; lack of motivation, insufficient infrastructure, | 0.6% | 1.8% | 9.8% | 48.2% | 39.6% | 4.3 |
| political problems, cultural Problems and economic conditions | 3.7% | 2.4% | 15.2% | 32.9% | 45.8% | 4.6 |

**Relationship between project design and performance of urban road projects**

The study sought to assess the relationship between project design and the performance of urban road projects in Kenya. A simple linear regression was performed to examine the link between the two variables. Table 3 presents R and R square values for coefficient of correlation and extent of variation respectively. The R value of 0.758 indicates a strong positive correlation between project design and the performance of urban road projects. The R-square value of 0.575 indicates that 57.5% of changes in performance of urban road projects is contributed by project design. The remaining 42.5% of the performance of urban road projects variation can be explained by other factors not captured in this model.

**Table 3: Model summary; Project design and performance**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .758a | 0.575 | 0.573 | 4.4162 |

a Predictors: (Constant), Project design

Table 4 indicates the ANOVA model results. The F statistic value was 252.991 and p value of 0.000 less than 0.05. This implied that the regression model predicts significantly the dependent variable (performance of road projects). This suggested that project design was a significant predictor of performance of road projects.

**Table 4: ANOVA; Project design and performance**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 4934.13 | 1 | 4934.13 | 252.991 | .000b |
| | Residual | 3647.09 | 187 | 19.503 | | |
| | Total | 8581.22 | 188 | | | |

a Dependent Variable: Project performance

b Predictors: (Constant), Project design

As indicated in Table 4, the statistical coefficients of project design and performance of road project showed that the value of unstandardized coefficient (B) was 2.41 (p value <0.05), which implied that project design significantly and positively predicts performance of road projects

The linear regression model equation is presented as follows;

Y= 2.838 +2.41X1

Where;

Y = Performance of road projects

X1 = Project design

From above equation, the model predicts that when project design is zero, the performance of road projects is 2.838. It also predicts that for a one unit increase in project design, performance of road projects increases by 2.41 units holding the other predictors fixed.

The study findings corroborated those of Simmavong, Hillier and Petrella (2019) who observed that project design was important in project delivery. Similarly, the findings agreed with Kiberu, Mars, and Scott (2017) conclusion that project design enhances project performance.

**Table 5: Regression coefficients; Project design and performance**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 2.838 | 0.975 | | 2.91 | 0.004 |
| | Project design | 2.41 | 0.151 | 0.758 | 15.906 | 0.000 |

a Dependent Variable: Performance

## CONCLUSION

The study concludes that using project design gives a more accurate and realistic design and that using project planning for design highlights construction and operational risks that would not be noticed using the traditional design method. The study also concludes that projects designed in project planning have better visualization which helps to better capture client requirements and that project planning makes it easy to sample different design options and identify the pros and cons for each and settling on the most suitable option. In particular, the study concludes that project design positively and significantly contributes to enhanced performance of urban road projects in Kenya.

**RECOMMENDATIONS**

From the findings, project design had a positive and significant influence on the performance of urban road projects in Kenya. The study recommended that construction firms management need to strengthen their project design. In particular, the management should focus on enhancing the following project design aspects: model development, model optimization, model visualization and technology integration.

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