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DETERMINANTS OF PROJECT MANAGEMENT INFORMATION SYSTEM ON SUCCESFUL IMPLEMENTATION OF ROAD CONSTRUCTION PROJECTS IN NAIROBI COUNTY

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Abstract: **Organizations are continually been involved in projects as a competitive tactic to ensure that they remain relevant in their respective fields. This research proposal sought to find out determinants of project management information system on successful implementation of Road construction projects in Nairobi County. The Objectives of this study were PMIS software, access to project reports, Influence of documentation management and complexity of the system. The four independent variables (the system, quality report, the documentation and complexity) were found to have a strong and positive correlation with the dependent variable (project performance).The research also found out that the use of the system to generate quality information needed by the user (project manager) to perform project tasks helped the project managers perform their tasks in a more professional manner thus increasing the performance of the project. It was therefore concluded that the use of PMIS has helped in the improving performance of project in Nairobi County while respecting the projects constraints of time, budget and quality specification while meeting the project objectives. Future studies could evaluate performance from the client's perspective and can also research Project management in relations to the counties.**

Keywords: **Determinants, Successful, Construction.**

1. INTRODUCTION

Background to the Study:

The road construction industry is one of the largest job creators in developing countries and has become highly competitive due to the effect of globalization (Nguyen, Ogunlana & Lan, 2007). Contractors, consultants and project managers in South Africa are finding it increasingly difficult to attract new clients. In addition, it is not clear as to what actions need to be taken in order to improve project success. According to Ojiako, Johansen & Greenwood (2008), project success in the construction industry in South Africa and most developing countries is measured by the 'iron triangle' parameters of time, result, and means. The high number of project failures suggests the existence of underlying critical success factors which have not been identified.

A Project Management Information System (PMIS) is a group of components which can increase competitiveness and gain better information for decision making. Therefore various institutions have chosen to apply this group of components to their associations (Spalding, 2008).However, various entities define project differently, and for example the World

Bank has its unique definition of Project which is different from the Project 13 Management Body of Knowledge's (PMBOK®'s) definition. Early project and project management writers such as Turner (2000); Avots (2005); Kerzner (2007); Duncan and Gorsha (2013) have provided conceptual definitions. Amidst all these definitions certain key characteristics feature in almost all. These are: • Set of Activities or Tasks • Has a Time-frame • Has a well-defined objective • Consumes resources (i.e. money, people, materials, equipment) • Has a quality aspect • Involves risk at every step of the process • It is unique: it may never be repeated in the same way by the same group of people at the same place. • Intended to generate benefit • Future benefit perspective

According to the United Nations Relief and Works Agency (UNRWA, 2006), there is no exception in Palestine as many local construction projects report poor performance due to: unavailability of materials; excessive amendments of design and drawings; poor coordination among participants, ineffective monitoring and feedback, and lack of project leadership skills and regional conflicts.

The Road construction industry is considered to be one of the most important industries in the economy. It interacts with nearly all fields of human endeavors. Unfortunately, the intrinsic complexity, uncertainty and dynamics of most construction projects create difficulties for even the best project managers. Decision milestones are used to anticipate outcomes, risk management is done to prevent disasters and sequential iteration is employed to ensure that the desired facilities are available, yet projects still end up with schedule delays, budget overruns and compromised specifications (Meyer et al., 2006).

Road construction in Africa is a scarce undertaking and where roads are available, they are largely poorly maintained. A survey carried out by the World Bank reveals that average road density in Africa is 20.4km per 100 square kilometer of land area. Worse still, of these only a quarter are paved. Southern Africa is the only region in Africa with a fairly good road transport system. South Africa in particular is reported to have 62km of road per 100km square kilometers close to the United States of America that has 67km of roads per 1000 square kilometer. This success story has been attributed to the country's revitalization of its road and railway system before the FIFA World Cup Of 2010.The low road construction in Africa has had dire consequences. The effects of poor road connectivity in Africa cannot be over emphasized. The World Bank notes that with poor road connectivity the cost of goods significantly goes up.

Information sharing, either on a one to one basis or in small workgroups allows individuals to share knowledge and test ideas in a supportive project activities. In a project environment, the face-to-face inter-disciplinary social interaction will usually occur in meetings, of various types and formality. Despite the amount of time and energy consumed by meetings they are relatively under-researched (Dainty et al, 2006; Emmit & Gorse, 2007). Although there are a number of books written mainly by practitioners with the aim of providing guidance, (Hartley, 2000; 2001) in his study concluded that despite their familiarity little do we know what goes on within this forum.

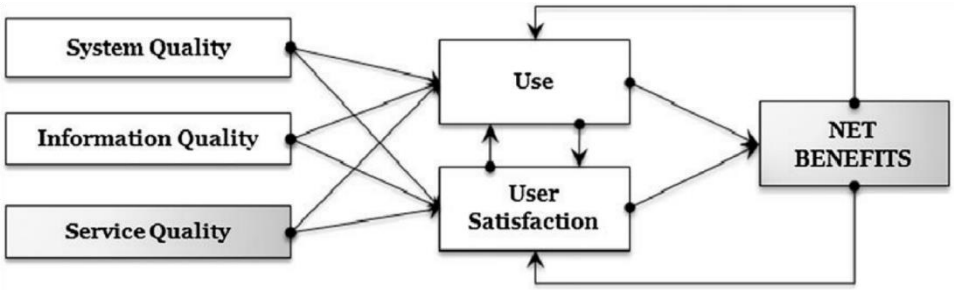
However, with Project Management Information System being increasingly used by project managers in many industries, not much is known on the success implementation of these PMIS that contribute on the road construction in Nairobi county and looking at the development of PMIS in advanced countries the application and usage is in Advance stage than countries like Kenya being in underdeveloped countries.Therefore this study sought to examine determinants of project management information system on successful implementation of Road construction projects in Nairobi county.

2. LITERATURE REVIEW

DeLone and McLean Information Success Model (ISSM):

DeLone and McLean (2008), introduced the first IS success model which was based on Shannon and Weaver's (2008) theory of communication. DeLone and McLean's model present different features differentiated by the two essential concepts: system quality and information quality. The utilizing of the system has a clear impact on the way individuals accomplish their performance. This impact may eventually effect on the organizational performance. It was among the first studies to impose some order in IS researchers' choices of success measures (Seddon et al. 2009). The model is based on theoretical and empirical research conducted by a number of researchers in the 1970's and 1980's. To construct the model, DeLone and McLean reviewed 100 papers containing empirical IS success measures published in seven publications during 1981-1987. They distilled the resulting huge range of Information system success measures into an integrated view of IS success, represented by the following the six dimensions: System Quality, Information Quality, Information Use, User Satisfaction, Individual Impact and Organizational Impact.

While the model integrates the comprehensive dependent variables used by IS researchers, it received several criticisms. Ten years later, DeLone and McLean presented an updated model reflecting the criticisms by other researchers and the situation at the time. As the service concept was added to IT with the use of the Internet, they increased the number of information system success factors to seven, including service quality, and analyzed the interdependence and correlation of these seven factors. Figure 2 represents the updated ISSM model of Delone and McLean (2013)



The Updated Information System Success Model (ISSM) (DeLone, McLean 2013)

TECHNOLOGY ACCEPTANCE MODEL (TAM):

Several studies of IS success models in the field of construction have been carried out the technology acceptance model (TAM), (Chung *et al*, 2009) attempted to determine the elements of the success or failure of the introduction of enterprise resource planning (ERP) systems that are widely utilized in construction enterprises with the purpose of contributing to assessing, planning, and conducting a project for introducing and establishing an ERP in an enterprise. In the research, the success factors of the ERP system are divided into two categories; the first category is user-related variables, including output, job relevance, image and result, demonstrability, compatibility, and system reliability. The second category is project-related variables, including internal support, function, and consultant support. It can be said that this research has a high level of completion in that it suggested a success model for construction ERP systems through extensive data collection and empirical analysis. Nevertheless, the success model suggested has limitations in its application to other types of IS because it was verified by focusing on ERP systems. Hjelt (2007) analysed factors related to end-users' attitudes toward Electronic Document Management (EDM) systems that are used for large-scale construction projects. The research conducted a survey to draw factors that affect acceptance of an EDM system to a construction project.

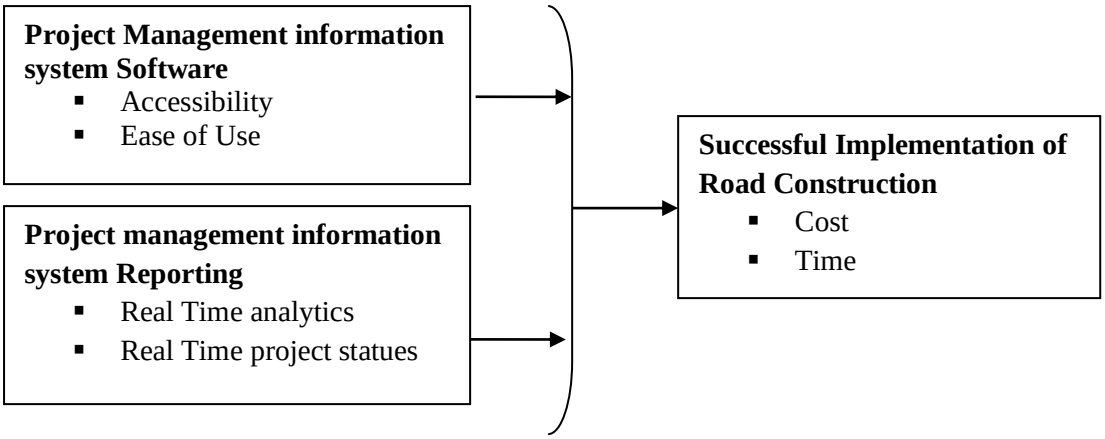
IS use developed in DeLone and McLean's IS success model (ISSM) (2002), later updated (2003), and in Davis et al.'s (2005) technology acceptance model (TAM). The ISSM incorporates information quality and system quality as antecedents of IS use, leading to individual IS impacts, that is, on users and their work (e.g., in regard to their effectiveness), and in turn to organizational impacts (e.g., in regard to business strategy and performance) (Raymond, Bergeron 2007). While the TAM explains IS use in a similar manner by the system's perceived usefulness and perceived ease of use. Both the ISSM and the TAM offer widely accepted and validated representations and explanations of the IS use phenomenon. This is supported by studies done by Larsen, Lee and Rai (Larsen 2003, Lee, Kozar & Larsen 2003, Rai, Lang & Welker 2002).

Diffusion of Innovation Theory (DOI)

DOI theory by Rogers (1995) is a theory of how, why, and at what rate new ideas and technology spread through cultures, operating at the individual and firm level (Oliveira & Martins, 2011). DOI provides insights into the innovation or technological factors that influence the adoption of innovation (Rogers, 1995). Originally, innovation characteristics in DOI was presented in the context of the innovation adoption at the individual level, however, Rogers (1995) argued that the characteristics of innovations could also be applied to the innovation adoption models at the organizational level (Picoto et al., 2012; Hameed&Counsell, 2012). Hence, DOI is used in many studies to study innovation adoption issues by firms (e.g. Tan et al., 2009; Ramdani et al., 2009; Ramdani&Kawalek, 2007; Hussin& Noor, 2005; Seyal&Rahman, 2003; Premkumar& Roberts, 1999; Thong, 1999).

DOI suggests that innovations possess certain attributes, which as perceived by adopters, regularly determine the adoption of innovation (Ozturk, 2010). The innovation attributes include relative advantage, compatibility, complexity, trial ability and observability (Roger, 1995). Each characteristic helps to reduce a potential adopter's uncertainty regarding the perceived benefits of innovation adoption (Yoon, 2009). Consequently, innovations which are perceived as having more relative advantage, compatibility, trial ability, observability and having less complexity will be adopted more rapidly than other innovations (Rogers, 1995).

Among these characteristics, the most frequently adopted factors are relative advantage, compatibility and complexity. They were chosen by many studies due to frequently found as significance factors in IT/IS adoption in many empirical researches (e.g. Ramdani et al., 2009; Thong, 1999; Al- Qirim, 2007b; Premkumar& Roberts, 1999).This is consistent with Tornatzky and Klein (1982) which identified only three characteristics of an innovation which would be the most important: relative advantage; compatibility; and complexity.



3. DATA ANALYSIS, PRESENTATION AND INTERPRETATION

Questionnaire Response Rate:

This study had a sample of 80 respondents whereby only 61 responses were obtained. This represents a response rate of 76.25%. According to Babbie (2002) any response of 50% and above is adequate for analysis thus 76.25% is even better.

Gender Distribution of Respondents:

The study sought to find out the gender of the respondents. The findings obtained are as shown in below.

Distribution of Respondents by Gender

	Frequency	**Per cent**
Male	36	59.0
Female	25	41.0
Total	**61**	**100**

As shown on table majority (59.0%) of the respondents were male while females contributed to 41.0% of the respondents. This is a very good representation of gender and shows that both genders are well represented. At least 2/3 majority of either gender indicates that there is gender equity and that there is no discrimination in terms of gender. These findings also indicate that most project managers were male.

Age Brackets of the respondents:

The study also sought to establish the age bracket of the respondents. Age bracket was important in order to know which age bracket formed the majority of those who utilised the system in project management. The findings were as shown in the table below.

Distribution of Respondents by Age:

	Frequency	**Per cent**
21-30 years	20	32.7
31-40 years	25	41.1
41-50 years	12	19.7
Above 50 years	4	6.5
Total	**61**	**100**

From the study findings, 41.1% of the respondents were aged between 31-40 years, 32.7% were aged between 21-30 years, 19.7% were aged between 41-50 years, and 6.5% were aged above 60 years. From these findings, it can be deduced that most of the project managers were aged between 31 and 40 years

Level of Education of the respondents:

The study also sought to establish the respondents' highest level of education. The level of education was important in order to determine the capability of the respondents to utilise Project Management information system.

Distribution of Respondents by their highest level of education:

	Frequency	**Per cent**
Undergraduate	20	32.8
Master's Degree	22	36.1
Diploma	15	24.6
Others	4	6.6
Total	**67**	**100**

From the findings in table 4.3, 32.8% of the respondents indicated that their level of education was masters, 32.8% indicated it was undergraduate, 24.6% indicated it was a diploma whereas 6.6% indicated other levels. These findings show that most of the project managers had master's degree as their highest level of education.

Project Management Experience:

The respondents were requested to indicate their experience in project management. The researcher obtained the following results.

Distribution of Respondents by their Project Management Experience:

	Frequency	**Percent**
More than 30 years	5	8.2
20 -30 years	17	27.9
10 -20 years	20	32.8
Less than 10 years	19	31.1
Total	**61**	**100.0**

From the findings, 32.8% of the respondents indicated that they had an experience of between 10 and 20 years in project management, 31.1% indicated that they had less than an experience of less than 10 years, 27.9% indicated that they had an experience of between 20 and 30 years while 8.2% indicated that they had an experience of more than 30 years. These findings show that most the project managers had an experience of between 20 and 30 years in project management.

Project Management Information System:

The study sought to determine the influence of Project Management Information System software on the performance of construction project. The respondents were requested to rate various aspects of general performance of Project Management Information System in their organization. The results are shown in table below.

Project Management Information System Software:

	Range	**Mean**	**Std. Deviation**
Accessibility	3.00	3.245	.869
Response Time	3.00	3.032	.893
Flexibility	3.00	3.262	.911
Ease of use	3.00	3.114	1.050
Querying Ease	3.00	3.114	.984
Learning Ease	3.00	3.557	1.057
System Integration	3.00	3.623	1.002
Multi-project Capability	3.00	3.475	1.177

According to the findings, the respondents rated systems integration in their organization as high as shown by a mean of 3.623 and a standard deviation of 1.002. The respondents also indicated with a mean of 3.557 and a standard deviation of 1.057 that the general performance of learning ease in their organization was moderate. Further, the respondents indicated with a mean of 3.475 and a standard deviation of 1.177 that the general performance of multi-project capability in their organization was moderate. Additionally, the respondents rated the general performance of flexibility in their organization as moderate as shown by a mean of 3.262 and a standard deviation of 0.911. Also, the respondents indicated with a mean of 3.2459 and a standard deviation of 0.869 that the general performance of accessibility in their organization was moderate. In addition, the general performance of ease of use was rated as moderate as indicated by a mean of 3.114 and a standard deviation of 1.050. As well, the respondents indicated with a mean of 3.114 and a standard deviation of 0.984 that the general performance of querying ease was moderate and the general performance of response time was moderate as shown by a mean of 3.032 and a standard deviation of 0.893 that.

Project Quality report of Information:

The study sought to establish the influence of quality information on the performance of construction project. The respondents were further asked to rate the impact of various aspects of quality of information produced by Project Management Information System in project implementation in their organizations. The findings are shown below.

	Range	Mean	Std. Deviation
Availability	3.00	4.032	.937
Relevance	3.00	3.524	.976
Reliability	3.00	3.491	.905
Precision	3.00	3.442	.847
Comprehensiveness	3.00	3.770	.933
Security	3.00	3.278	.874

From the findings, the respondents indicated with a mean of 4.032 and a standard deviation of 0.937 that availability of information produced by Project Management Information System in project implementation in their organizations was very high. In addition, the respondents indicated with a mean of 3.770 and a standard deviation of 0.933 that comprehensiveness of information produced by Project Management Information System in project implementation in their organizations was high. Also, the relevance of information produced by Project Management Information System in project implementation was rated as high as shown by a mean of 3.524 and a standard deviation of 0.976.

Additionally, the respondents indicated with a mean of 3.491 and a standard deviation of 0.905 that reliability of information produced by Project Management Information System in project implementation in their organizations was moderate. Precision of information produced by Project Management Information System was also rated as moderate as shown by a mean of 3.442 and a standard deviation of 0.847. Lastly, the respondents indicated with a mean of 3.278 and a standard deviation of 0.933 that security of information produced by Project Management Information System in project implementation in their organizations was moderate.

4. SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

The study sought to examine the influence of project management information system on project performance, assess the influence of quality information on performance of project, and establish the influence of the system documentation and system complexity on performance of Road construction projects.

The Project Management Information System on Software:

According to the findings, the respondents' systems integration had an excellent response in their organization with a mean of 3.623 and a standard deviation of 1.002. However, most of the respondents were not very confident with the ability of the system to protect the information from any kind of invasion (corruption by viruses or by hackers). On average the system was rated good. This meant that the users felt that the system played an important role in the performance of their tasks. 85% of the respondent felt that the system helped them in keeping track of information needed for monitoring the projects while 60% were able to retrieve information for a different but similar project to use it as baseline data for their projects. It was noted that the system played an important role in generating the information to be used in management of the projects. Also said they were able to effectively and efficiently manage the project resources.

Conclusions of the Study:

The research aim of this study was to determine the impacts of Project Management Information Systems upon project performance. More specifically, one objective was to determine the influence of the system on the performance of construction projects. Another objective was to establish the influence of quality information on performance of construction projects. Another objective was to assess the influence of the system user on performance of construction projects and the last objective was to assess the influence of the system use on performance of construction projects in order to get a better understanding of the contribution of these systems to the performance of projects.

Following the conclusions of previous research that project management information system success models should continue to be validated and challenged, the results of this research show that the use of a project management information system is in fact advantageous to construction project managers in Nairobi County, Kenya. Improvements in effectiveness and efficiency in managerial tasks were observed in terms of better project planning, scheduling, monitoring, and control. Improvements in productivity were also observed in terms of timelier decision-making and proper budgeting. Advantages obtained from project management information system use are not limited to individual performance but also include project performance.

It should also be noted that the systems must provide reliable and accurate information that will enable the project team to perform their tasks efficiently and effectively. It is not the complexity of the software that matters but the quality of the information generated by the system and the ability of the user to use the information to manage the project. This information helps the users/ project managers to perform their tasks in a much professional manner. One can therefore conclude that project management information system make a significant contribution to project performance and should continue to be the object of project management research.

Recommendations of the Study:

It is recommended that:

1. The results of this research show that organizations should adopt the use of Project Management Information System in the management of their projects. This is because they guarantee better management of project since it generates quality information needed for the effective and efficient management of the project.
2. The results of this research show that the use of a project management information system is advantageous to project managers (PMIS Documentation). This is due to the fact that improvements in effectiveness and efficiency in managerial tasks were observed in terms of better project planning, scheduling, monitoring, and control. Improvements in productivity were also observed in terms of timelier decision-making.
3. The system itself has no direct influence upon project performance; it is only through quality information, extensive use of the system, and individual impacts on the project manager that the system has an effect on project performance.

Suggested areas for further Research:

Future studies of the influence of Project Management Information System towards project performance could:

1. Evaluate performance from the client's perspective, that is, evaluate if the impacts of the Project Management Information System on project outcomes provide an adequate solution to the client's problem, bring true advantages to the organization in terms of quality of product/services offered, greater output volume, quicker delivery, and provide tangible benefits such as increased sales and revenues.
2. Evaluate the effects of the use of Project Management Information Systems in decision making in a multi-project environment
3. And the same can be applied in different field but to different counties.

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