

EFFECT OF ROAD ASSETS MANAGEMENT ON PERFORMANCE OF ROAD AGENCIES IN KENYA

Mutai Henry Kipkurui,¹ Dr. Johnmark Obura,²

¹Management Science Department, Maseno University, Kenya

²Business Administration Department, Maseno University, Kenya

ABSTRACT: *The study sought to analyse the effect of road asset management (RAM) on performance of road agencies in Kenya. The study was guided by stakeholder theory and it posited a conceptual framework in which road assets management was the independent variable, road agency performance the dependent variable. A correlation survey design was employed to find out the relationships between the study variables. A purposive sampling technique was used to select the respondents for the study and data was collected using structured questionnaire. Results showed that RAM was a positive and significant predictor of road agency performance in Kenya and it accounted for 81.7% of variance in performance of the road agencies in Kenya. The study concluded that RAM contribute significantly to road agency performance and recommends that RAM should be integrated in the policies of road agencies in Kenya in order to realize better condition of roads in Kenya in the long run.*

KEYWORDS: Road assets, management, Road Agency, Performance

INTRODUCTION

Efficient and effective road transport is central to the economic growth and development of all African countries, this mode accounting for about eighty to ninety percent of the continent's total trade in goods and services. For this reason, countries need adequate road infrastructure management policies, strategies and institutions to manage this crucial asset in an optimal manner. This includes systematic means of measuring the performance of the road agencies as a basis for determining those factors that aid or impede the attainment of their desired results (Pinard, 2015).

According to Organization for Economic Co-operation and Development (OECD, 2001), road network constitutes one of the largest community assets and is predominately government owned. Road agencies must maintain, operate, improve, replace and preserve this asset while, at the same time, carefully managing the scarce financial and human resources needed to achieve these objectives. All of these are accomplished under the scrutiny of the public who pay for and are regular users of the road network, and who increasingly demand improved levels of service in terms of safety, reliability, environmental impact and comfort. Governments are therefore placing greater pressures on road administrations to improve the efficiency of, and accountability for, the management of the road network (OECD, 2001)

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Road asset management as applied to the roads sector represents a systematic process of maintaining, upgrading and operating assets, combining engineering principles with sound business practice and economic rationale, and providing tools to facilitate a more organized and flexible approach to making the decisions necessary to achieve the public's expectations (OECD,2001). Road asset management is about managing road agency resources more like a business. A key part of this is the need for road agency managers to develop a common language with budget holders, therefore giving them the critical ability to demonstrate the implications of investment options. This business-like approach of road asset management requires estimation of the value of infrastructure assets, as this value is a significant factor in determining priorities for future investment in road assets (New York State Department of Transportation, 1998). The valuation process, with its emphasis on economics or finance, represents a shift in thinking from the traditional engineering approach to transport program development. Road asset values can be expressed in a variety of ways. For example, each road asset could have an intrinsic economic value to the transport network as a whole; that is, the value of the efficient movement of people and goods. Alternatively, again for example, each road asset could have a capital value either calculated from the cost of repairing the asset to an "as built" condition or the cost of replacing the asset in kind. The expression of road asset value in such accounting terms is a key element in developing the common language between engineers, financial managers and road boards (OECD,2001).

According to Transport Association of Canada (TAC, 1999), one of the key aspects of road asset management is integration. Road asset management system (RAMS) provides an integrated approach to all administration costs, be they road user, works administration, environment or social costs, and the use of existing administration data sources. It integrates existing management systems for individual assets including pavement management system, bridge management system, traffic management system and safety management system. This merger provides road agency with consistent system-wide data, enabling the allocation of available funds across competing pavement, structure and other infrastructure needs. OECD (2001) in their report also asserted that community consultation is an important aspect of road asset management as it provides an understanding of stakeholder requirements and public expectations. This is therefore essential if road agencies are to develop the right policies for road use and sustainable development.

Another important aspect of the use of road asset management systems is the need to monitor the performance of the road asset against defined required outcomes or targets of performance (OECD, 1997). One approach for this is the use of performance indicators to measure progress towards achieving the road agency objectives. Other simpler approaches include the straight forward recording of condition of the road asset with time. Some of the different ways that performance can be represented are percentile of level of condition, effects on users, levels of safety, effects on the environment and economic aspects of the road network. Each of these represents different

measures of performance of the road asset and may be defined by more than one factor (OECD, 2001).

Even though the traditional approach to road management and maintenance has been practiced in Kenya for a couple of decades, the general paved road and earth road condition has fallen short of the expectation of the road users as a majority of Kenyan highways have potholes which often lead to fatal road accidents every year. This is attributed to the failure by the road agencies in Kenya to perform their core mandate of managing and maintaining road assets. Similarly, studies have also fell short of linking the road agency performance to the deplorable state of major highways as blames are shifted to the government who avails fuel levy funds to the road agencies for the maintenance of roads. The current study therefore aimed to establish the effect of road assets management on the performance of road agencies in Kenya.

LITERATURE REVIEW

Stakeholder Theory in Road Asset Management

This theory was advanced by Freeman (1999). He postulated that a road infrastructure project consists of many complex activities which the project teams have to manage. Stakeholder theory is a theory of organizational management and ethics (Phillips, Freeman, & Wicks, 2003). It opposes the free market norm of shareholder capitalization and promotes stakeholder maximization. One of the activities consists of managing the project stakeholders who have a certain interest and power in the project in which they are involved (Hartmann *et al.*, 2012). Effectively managing and controlling these stakeholders and their expectation has become intrinsic to project success (Parnell, Driscoll, & Henderson, 2011). The tool in doing so is also considered to be extremely important for achieving project success. Stakeholder is a concept that refers to the necessity for an organization to manage the relationships with its specific stakeholder groups in an action-oriented way. (Freeman, 1999).

Attention to stakeholders is important throughout the planning process of road maintenance projects because the project success is defined by the stakeholders depending on their evaluation of the infrastructure (Bryson, 2004). However, public agencies responsible for managing infrastructure assets routinely fail to consider the relationship between the road assets and those people and organizations being influenced by the performance of those road assets.

Sutterfield, Friday-Stroud, and Shivers-Blackwell (2006) argue that in order to achieve a successful road project outcome, the road project managers must adapt to managing the interest of stakeholders throughout the project management process. A good project stakeholder management enhances the possibility of a good project result. To manage the road network, road managers and operators have to consider existing policies, such as the requirement to keep the network in good condition, and to deliver this condition at minimum whole life cost. However, the condition should also meet the expectations of stakeholders. The management process has to optimise the total costs for society, whilst minimizing the effects of given condition levels on safety, reliability, environmental impact, economics and sustainability (Edvardsson *et al.*, 2013)

The Concept of Road Asset Management

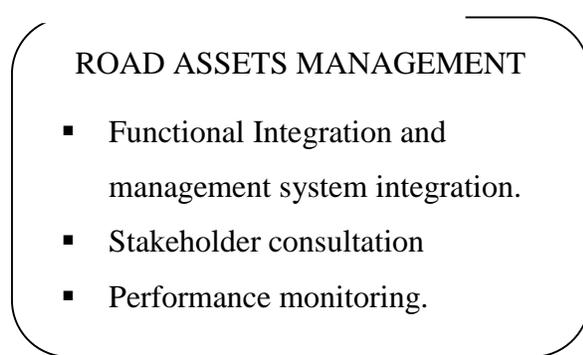
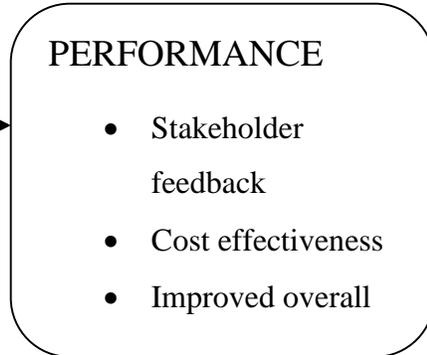
Road asset management (RAM) is a strategic and systematic process of operating, maintaining, and improving physical assets (Pavements and bridges), with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the road assets at minimum practicable costs (Wood, & Metschies, 2006).

According to the Institute of Asset Management (IAM 2008), road assets management is a systematic and coordinated activities and practices by which an organization optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for achieving its organizational strategic plan. This definition recognizes that asset management is related to delivering business goals through a combination of management, financial, economic, engineering and other related activities with the objective of providing the required level of service in the most cost-effective manner. Therefore asset management can be viewed conceptually as the central overlap of the key activities. Unlike pavement and bridge management, RAM encompasses all classes of infrastructure within an agency's jurisdiction with the objective of upgrading, preserving and maintaining infrastructure over the lifecycle, RAM systems and the process of managing infrastructure assets can guide an agency in efficiently allocating resources. One of the most important components of a RAM system is the continuous evaluation of the progress towards an agency's goals, in a feedback loop driven by performance monitoring.

Road Agency Performance

Salih *et al* (2016) states that performance indicators in roads are important to measure the output, which is made by the road agency despite how far the target has been achieved. Suslo & Hartano (2001), however emphasized that the role of performance indicators in roads could be categorized as monitoring, diagnosis, management, prognosis, effectiveness and efficiencies and comparisons which, could be used by road user.

According to Pinard (2015), performance of a road agency is a multidimensional balance between its effectiveness, relevance, efficiency and financial viability. The research on performance indicators for the road sector done by a scientific expert group in 1995 recommended that quantitative comparison between administrations is of limited usefulness unless it is accompanied by a thorough examination of the underlying reasons for any differences. The performance indicators for road assets they identified were: road user costs, travel time, road user risks, resource allocation for road infrastructure, road roughness and road user satisfaction.

Conceptual Framework**INDEPENDENT VARIABLE****DEPENDENT VARIABLE****Figure 1: Interaction between road assets management and road agency performance**

The figure depicts the interaction of the independent variable, which is road assets management and the dependent variable; road agency performance. It is expected that when a road agency manages road assets well, the overall performance of the agency would improve in terms of stakeholder satisfaction, cost, and improved overall road condition (Greenwood, 2012). OECD (2012) in their report affirmed that the main elements of road asset management are functional integration and management system integration, stakeholder consultation and Performance monitoring.

Empirical literature Review

Queiroz, & Kerali (2010) carried out a review of institutional arrangements for road asset management providing lessons for the developing world. This paper reviewed such arrangements for selected countries including China, Brazil, Slovenia, New Zealand, United Kingdom, and the Slovak Republic. These countries had adopted different approaches of road asset management in several dimensions, such as decentralization, sources of financing, management structure, and modal responsibility. The paper reviewed main factors affecting the efficiency of road agencies and described the steps taken in creating a new institution, or transforming an existing one, and assessed the efforts required to achieve such results. The main aspects of institutional reforms that contributed to increased efficiency of road and transport agencies included improved institutional structures, separation of the client and supplier functions, separation of client and supplier organizations, privatization of the supplier organizations, establishment of an executive agency or a commercialized (client) organization, user participation through oversight boards, improving management information systems, and seeking additional sources of financing.

Banyenzaki (2016) examined the use of contract management practices and performance of the road construction projects in Wakiso district-Uganda. The main aim of the study was to examine the role of monitoring intensity in enhancing performance of the road construction projects in Wakiso district and to analyze the relationship between risk management and performance of the road construction projects in Wakiso district. The findings indicated that there was a significant positive relationship between monitoring intensity, risk management, evaluation and performance of road construction projects in the study context. The study recommended that there should be

intensity of monitoring should be enhanced for construction projects to attain the expected performance standards.

Byaruhanga & Basheka (2017) conducted a study on contractor monitoring and performance of road infrastructure projects in Uganda and developed a management model. The objectives of the study were to assess the relationship between contractors monitoring and performance of national road infrastructure projects and the relationship between contractor monitoring components and performance of national road infrastructure projects in Uganda. Purposive sampling was employed in selecting the procurement professionals, engineers and simple random sampling was adopted in selecting private consultants, members of parliament and respondents from the civil society organizations. The findings revealed that weak procurement rules which lead to awarding road projects to incompetent contractors; contractor monitoring being handled by unqualified, incompetent and inexperienced professionals; lack of contractors and contract supervisors appraisal system; delay of contractors payments which affects timelines in services delivery; lack of a strong internal project monitoring and evaluation mechanism at the Uganda National Roads Agency (UNRA).

Kamau & Mohamed (2015) did a study on efficacy of monitoring and evaluation function in achieving project success in Kenya. This paper was set out to review literature on the efficacy of monitoring and evaluation in achieving project success in Kenya. The researcher used literature review approach to analyze the factors related to M&E influencing project success. All the factors identified were grouped into four main categories which included strength of M&E team, monitoring approach adopted, political influence and project lifecycle stage. The study revealed that management support is a mediating factor between M &E and the Project Success and emphasised that a good performance monitoring and evaluation without management support is likely not to succeed.

Wairimu (2016) conducted a study on factors influencing completion of road construction projects in Embakasi, Nairobi county Kenya. The study aimed to highlight factors that influence completion of road projects. The study focused on how resources, competency of staff, stakeholder participation and procurement procedures influence completion of road construction projects. The research design used was descriptive research design. The findings revealed that competency of staff positively influences completion of road construction projects since if the staff have the required skills, experience and knowledge in the area this would help them undertake the task placed on them. It also found out that stakeholder participation positively and significantly influences completion of road construction projects and that stakeholders should be encouraged to participate in road projects.

Geddes, Gongera & Solutions (2016) reviewed economic growth through effective road asset management. The main purpose of the project was to review literature and report on existing and recent road management and maintenance programs and identify 'what works' and 'what doesn't work' in the type of environment likely to be encountered in the project area. The approach to the project was intended to foster self-reliance in road agencies in the project areas and encourage greater accountability to road users and other sector stakeholders.

Sodikov & Jamshid (2015) conducted a study on road asset management systems in developing countries with specific reference to Uzbekistan. The study explored the key issues on how to manage existing assets in way that it delivers maximum benefit to public taking into account limited financial resources. Road asset management system was reviewed from perspective of four major components such as goals, budget, asset and performance. The study established that there are several issues at policy level of analysis such as set up long term goals, expansion of road network, traffic safety action plans, environmental impact analysis, economic development and other; at budget level to plan year and multiyear financing plan, budget breakdown and cost estimation; at data management level inventory and condition data collection, database management, traffic data and other; at performance modeling level to predict future condition, network level analysis and other; at programmed optimization level to perform economic, environmental and risk analysis, multi-criteria analysis and other; implementation programme to carry out construction, maintenance and operation of road assets.

Arif & Bayraktar (2012) did a theoretical framework for transportation infrastructure asset management based on review of best practices. The study provided a review of the best practices adopted by different transportation infrastructure agencies internationally and in the United States. The review showed that the front-runners in the asset management system internationally are Australia while Michigan takes the lead in US. Finally, based on the review of best practices, a theoretical framework for transportation infrastructure asset management was proposed. The framework focused on six important aspects of an asset management system i.e. asset management organization and concept, planning, contractual arrangement and mechanisms, monitoring and performance measurement, information systems and decision making.

Bal, Bryde, Fearon & Ochieng (2013) conducted a review on stakeholder engagement in the construction sector in Sweden, Australia, UK, Italy and U.S.A in the years 2004-2008. This paper reported the results of an exploratory study involving interviews with construction project practitioners that were involved in sustainability in some way. Data was collected from the practitioners in terms of the processes for engaging with stakeholders to deliver sustainability. The data suggested six steps to a stakeholder engagement process: (i) identification; (ii) relating stakeholders to different sustainability-related targets; (iii) prioritization; (iv) managing; (v) measuring performance; and (vi) putting targets into action. The results suggest that understanding the different sustainability agendas of stakeholders and measuring their performance using key performance indicators are important stages to be emphasized in any stakeholder engagement process in order to achieve sustainability-related goals.

Phiri (2015) investigated the influence of monitoring and evaluation (M&E) on project performance: A Case of African Virtual University, Kenya. In this study, monitoring and evaluation was defined by its activities including M&E planning, M&E training, baseline surveys and information systems while project performance was considered as the degree of goal achievement. The study also reviewed the evolution of M&E and examined how the discipline has evolved over time. Spearman correlation analysis showed a positive relationship of 0.6 between M&E and project performance for both projects surveyed. Particularly, it showed that on average, M&E planning and M&E training had statistically significant correlation with project

performance. The study recommended the integration of monitoring and evaluation into the organizational strategy especially construction projects.

Zanule (2015) carried out a study on road management system and road safety in Uganda. The purpose of the study was to describe the strategies and processes needed to implement a road management system that would significantly reduce the fatalities and accidents in Uganda. The study was anchored on management theory, strategic management theory and criminology theory. The action requirements that emerged from data analysis were that there is need to improve transport operations and transport services profitability, reduce traffic jams and fatalities, provide sufficient driving training and maintain road infrastructure.

Greenwood, Porter, & Henning (2012) did a study on delivering good asset management in the road sector through performance based contracting. This was a review paper that was done in Auckland, New Zealand and aimed to help the reader understand what asset management is and why it is important. The paper concluded that Performance-based contracting necessitates the identification of many of the cornerstones to asset management, such as managing risks and determining the sustainable level of service for the funds available. The paper further identified that implementing a RAM is a proven method to deliver a paradigm shift in all parties responsible for the management and preservation of the road infrastructure, including addressing construction quality issues, delivering consistent levels of service and reducing the opportunities for corruption.

SUMMARY OF LITERATURE AND GAPS

On the whole, theoretical literature reveals that road assets management which include preservation, repair, rehabilitation, and replacement should have positive effect on road agency performance in terms of actions that will achieve and sustain a desired state of good repair over the lifecycle of the road assets at minimum practicable costs (Wood, & Metschies, 2006). The studies have delved into the various elements of road assets management but have fell short of assessing their relationship with road agency performance. Status of joint practice of the elements like functional integration and management system integration; stakeholder consultation and performance monitoring among road agencies is still not clear as their joint contribution to road agency performance is not ascertained by previous studies.

Further, a majority of studies reviewed concentrated on how the elements of road assets management influence contractor or project performance (Bunyenzaki 2016, Byaruhanga 2017, Wairimu 2016; Phiri 2015) while Kamau (2017) deviated a little by focussing on factors that influence completion of road projects in Kenya. Similarly, other studies just reviewed literature on various issues on road asset management but failed to focus on the linkage with road agency performance. This includes the works of Geddes (2016); Arif & Bayractor (2012); Bal *et al* (2013). They also focused their review in the developed countries like U.S.A, UK and Italy which makes their findings difficult to generalize to developing countries like Kenya.

According to Organization for Economic Co-operation and Development (OECD, 2001), The major elements of road assets management are performance monitoring and stakeholder consultation while the transport Association of Canada (TAC, 1999) also identified

performance and management system integration as a main element of RAM. It is however clear from the review that past studies have never put the aforementioned elements as components of road assets management. There is therefore need to interrogate how the elements of RAM according to TAC (1999) and OECD (2001) can influence road agency performance in Kenya and elsewhere in the world.

METHODOLOGY

Research Design

The study adopted a correlational survey design. According to Fife-Schaw, Breakwell, & Hammond (1995), correlation design is a tool that enables measurements of two or more variables at about more or the same time and provide suitable ground for the analysis of the relationship between the variables. Correlation research design would enhance the establishment of relationships using regression techniques thereby bringing out the desired outcome of the research objectives.

Population

Study population as defined by Cooper & Schindler (2003) refers to the collection of elements about which we wish to make some inferences. The population of this study comprised of 250 employees drawn from procurement, Finance and engineering departments of Kenya National Highways Authority (KeNHA), Kenya Rural Roads Authority (KeRRA), and Kenya Urban Roads Authority (KURA) who are involved in project implementation. This included resident engineers and their assistants, procurement officers and their assistants and finance officers and their assistants in every region and the headquarters. The staff selected were expected to be best placed to articulate issues in the study as they have the conceptual view of their respective organizations (Elbanna and Child, 2007), a view supported by Hambrick and Mason (1984) who argued that that organization strategy is shaped by perceptions and opinions of its leadership.

Sampling Technique

A judgemental sampling approach was adopted for the study. It is a situation where the researcher actively selects the most productive sample to answer the research question (Marshall, 1996). This can involve developing a framework of the variables that might influence an individual's contribution and will be based on the researcher's practical knowledge of the research area, the available literature and evidence from the study itself (Marshall, 1996, Sandelowski (1995)). Since the researcher knows the study units from which to get the relevant information for the study and that the units of study were concentrated thereby favouring costs, time and other resources, this sampling technique was deemed appropriate.

Sources of Data

Both primary and secondary data was used. The researcher gathered secondary data from KeNHA, KeRRA and KURA internal records and reports. Primary data was obtained from the particular staff involved in project implementation. Primary data was collected using structured questionnaire which were administered using trained research assistants.

Data Analysis

Data analysed using multiple regression analysis after the responses were coded and the average score for each construct of all items noted.

RESULTS AND DISCUSSION

Effect of Road Assets Management on the Performance of Road Agencies in Kenya

The main objective of the research was to determine the effect of road assets management on the performance of road agencies in Kenya. The study conceptualised that performance of road agencies was a function of road assets management (RAM) practices i.e functional integration and management system integration, stakeholder consultation and performance monitoring. Consequently, a multiple regression model was hypothesised. The construct scores were estimated by obtaining the average response score of all items per case under each construct.

Table 3.1 Effect of RAM on Road agency Performance

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.				
	B	Std. Error	Beta						
(Constant)	1.472	.129		11.405	.000				
Functional and mgt system	.113	.039	.194	2.898	.005				
Stakeholder consultation	.318	.035	.639	9.125	.000				
Performance monitoring	.122	.061	.143	1.989	.049				
Model	R	R Square	Adjusted R Square	Std. Error of the Change	R Square Change	F Change	df1	df2	Sig. F Change
1	.916 ^a	.839	.834	.18375	.839	173.131	3	100	.000

a. Predictors: (Constant), Performance monitoring, Functional & mgt system integration, Stakeholder consultation
Dependent Variable: Road agency performance

Results of the multiple regression analysis (table 3.1) indicate that the three road asset management practices were significant positive predictors of performance of road agencies in Kenya. In particular, functional and management system integration ($\beta = 0.194$, $p < 0.05$); stakeholder consultation ($\beta = 0.639$, $p < 0.05$); and performance monitoring ($\beta = 0.143$, $p < 0.05$) were found to be positively and significantly influence road agency performance in Kenya. The standardised Beta (β) coefficients imply that a unit standard deviation of functional and management system integration causes 0.194 standard deviation in road agency performance. Similarly, a unit standard deviation in stakeholder consultation and performance monitoring causes 0.639 and 0.143 standard deviations in road agency performance respectively. R^2 is 0.839. This implies that the functional and management system integration, stakeholder consultation and performance monitoring altogether predicts 83.9% of road agency performance. The analytic model shown below was therefore developed as a result of the above empirical findings:

Road agency performance = 1.472 + 0.113 Functional & mgt systems integration + 0.318 stakeholder consultation + 0.122 performance monitoring

The findings that functional and management systems integration positively and significantly affect road agency performance concurs with the review findings of the study by Queiroz, & Kerali (2010) who concluded that the main aspects of institutional reforms that contributed to increased efficiency of road and transport agencies included improved institutional structures, separation of the client and supplier functions, separation of client and supplier organizations and improving management information systems. However, this study fell short of highlighting the measures of efficiency of road transport agencies.

The finding that performance monitoring was a positive significant predictor of road agency performance in Kenya is consistent with the findings of Byaruhanga & Basheka (2017) who conducted a study on contractor monitoring and performance of road infrastructure projects in Uganda. Their study revealed that weak procurement rules lead to awarding road projects to incompetent contractors which in turn affects timelines in services delivery by the contractors. Similarly the findings are in agreement with the study carried out by Phiri, B (2015) that investigated the influence of monitoring and evaluation (M&E) on project performance and the correlation analysis showed a positive and significant relationship between M&E and project performance for both projects surveyed. Muchelule (2018) study findings that that monitoring techniques and its adoption contributes to project performance significantly as well as monitoring planning and tools contributes to organization performance concurred with the findings of this study. The only difference was that Muchele's study covered all construction project in Kenya while the current study focussed on road agency performance.

According to the study findings by Banyenzaki (2016) who examined the use of contract management practices and performance of the road construction projects in Wakiso district-Uganda, there was a significant positive relationship between monitoring intensity, risk management, evaluation and performance of road construction projects. This also concurs with the findings of this study. A contradiction to this study findings was the study of Kamau & Mohamed (2015) on efficacy of monitoring and evaluation function in achieving project success in Kenya. The study contradicted that management support as a mediating factor between M&E and the Project success and emphasized that a good performance monitoring without management support is likely not to succeed.

The finding that stakeholder consultation is a positive and significant predictor of road agency performance in Kenya is concurrence with the works of Bal, Bryde, Fearon, & Ochieng, (2013) who suggested in their study titled "Achieving sustainability in the construction sector" that understanding the different sustainability agendas of stakeholders and measuring their performance using key performance indicators are important stages to be emphasized in any stakeholder engagement process to achieve sustainability-related goals. Another similar finding was by Wairimu (2016) who conducted a study on factors influencing completion of road construction projects in Embakasi, Nairobi county Kenya found out that stakeholder participation positively and significantly influences completion of road construction projects.

CONCLUSION

From the findings of this study, it can be concluded that road assets management as a practice in road maintenance has a significant contribution to the performance of road agencies in Kenya. Similarly, functional and management system integration; stakeholder consultation; and performance monitoring explain performance of road agencies (KeNHA, KERRA, KURA) either individually or combined. It can also be concluded that any enhancement of functional and management system integration, stakeholder consultation and performance monitoring among the road agencies will positively contribute to their performance improvement of road agencies in terms of stakeholder feedback, cost effectiveness and improved overall road condition. Road agencies should therefore be more vigilant with their contractors in order for the overall condition of roads to be maintained.

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