PROJECT MANAGEMENT INFORMATION SYSTEMS AND PERFORMANCE OF ROAD CONSTRUCTION PROJECTS IN TRANS NZOIA COUNTY, KENYA

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ABSTRACT

The study examined the influence of Project Management Information Systems and performance of road construction projects in Trans Nzoia County, Kenya. The study focused on four specific objectives: to assess the influence of supply chain integration and performance of road construction projects in Trans Nzoia County, Kenya; and to determine the influence of electronic procurement and performance of road construction projects in Trans Nzoia County, Kenya. The study was pegged on Unified Theory of Acceptance and Use of Technology (UTAUT). The research relied on structured questionnaires in the data collection processusing a descriptive research design. The total target population for the study was 93 respondents. The research instrument was piloted to West Pokot County. The reliability of the research instrument was completed using Cronbach alpha. Constructs were tested for validity using the content validity index. Data collected was coded, keyed in the computer and analyzed with the aid of the Statistical Package for Social Science (SPSS version 29). The findings showed that the research instrument passed both the reliability and validity tests. Inferential statistics and descriptive statistics were utilized in data analysis. The study also relied on frequencies, mean and standard deviation in presenting descriptive results. The inferential statistics used were correlation analysis, regression analysis and analysis of variances. The study employed the F-test in predicting the dependent variable which indicated that the model significantly predicted how the independent variables affected the dependent variable (performance of road construction projects in in Trans Nzoia County, Kenya). The study further made recommendations on each of the variables for management consideration in future decision making processes. The findings were of great importance to policy makers, existing literature in project management, future scholars and more specifically, management of road construction projects in Trans Nzoia County and other counties in Kenya and globally.

Key Words: Supply Chain Integration, Electronic Procurement, Road Construction

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- 1353 -

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INTRODUCTION

The Trans Nzoia County Integrated Development Plan 2013-2017 and 2018-2022 emphasized on the importance of modern road infrastructure in achieving social and economic success of the county which includes creation of wealth and jobs for the youth. The Kenya Ministry of Roads is of pivotal significance in attainment of County Government road network objectives. For the past decade, Trans Nzoia County has constructed a number of major roads in conjunction with the National Government. It should be noted that Kenya Ministry of Roads has keen interest in development of road network in Trans Nzoia County due to its strategic position. Trans Nzoia County is a major link between Kenya and East African Community and hence the inevitable need to have functional roads within/in and out of the county. For Example, the Kapchorwa-Suam-Kitale and Eldoret Bypass Roads Project which stands at 80% completion as at September 2024 links Kenya and Uganda and further links Democratic Republic of Congo (DRC) and South Sudan. It is a transformative road construction project expected to enhance regional integration in eastern Uganda and western Kenya.

Trans Nzoia County has achieved success that can be evidentially proven in construction and management of roads. The success has not been without challenges too. All these have been influenced by a number of factors and variables associated with road projects management systems. Information Management System in road construction is one of the major factor that influences the outcome of a road construction projects. With dynamic technology and new innovations, the manner and methods of construction management of road projects keep advancing. Information System has proved to be one of the crucial factors that influence road project management. Wilkinson argues that road construction sector is complex because it encompasses a relatively large number of players including shareholders, consultants, stakeholders, construction contractors, regulators and clients (Wilkinson, 2023).

In light of the above, Information technology usage has become the most important aspect of construction industry. Project monitoring and evaluation encompasses continuous collection and analysis of information to track project progress (Harrison 2018). Monitoring and evaluation is a non-negotiable management function and it can only be achieved through an effective and convenient information system. Information communication technology is crucial in provision of new opportunities to innovative construction companies so as to enhance the process of communication, collaboration and exchange of information.

Regardless of the foregoing, it is important to note a good number of players in road construction have started adopting supply chain integration to improve efficiency and supply chain performance. One of the notable characteristics of an integrated construction supply chain is the fact that it is coordinated at the center. Moreover, an integrated construction supply chain enhances and nature relationship between parties for the period that a project has been undertaken (Xiangjun & Weimei, 2023). The supply chains are significant in ensuring that transaction costs are minimized as well as, transfer and enhancement of expertise among the parties in the construction project (Well & Stam, 2023). Besides, during this error where Procurements are mainly done online, a good information system which enables performance of such online activities is necessary as E-Procurement is pocket friendly and very efficient. Another benefit of E-procurement systems is exchanging of information technology with human labor and minimization of transaction costs through automation of processes.

In the United States, the performance of projects is directly linked to the usage of information technology in the sense that, the more the use of information and communication technology the

more desirable the performance of projects Pellerina *et al*. (2020).

In Kenya, an analysis of construction companies in terms of performance and reliability points to the fact that those which utilize project management software have higher propensity of achieving project success, Kinuthia and Were (2020). Also, the researchers have established the fact that many projects fail due to failure to adopt the necessary project management software in the management of the schedule, labor, project activities and budget. On the same note, Ndiang'ui, Ombui and Kagiri (2019) observed that database management, communication and software management were some of the most significant factors that influence road construction projects completion in Kenya.

Trans Nzoia County has approximately 4421.7 kilometers of road network out of which bitumen surface is 163.3 KM, gravel surface is 2165.4 KM and earth surface roads is 2093 KM. (KNBS, 2024). Roads within Trans Nzoia County can further be classified into the following classes- Class A1: Webuye – Kitale - Kapenguria – Lodwar - South Sudan Border; Class B: Eldoret - Kitale – Endebess - Suam; Class C: Kitale – Kachibora - Chepkoilel; Class D: Maili Saba - Sibanga – Kaplamai - Nzoia roads; Maili Saba (along Kitale - Eldoret road) - Kachibora - Kapcherop: Urban roads: Hospital Road, Show ground - Bikeke; Kenya Wildlife Service roads which serve the National Parks and Game Reserves like Saiwa and Mt. Elgon National parks.

Management of the above road networks within Trans Nzoia County is done collaboratively by the national and county government. The County Government manages class D, E and unclassified rural roads. On the other hand, the Kenya National Roads Highway Authority (KENHA), Kenya Urban Roads Authority (KURA) and Kenya Rural Roads Authority (KeRRA) manage the national trunk roads, urban roads and class C roads respectively.

Statement of the Problem

Project management information system is a computer-based information technology software

system which is used by organizations to generate, store and manage project data in pursuit of optimal project performance. It assists with planning and napping out project timelines by providing tasks with start and finish date. Additionally, it makes project cost control easier in terms of cost estimation and evaluation of cost estimate alternatives. It also ensures efficient project communication by enabling stakeholders to source and share documents in a timely way. According to public works, the contractors give poor services due to improper documentation and mismanagement of funds that leads to project delays and failure. For example, Thika Super Highway initial budget was ksh27 billion, however, it eventually consumed Ksh 31 billion. A project manager simply cannot make and execute meaningful decisions without relevant and timely information (Cleland, 2024).

Successful completion of projects in Trans Nzoia County has been constrained by the scheduled due date. One of the critical challenges faced by these projects is poor planning and irregularities in utilization of available resources (Caniato, Longoni & Moretto, 2022). This is as a result of conflicting demands and competing priorities within the project environment, and if they are not managed accurately and effectively by making use of PMIS, success will not be achieved.

If the failure in road construction persists there would be high cost of transportation due to poor roads, more costs would be incurred in traffic control and spoiling of agricultural products on the road. Moreover, half build projects fail in to disrepair meaning the used money would be wasted. For example, Kitale – Suam - Kapchorwa road was intended to reduce time and cost of transportation between Endebess - Suam and connect Kenya to other countries. According to Farag *et al* (2019), transition becomes a problem to the next generation because much data and resources are lost in the process of transition without (PMIS). In this case PMIS will help with material management, support cost collection, performance measure and reporting.

- 1355 -

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This research aspires to investigate cost management, material management, how project is scheduled and to reconcile the project back to timely and cost-effective completion using PMIS. It addressed the role of project management information system on road projects, case Trans Nzoia County.

Study Objectives

The general objective of the study was to examine the influence of project management information systems and performance of road construction projects in Trans Nzoia County, Kenya. The study was based on the following specific objectives;

- To assess the influence of supply chain integration and performance of road construction projects in Trans Nzoia County, Kenya.
- To determine the influence of electronic procurement and performance of road construction projects in Trans Nzoia County, Kenya

LITERATURE REVIEW

Theoretical Framework

Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh is the proponent of UTAUT theory. This theory is more concerned with explaining the motive of the user in the application of subsequent usage behavior and the information system (Venkatesh, *et al.,* 2020). The other researchers who support the advancement of this theory are Lin and Anol (2018) and also Wang and Wang (2020). Wang and Wang (2010) carried out a study based on this theory in Taiwan where they interviewed a target population of 343 to establish gender variance on mobile Internet acceptance. In their study they considered three major constructs as follows- perceived value; palm-sized computer self-efficacy and perceived playfulness to UTAUT. They then chose the intentional behavior as the dependent variable (Lin & Anol, 2018).

The theory was established on four theoretical constructs representing determinants of Intention to Use or Usage Behavior, which form the basis upon which Technology Acceptance Model was founded. These constructs are: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Further to these variables, the theory considers also moderating factors which moderate the relations between various variables and Intention to Use. The Moderators are Gender, Age, Experience, and Voluntariness of use (Venkatesh, *et al*, 2020).

A research study to examine IT acceptance was conducted by Al-Gahtani *et al*. (2017) in Saudi Arabia. According to the study, of all the articles that used UTAUT, only 3.6% used the full theory, including the intended method as opposed to another statistical method. The researchers concluded that there is a trend of using external variables and external theories together with UTAUT to better explain and identify factors likely to influence adoption of technology.

According to Straub (2019), both TAM and UTAUT, does not give a conclusive overview of whether an individual will adopt a particular technology or not. He further argues that, technology adoption is a complex, inherently social, developmental process and for this reason, to successfully facilitate an adoption, the concerned organization has to be able to address individual's contextual interests and concerns. Additionally, the researcher emphasized that UTAUT is a relatively new model and that it needs further validation.

According to Dunnebeil *et al.,* (2022), Intentional behavior refers to the intention of a person to work out on a certain did that predicts the behavior of an individual. Besides this, behavioral intentions are subject to probability of conducting behavior and also effect of a particular usage behavior. Therefore, intentions show factors that are motivational and influence the behavior and reveal willingness of people to attempt. Performance expectancy involves the scope to which users gain advantage in the use of a technology while

conducting activities (Venkatesh *et al.* 2020). On the other hand, effort expectancy is the degree to which a technology is easy to use. Social influence is a positive perception of an individual towards adoption of technology and is always different from those of other people on the same.
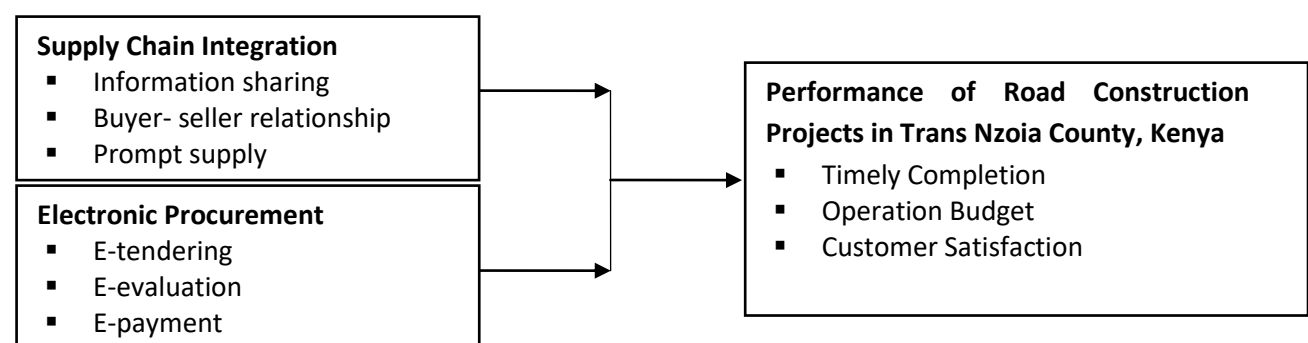
Venkatesh explained the constructs as follows: - Facilitating Conditions refers to perceiving that technical and organizational infrastructure exist so as to support technology Venkatesh *et al.* (2020); hedonic Motivation points to the pleasure of adopting technology; price Value involves trade-off between cost paid by adopting a particular technology and benefits received thereof and habit involves the extent of execution of behaviors automatically by an individual Venkatesh *et al.* (2020). He proposed that habit indirectly and directly influences behavior of adoption of technology. In addition, it was established that increase in experience of use leads to habitual use of technology.

The researcher herein deemed it fit to adopt this theory in order to explain the effect of utilization of information technology on the performance of road projects. This is measured in terms of effectiveness of the system, enhancement in the work performance of the system, improvement in the work productivity of the system, possibilities of getting better control and transferable skills of work. Effort Expectancy refers to an individual's attitude and perception that the use of an IT system will be a free of effort (Dunnebeil *et al.,* 2022). This is measurable in terms of clarity of data, how accessible data is, flexibility in the interactions with the system, the ability of identifying the relevant data, and overall presentation of the system and outline.

According to Brown *et al,* (2020), social Influence is an individual's perception of the degree to which other important people approve or disapprove of the target behavior. It is possible to measure this organizational encouragement; pressure exerted by the organization for change; management of communication and involvement of people in the process of change and availability of an "open door" policy which allows for discussion of aspects related to change. Facilitating Conditions refers to accessibility of information systems, computers and other related equipment. On the same note, lack of adequate funds has proved to be one of the major hindrances of information and communication technology adoption.

Conceptual Framework

Supply Chain Integration
- Information sharing
- Buyer- seller relationship
- Prompt supply

Electronic Procurement
- E-tendering
- E-evaluation
- E-payment

Performance of Road Construction Projects in Trans Nzoia County, Kenya
- Timely Completion
- Operation Budget
- Customer Satisfaction

Independent Variables   **Dependent Variable**

Figure 1: Conceptual Framework

Empirical Review

Road construction sector is one of the unique sectors of the economy. It involves collaboration among many stakeholders for the ultimate desired result of the project to be achieved. The great part, approximately 75 percent and more, of the construction project product's value is built with help of other stakeholders like suppliers and subcontractors (Dubois & Gadde, 2022). Therefore, supply chain integration is needed to link all the

participants and ensure effective coordination of all the construction activities. Dubois and Gibbert (2020) categorized the supply chain in construction sector in the following manner: converging at the construction site where the object is assembled from incoming materials; temporarily producing one-off construction projects through repeated reconfiguration of project organizations separated from the design; and typical make-to-order supply chain, with every project creating a new product or prototype. In the foregoing, the study focused more on other forms of construction like buildings but the same applies to road construction projects too.

According to Ballard and Howell (2020), there has been increased number of construction companies in the past few years and hence, there is need for Supply Chain Management (SCM). The construction industry has been observed to be slow in adopting the use of SCM concept unlike the manufacturing and retail sectors. According to Ofori (2023), utilization of Supply Chain Management based methods can lead to overcoming various challenges associated with traditional practices that are still being embraced in the construction sector. The obstacles that are resolved are mainly due to unreliable project management arrangements leading to-difficulties that are encountered in the construction processes; inadequate exchange of information and knowledge; unexpected surge in price due to competition resulting from purchases involving many suppliers; unsafe business environment that is full of frustration, dishonest and fear (Veal, 2021).

Pierre Hadaya and Robert Pellerin, (2020) conducted a study in Canada to find out Determinants of construction companies in the use of web-based inter-organizational information systems. The researchers argued that Information technologies (IT) may be beneficial to the construction industry by linking main contractors with their subcontractors, by reducing the response time and by enabling companies to expand their activities into new local and international markets. However, studies have concluded that construction industry is still lagging in adoption of Information Technology unlike other types of industries. The study surveyed 67 senior managers of Canadian construction companies. The research was based upon characteristics of the organization and characteristics of its supply chain. It was found out that technology experts are not in the forefront in fostering adoption of Information Communication Technology in the construction sector. Additionally, construction companies will more likely use web-based transactional processes with those strong supply chain relationships that can provide them with a competitive advantage.

In Kenya, Njagi and Ogutu (2024) carried out research on the importance of integration of supply chain on performance supply chain among the Kenyan State Corporations. The researchers adopted a descriptive survey design and surveyed 15 state corporations. The study demonstrated that state corporations had attained an average that was above the level of integration in the external integration of suppliers and in the internal integration of operations. The findings also showed that integration of supply chain is one strategy of efficient competition, and implementation of supply chain integration has a significant effect on competitive advantage of the firm and supply chain performance. The integration of supply chain has proved to be a major success element for a company's performance and supply chain.

CIPS, (2023) defines procurement as the purchasing of goods and services for the day-to-day operation of a business. On the other hand, E-Procurement refers to the use of Internet-based information and communication technologies to carry out individual or all stages of the procurement process including search, sourcing, negotiation, ordering, receipt, and post-purchase review (Croom & Brandon-Jones, 2024). Construction industry and other sectors have for some time now started adopting e-procurement in order to address challenges associated with paper based traditional practices.

According to Byline (2020), Subramaniam and Shaw (2022) and PWC (2023), E-procurement is the use of

social media like intranet in the process of purchase and sale of goods and services. The need to address the following three major concerns associated with manual procurement practices by construction project managers led to adoption of E-procurement: corruption, inadequate accessibility to bid information, and collusion in the bidding process. One of the major significances of E-procurement is that it increases the number of bidders by reducing information collection with regards to the tendering process; in turn this leads to an increase in the number of firms which can bid. On the same note, e-procurement alleviates the challenge of collusions and unfair competition practices among the bidders by providing information on tenders to other different firms which are not part of a local cartel. This allows the non-cartel firms to equally compete and break the chain of dominance by the local bidding cartels which normally prevent other more qualified firms from bidding. E-procurement minimizes corruption by preventing government officials from withholding information discriminately and refusal to collect bids from unfavoured bidders. In addition, by ensuring accessibility of procurement data by the public, it facilitates the possibility of public and oversight transparency (Veal, 2021).

However, migration to e-procurement has not been without challenges. Many government organizations and private construction firms are still hesitant to fully adopt e-procurement. Wyld (2024), established that most firms face proprietary systems challenges which has continued to be an impediment to full adoption and implementation of e-procurement. Uyarra and Flanagan (2020), conducted a study on the problems related to the adoption of e-procurement for indirect purchases and identified five problems related to e-procurement adoption as follows-standardization issues and lack of flexibility; scarcity of resources; low transaction volumes; integration issues and suppliers' own portals.

Significant barriers to achieving goals in e-procurement adoption is chiefly reliant on supplier capacity, user adoption, budget and policy support and information communication technology (ICT) support Giunipero and Sawchuk (2020). According to Khanapuri *et al.* (2021) there are a specific requirement relating to the adoption of e-procurement system. These requirements vary depending on nature of business environment in each country technology. Such requirements include; objectives, information, staffing and skills. These requirements make the adoption process to face a number of barriers such as compatibility, integration, adoption and regular use by employees and lack of capacity by small supplier

Quesada *et al.* (2020) carried out research in the Unites States on effects of e-procurement on performance and procurement practices. This study assumed a structure of interdependence among e-procurement technology (EPT) usage, procurement practices, and procurement performance. The structure was ratified and tested by use of 368 specialists in procurement found in USA. The outcome clearly showed that use of EPT influence manager's perceptions positively in both procurement performance and the procurement practices.

In Kenya, Matunga and Okibo (2023) observed that many government facilities including hospitals have started adopting e-procurement practices. For instance, most county referral hospitals have migrated to the use of e-quotations, e-sourcing and e-tendering as the main e-procurement applications. On the same note, the study revealed that the most prevalent challenges faced when e-market provider is used is the problem of inability of the organization to deal with changes in management, inadequate employee training on the way the system is used and lack of funds. In Elgeyo-Marakwet County, Barngetuny and Kimutai (2020) established that failure by the county government to adopt E-Procurement system has made it hard for the county to attain better deals of the supply contract; moreover, right information is not given out to the public. More often than not, service delivery is delayed and thus the county is slow in

delivering as a result of timelessness in supply. Also, resistance towards full migration and implementation of e-procurement procedures has occasioned delays in paying suppliers and approval of supply of services as well as, goods needed by county government.

METHODOLOGY

This study used a descriptive research design. The design was selected because of its ability to perform comparative analyzes of sample quantity assumptions. The population of this study were all the road construction projects within Trans Nzoia County with the project managers and stakeholders being targeted to provide answers to the research questions. This consisted of 93 respondents. This study used primary data, which was quantitative. The primary data in this study was collected by use of questionnaires.

Different methodologies were used to analyze the data. To examine qualitative data, thematic content analysis was employed, and the results were presented in prose. With the use of statistical software known as Statistical Package for Social Sciences version 29, quantitative data was evaluated using inferential and descriptive statistics. Tables and figures, including bar charts and pie charts were used to present the findings. The association between the independent and dependent variables was established using inferential statistics such as correlation analysis and multiple regression analysis. Correlation analysis was used to establish whether there was a relationship between the dependent and independent variables. On the other hand, multiple regression analysis was used to show the weight of the relationship between the dependent and independent variables.

The multiple regression results took the following model format:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$

Where:

Y   Performance of Road Construction Projects in Trans Nzoia County, Kenya.

β_0 Constant

$\beta_1 - \beta_2$ Beta Coefficients of independent variables

X_1 Supply chain integration

X_2 Electronic procurement

ε Error term

FINDINGS AND DISCUSSION

Response Rate

The research distributed 93 questionnaires to the target sample respondents, 88 questionnaires were filled and returned, 3 questionnaires were returned though incomplete while 2 questionnaires were not returned at all. This amounted to a 95% response rate which was considered sufficient for research purposes according to Bratton and Gold (2023). The analysis adopted a 5% significance level.

Performance of Road Construction Projects in Trans Nzoia County

Data on the dependent variable was collected and tabulated as shown in the table below;

Table 1: Performance of Road Construction Projects

Item	SA %	A %	N %	D %	SD %
Proper project evaluation and implementation leads to planned completion of the road construction project	35	33	6	14	12
Involvement of locals in road construction supports timely completion	26	23	7	27	17
The system provides an avenue for continuous tracking of road projects success	26	30	10	21	13
Monitoring and evaluation ensures proper project implementation and progress.	19	18	6	27	30

The table above presented the feedback from the respondents on the dependent variable, performance of road construction projects in Trans Nzoia County, Kenya. On whether proper project evaluation and implementation leads to planned completion of the road construction projects, 35% of the respondents strongly agreed, 33% agreed, 6% were neutral, 14% disagreed while 12% strongly disagreed that proper project evaluation and implementation leads to planned completion of the road construction project. On whether Involvement of locals in road construction supports timely completion, 26% strongly agreed, 23% agreed that involvement of locals in road construction indeed supports timely completion, 7% were neutral on this statement, 27% disagreed and 17% strongly disagreed.

As to whether the system provides an avenue for continuous tracking of road projects success, 26% of the respondents strongly agreed, 30% agreed,

10% were neutral, 21% disagreed while 13% strongly disagreed and indicated that probably the system does not provide an avenue for continuous tracking of road projects success. Asked whether monitoring and evaluation ensures proper project implementation and progress, 19% strongly agreed, 18% agreed that indeed monitoring and evaluation ensures proper project implementation and progress. 6% remained neutral while 27% disagreed with the statement, 30% of the respondents strongly disagreed which implied that monitoring and evaluation did not ensure proper project implementation and progress in Trans Nzoia County.

Analysis of Specific Variables

Supply Chain Integration and Performance of Road Construction Projects

The data on the supply chain integration and performance of road construction projects in Trans Nzoia County was collected and findings tabulated as shown below;

Table 2: Supply Chain Integration and Performance of Road Construction Projects

	SA %	A %	N %	D %	SD %
We strategically coordinate our supply chain operations with those of stakeholders in the same sector	24	25	13	19	19
Our demand system is linked with that of our suppliers for automatic ordering	28	25	8	23	16
Our logistics providers meet our strict logistics operation requirements	38	31	8	17	7
We have a fully synchronized communication system with our suppliers	52	28	7	6	7

The study collected data on the supply chain integration by posing several questions to the respondents. The first question was whether they strategically coordinate their supply chain operations with those of stakeholders in the same sector; 24% of the respondents strongly agreed, 25% agreed, 13% of the respondents were neutral, 19% of the respondents disagreed with another 19% strongly disagreeing that they did not strategically coordinate their supply chain operations with those of stakeholders in the same sector. With only a total of 49% of the respondents agreeing or strongly agreeing as to this statement, it was concluded that they did not strategically

coordinate their supply chain operations with those of stakeholders in the same sector in Trans Nzoia County.

On whether the demand system was linked with that of the suppliers for automatic ordering, 28% of the respondents strongly agreed, 25% agreed, and 8% were neutral. On the other hand, 23% of the respondents disagreed and 16% strongly disagreed that the demand system was linked with that of the suppliers for automatic ordering. With a total of only slightly above the fifty percent of the respondents being in affirmative, as to whether the demand system was linked with that of the suppliers for automatic ordering, it was concluded

that the demand system was not entirely linked with that of the suppliers for automatic ordering. On whether company logistics providers meet strict logistics operation requirements, 38% of the respondents strongly agreed, 31% agreed, 7% remained neutral, 17% disagreed while 7% strongly disagreed which implied that company logistics providers met strict logistics operation requirements since a total of 69% of the respondents supported the statement.

The last question to the respondents, on this variable was whether they had a fully synchronized communication system with their suppliers. 52% of the respondents strongly agreed, 29% agreed, 7% were neutral, 5% disagreed while 7% strongly disagreed that they had no fully synchronized communication system with their suppliers. From the findings, it was evident that 81% of the respondents positively responded in affirmative that indeed they had a fully synchronized communication system with their suppliers.

E-procurement and Performance of Road Construction Projects

The entries presented in the table below concerned the data collected on the last specific variable on the effect of e-procurement and performance of road construction projects in Trans Nzoia County.

Table 3: E-procurement and Performance of Road Construction Projects

	SA %	A %	N %	D %	SD %
We usually send request for information (RFI), request for price (RFP), etc to suppliers and receive the responses using Internet technology following the procurement process	27	22	7	27	17
We buy goods and services that have the lowest price or combination of lowest price and other conditions via Internet technology	35	22	6	20	17
We usually participate in KeRRA pre-qualification of suppliers through the Internet	22	24	7	24	23
We electronically respond to KeRRA tender Advertisements	24	23	8	23	22

Data was collected and analyzed and the results presented on the final specific variable, e-procurement, as shown in the table above. The respondents' views as to whether they usually send request for information (RFI), request for price (RFP), etc to suppliers and receive the responses using internet technology following the procurement process, were that 27% strongly agreed, 22% agreed, 7% were neutral, 27% disagreed, while 17% strongly disagreed that they usually did not send request for information (RFI), request for price (RFP), etc to suppliers and receive the responses using internet technology following the procurement process. From the data, the respondents were equally divided on this statement since the responses were split equally in the middle. There is need for further research on why the respondents reacted in this manner with only 7% appearing neutral.

On whether they bought goods and services that had the lowest price or combination of lowest price and other conditions via internet technology, 35% of the respondents strongly agreed, 22% agreed, 6% were neutral while 20% disagreed and 17% of the respondents strongly disagreed that they did not buy goods and services that had the lowest price or combination of lowest price and other conditions via internet technology. These results indicated that majority of the respondents, 57%, affirmed that indeed they bought goods and services that had the lowest price or combination of lowest price and other conditions via internet

technology. On whether they usually participated in KeRRA pre-qualification of suppliers through the internet, 22% strongly agreed, 24% agreed, 7% remained neutral, 24% disagreed while 23% strongly disagreed that they did not usually participate in KeRRA pre-qualification of suppliers through the internet. Respondents were equally divided on this statement with 46% returning an affirmative feedback while 47% returning a negative verdict. There is therefore need for further research on whether their companies participated in KeRRA pre-qualification of suppliers through the internet.

Concerning whether the companies electronically responded to KeRRA tender advertisements, 24% of the respondents strongly agreed, 23% agreed, 8% remained neutral, 23% disagreed while 22% strongly disagreed that the companies did not electronically respond to KeRRA tender advertisements. Generally, it appeared that the respondents were once more equally divided on whether trainees were usually satisfied with the overall aspect of whether companies electronically responded to KeRRA tender advertisements in Trans Nzoia County, Kenya. The equally negative and positive feedback on the three statements in this variable needed further investigation.

Correlation Analysis

The study used correlation analysis in measuring the strength of the relationship among variables, both dependent variable (Performance of road construction projects in Trans Nzoia County) and independent variables (supply chain integration and electronic procurement) and the results presented in the table below;

Table 4: Pearson Correlation Matrix

	Supply chain integration	e-procurement	Performance
Supply chain integration	1		
e-procurement	.623	1	
Performance	.788	.855*	1

**Correlation is Significant at .01 level (2-tailed). *Correlation is Significant at .05 level (2-tailed).

The results indicated the presence of a strong relationship among the variables in the study which were therefore employed by the study in arriving at the recommendations and conclusions.

Regression Results

ANOVA

The study determined the ANOVA statistic (F-value) and compared with the F-table (F-critical) value and made the conclusion from the findings as shown below:

Table 5: ANOVA[a]

Model		Sum of Squares	df	Mean Square	f	Sig.
	Regression	36.357	2	18.1785	4.9015	.000[b]
1	Residual	315.249	85	3.7088		
	Total	351.606	87			

a. Dependent Variable: Performance
b. Predictors: (Constant); supply chain integration and electronic procurement.

The significance value of .000 which was less than 0.05 led to the overall model being adjudged fit for the analysis and eventual prediction of the results together with the fitting of the study multiple regression model. It was therefore adopted in determining the relationship between the independent variables (supply chain integration and electronic procurement) and the dependent

variable (Performance of road construction projects in Trans Nzoia County). This was also due to the F critical value (F-Critical = 3.10) at 5% level of significance being less than the F calculated value (F-calculated = 4.9015), which showed that the overall model was significant.

Model Summary

The study explored the dependent variable (Performance) indicators using the independent variables in the model. The coefficient of determination (R-square) was used to identify the variance at which the independent variables explained the dependent variable in the model.

Table 6: Model Summary

Model	R	R-Square	Adjusted R-Square	Std Error of the Estimate
1	.811[a]	.658	.647	.01587

a. Predictors: (Constant), Predictors: (Constant), supply chain integration and electronic procurement.

The predictor variables (supply chain integration and electronic procurement.) contributed, overall, 65.8% (Adj. R^2 = .647) of the predicted variable (Performance of road construction projects in Trans Nzoia County). From the study analysis, the independent variables explained 65.8% of the variations in performance of road construction projects in Trans Nzoia County while 34.2% of the variations was explained by other variables not covered by the study.

Regression Results for the Predictor Variables

Data on the nature of the relationship among variables was analyzed and results presented in the table below;

Table 7: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		β	Std. Error	Beta		
	(Constant)	1.697	1.521		1.859	.002
1	Supply Chain Integration	.637	.635	.628	3.914	.004
	e-procurement	.876	866	.881	3.268	.031

a. $P<.001$, 95% Confidence level, N=88

The following multiple regression model was then extracted from the above results;

$$Y = 1.697 + .637X_1 + .876X_2$$

The predictor variables (supply chain integration and electronic procurement) in the study, significantly influenced the predicted variable (Performance of road construction projects in Trans Nzoia County) in a multi-linear relationship as indicated by the regression model above. Accordingly; a unit increase in supply chain integration led to .637 while a unit increase in the e-procurement caused a .876 increase by a unit of performance in the road construction projects in Tran Nzoia County. *Ceteris paribus*, Performance remains at the 1.697 index.

CONCLUSIONS AND RECOMMENDATIONS

The data analysis on Performance of Road Construction Projects in Trans Nzoia County, Kenya, revealed that respondents were satisfied that proper project evaluation and implementation led to planned completion of the road construction project, however, involvement of locals in road construction did not essentially support timely completion. The company systems provided avenues for continuous tracking of road projects success and that monitoring and evaluation ensured proper project implementation and progress.

The study, from the data analysis on whether the respondent companies strategically coordinated

- 1364 -

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their supply chain operations with those of stakeholders in the same sector, established that the respondents were divided in to two equal portions which implied that there was no full strategic coordination of the supply chain operations with those of stakeholders in the same sector. The demand systems of the construction firms were linked with those of the suppliers for automatic ordering. The logistics providers met strict company logistics operation requirements and that the road construction firms in Trans Nzoia County had fully synchronized communication systems with the suppliers.

From the analyzed data, it was not very clear whether road construction firms usually sent request for information (RFI), request for price (RFP), etc to suppliers and received the responses using internet technology following the procurement process. Majority of the respondents affirmed that their road construction firms bought goods and services that had the lowest price or combination of lowest price and other conditions via internet technology, however, it was clear whether road construction firms usually participated in KeRRA pre-qualification of suppliers through the internet And finally, it appeared that the respondents were once more equally divided on whether the road construction firms electronically respond to KeRRA tender Advertisements.

The study made the following conclusions based on the findings from the analyzed data: that the independent variables (supply chain integration and e-procurement) strongly and significantly correlated with the dependent variable (performance of road construction projects in Tran Nzoia County as shown by the correlation matrix findings.

The correlation results per predictor variable, in a descending order, were as follows; E-procurement - r = .855, and Supply Chain Integration - r = .788 . According to Musong, Komen and Cheboi (2023), these results denoted a strong relationship among

variables as indicated by the study regression results.

The study, from the data analysis on strategic coordination of supply chain operations with those of stakeholders in the same sector. It was recommended that it should be given management attention fully by the road construction companies in Trans Nzoia County, Kenya, since majority of respondents felt it was not given required priority. And that the road construction demand system be linked with that of the suppliers for automatic ordering and be adopted strictly to avoid stock-outs.

That the logistics providers meet road construction companies' strict logistics operation requirements as per the each firm for efficiency and effectiveness. And lastly, the road construction companies to keep it on the fully synchronized communication system with suppliers, this was given a thumbs up by a big majority of respondents.

From the research data analysis on the variable e-procurement; it was recommended that road construction companies to usually send request for information (RFI), request for price (RFP), etc to suppliers and receive the responses using internet technology following the procurement process. The continuation and strengthening of purchasing of goods and services that have the lowest price or combination of lowest price and other conditions via internet technology since it eliminates malpractices. Participate in KeRRA pre-qualification of suppliers through the internet should be made to be mandatory as well as electronically responding to KeRRA tender advertisements.

Areas for Further Research
Road construction in any economy is a very important aspect, especially in relation to economic growth. This study only covered one county, Trans Nzoia County, out of the forty-seven counties in Kenya. It was, therefore, suggested that similar work be carried out in a number of counties, more so in the North Rift counties, since Trans Nzoia County is a North Rift county for better results comparison. The studies will be used to aid the

- 1365 -

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establishment of the true position in relation to project management information systems and how they impact road construction projects and probably how they can be improved to increase sufficient road infrastructure in Kenya.

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