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INFLUENCE OF PROJECT MANAGEMENT INFORMATION SYSTEM ON PROJECT PERFORMANCE IN THE CONSTRUCTION INDUSTRY. CASE OF HORIZON CONSTRUCTION COMPANY

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ABSTRACT

The purpose of the study was to establish the influence of Project Management Information System on project performance in the construction industry; a case of Horizon construction company. The Objectives of this study were to determine the influence of: the system, quality information, the system user and the system use on performance of construction projects. Descriptive survey design was used. The target population of the study 110 respondents from which a sample size of 86 was determined using Yamane's formula. purposive sampling was used to select the sample from the target population. The study used both primary and secondary data, where questionnaires were used for data collection. Cronbach's alpha test was utilized in assessing reliability of research instrument. Data collected was analyzed through SPSS version 21. Data analysis involved statistical computations for averages, percentages, and correlation and regression analysis. Descriptive statistics and Correlation (using the Karl Pearson's coefficient of correlation) was used to analyze the data and establish the relationship between the dependent variables and the set of independent variables. The four independent variables (the system, quality of information, the system user and the system use) 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 Project Management Information System helped in the improving performance of project while respecting the projects constraints of time, budget and quality specification while meeting the project objectives. From the correlation analysis, it can be deduced that there is a positive relationship between the project management information system and project performance, where the correlation coefficient was 0.925 and a p-value of 0.000. The findings indicate that the quality of information and project performance correlate positively with correlation coefficients of 0.925 and p-value of 0.000. The study further established that there is a positive relationship between project management information system use and project performance with a correlation coefficient of 0.941 and p-value of 0.000. Lastly, the study found that there is a positive relationship between the project management information user and project performance with a correlation coefficient of 0.914 and a p-value of 0.000. Future studies could 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 better strategic positioning, and provide tangible benefits such as increased sales and revenues.

Key words: Project management; Information systems, Project Management Information Systems (PMIS), Software, Information, User, Project performance

1.1 Introduction

Globalization and the internationalization of markets have increased competitive pressures on business enterprises. This has led companies to engage in projects that are vital to their performance, if not their survival. The evolution of worldwide competitive markets has led to a fact that projects in an ordinary business such as engineering, information technology; construction, etc. need to be highly managed, in terms of planning, scheduling, organizing, monitoring, and controlling (Liberatore & Johnson, 2003). In order to accomplish this, organizations must manage projects within selected time, budget, and in high performance while managing project risk.

According to Raymond et al., 2008, it is paramount for organizations to adequately manage their projects if they are to achieve their performance objectives. They further observe that project management remains highly a problematic endeavor since most projects are either not completed on time or exceed the budget. For instance, the Athens Olympic Games Stadium exceeded its budget by 9 billion Euros while the Canadian Arms Registry was completed 10years later (Ibid).

They continue to note that Gartner Research (an Information Technology Research and Advisory Company) estimates that 75% of IT projects managed with the support of Project Management Information Systems (PMIS) will succeed while 75% of those that don't have the support of PMIS will fail. Although the use of PMIS in the management of projects is not a guarantee that projects will be successful PMIS have become a necessity in the management of all projects whether small or large, public or private.

Although project management systems assist an organization decrease product and service development time to market, exploit restricted resources, and enlarge global market rivalry, project managers still need to utilize tools that helps in overcoming various challenges such as: uncontrollable time and budget restrictions; inconsistent project teams; unpredictable of firms resources; lack of clarity in prioritizing projects; delays in project decisions making; and lack of clarity in collaboration among project team members (Lacovou & Dexter, 2004). According to Becker, 2005, projects managers continue to struggle with these problems since they are obligated at the same time to make decisions in such a way that risk is controlled, uncertainty minimized and where every decision made by them will ideally be beneficial to the project. This can be accomplished when the enterprise acquires a Project Management Information System as a mean to provide top managers with the essential tools that aid the decision making process with regards to selecting, planning, organizing, and controlling projects and portfolios (Haenlein & Kaplan, 2004).

The project management systems currently employed in the construction industry can be divided into two types. The first one is off-the-shelf commercial software, where projects are managed using Gantt Charts, the Program Evaluation and Review Technique (PERT) (Kerzner, 2005) and the Critical Path Method (CPM) (Woolf, 2007). These management techniques have quickly spread into many private enterprises. Thus, a lot of the related commercial software packages cater for the aforementioned techniques; examples include Microsoft Project, Primavera Project Planner and SAP. The second type of project management system is custom in-house software, when commercial software does not meet the particular requirements of an engineering project or firm; some firms will develop custom in-house project management software to meet their needs. Examples of this include Bechtel (Schmitz, 1991), Parsons Brinckerhoff (2004), Kajima (Nagasaki, *et.al*. 2000).

Traditional project management systems mainly provide text, basic graphs, and complicated network schedules for controlling projects and making decisions. Today's projects are becoming ever more complex and time driven, especially as the amount of project information and active project participants increases. Thus, we require more effective project tools for integration, management and communication. The question then arises about multidimensional information integration, management, and visualization of engineering projects.

It therefore follows that an effective project management system should not only provide sufficient and comprehensive information to facilitate project management, but also provide the various visualization tools to assist with information distribution and communication. Among various IT solutions, the internet-based (or web-based) Project Management Information Systems has been highlighted because of its strong advantages such as low cost compared with traditional communication methods, location-free access, speedy and reliable data transfer and storage, and efficient information sharing among parties (Tam *et.al*., 1999).

In Korea and Japan web based Project Management Information Systems is one of the most widely used tools that supports and enhances the collaboration and communication between construction project participants. The reason for the swift adoption of web-based Project Management Information Systems in the Korean and Japan construction industry closely relates not only to the above-mentioned advantages, but also to the well-established internet infrastructure and users' familiarity with web-based computing environment (Jung et al.,2004b). Besides these technical reasons, the Korean construction management guidebook specifies the use of Project Management Information System by construction managers hired by government or government agencies for efficient information management has strongly facilitated the adoption of web-based Project Management Information Systems in the Korean construction industry.

In England, there are two types of Project Management Information Systems in the construction field: One is that which is developed and used by individual construction companies. The other is the ASP (Application Service Provider)-based Project Management Information System which is developed for general construction projects but can be customized for specific construction projects. The former can be considered as one of the information systems (e.g. MIS and ERP systems, etc.) used in a company exclusively, while the latter are generally used by various project participants such as client, architect, constructor, sub-contractor and construction manager, and their quality is considerably more dependent on the capability of service providers (Stewart & Mohamed, 2004).

In South Africa, ERP systems are being used by construction companies to improve responsiveness in relation to customers, strengthen supply chain partnerships, enhance organizational flexibility, improve decision making capabilities and reduce project completion time and lower costs. These information systems are designed to integrate and partially automate many of the company’s business processes such as human resources, financial management, manufacturing, procurement, construction, operations and maintenance (Andrejs Tambovcevs 2011).

The use of these systems not only gives the firms competitive edge against their competitors but also enhances the effectiveness of construction projects throughout their life cycle and across the different construction business functions. According to (Kaiser et al., 2010) the use of Project Management Information System is based on the belief that their cost will be offset by the benefits that come along with it. They continue to say that the broadening of Project Management Information System scope enables organizations to not only manage individual projects but whole project portfolios. In general, Project Management Information System support most of the project life cycle phases from the idea generation, risk management, stakeholder management to the management of knowledge created long after the project completion.

PMIS as a part of IS refers to the tools and techniques used to gather, integrate, and disseminate the outputs of project management processes. It is used to support all aspects of the project from initiation through closing, and can include both manual and automated systems (PMI, 2008). This study focuses on influence of PMIS on performance of projects in Horizon construction company in Rwanda. In its design PMIS adoption is tied to the ICT literacy of the users, nature of organizational task and thus a critical evaluation of the workforce competency in usage of related ICT systems is valuable. Using PMIS has become necessary

to effectively and efficiently manage projects while supporting the project team to meet the constraints associated with projects. Although the use of PMIS in the management of projects is not a guarantee that projects will be successful PMIS have become a necessity in the management of all projects whether small or large, public or private. Therefore, the study aims at finding out the influence of PMIS on project performance using a case of construction company in Rwanda

1.2 Statement of the Problem

Construction projects are commonly acknowledged as successful when they are completed on time, within budget, and in accordance with specifications and to stakeholders' satisfaction. Owing to the technical and complex nature even with good designs and plans it is of paramount
importance that they are well managed if they are to be successful. According to latest reports from the Ministry of Infrastructure during the handover of Kigali Convention Centre, contractors give poor service through poor documentation, poor decision making and extension of time variation during project implementation leading to stalling of projects or total failure. According to the ministry official, project documents were available, but there was no evidence of a system for tracking implementation of plans contained in the documents or even a repository of data relating to the projects in progress.

For instance, report on March, 2014 by Edwin Musoni an editor of new times projects in Rwanda fail as a result of initial contractor failing to deliver project on time.

For instance, the construction of Kigali Conventional Centre whose construction budget was initially Usd 226 million but eventually consumed Usd 500 million; an amount that the Ministry of infrastructure attributed to inflation and additional works on the road. The project overshot its budget by Usd 274 million due to inflation and additional features that changed the original design work. These additional works were either initially ignored or were not well planned to fit into the overall project plan without pushing the cost higher and increasing the time initially set.

Another project was the construction of Nyabarongo I hydro power project whose contract commencement date was on May 2009 with an expected completion date of February 2013. But the project incurred two deadline extensions; April 2014, and finally October 2014 which counts to about 20 months' extra time to the initial set deadline.

With the advent of computer software that facilitate the process of decision making, data irretrievability (for better documentation), timeliness of information and general project planning. The use of PMIS can potentially improve documentation, better decision making based on accurate information from the database and helps in time and cost management (Kaiser & Ahlemann, 2010).

In Rwanda Higiro 2015, investigated influence of implementation factors on effective delivery of energy projects in Rwanda. He recommended a research on the influence of PMIS on project performance and thus the researcher want to fill the gap by establishing the influence of Project Management Information System on project performance in the construction industry using the case of Horizon Construction Company.

1.3 Objectives of the study

1.3.1 General objective

The general objective of the study was to establish the influence of Project Management Information System on project performance in the construction industry: A case of Horizon Construction Company

1.3.2 Specific objectives

This study was guided by the following research objectives:

1. To determine the influence of Project Management Information software on performance of construction project.
2. To establish the influence of quality information on the performance of construction project.
3. To assess the influence Project Management Information System user on performance of construction project.
4. To determine the influence of Project Management Information System, use on performance of construction projects.

1.4 Research questions

The study was guided by the following research questions:

1. How does Project Management Information software influence of performance of construction project?
2. To what extent does the quality of information Influence the performance of construction projects?
3. In what ways does the Project Management Information System user influence performance of construction projects?
4. To what extent does the Project Management Information System use influence the performance of construction projects?

2.0 Literature Review

2.1 Empirical review

In the project management literature, the definition of project has been discussed by numerous literatures, for instance, PMI (2000) define projects as 'a temporary (definitive beginning and definitive end) endeavor undertaken to create a unique (projects involve doing something that has not been done before) product or service'. (Cleland, 2004) describe a project as "a combination of organizational resources pulled together to create something that did not previously exist and that will provide a performance capability in the design and execution of organizational strategies". Some authors describe Project Management tool as "software for project management" (Fox, Murray *et al*., 2003), while others view them as "systematic procedures or practices that project managers use for producing specific project management deliverables" (Milosevic, 2003). Thus the core of a Project Management Information System is usually project management software which involves wide alteration, configuration or customization before to its applied. Besner, (2009) declared that projects nowadays are most often used in information technology (IT), software development, business process reorganization and research and development. Essentially, the task of Project Management Information System has been described as "subservient to the attainment of project goals and the implementation of project strategies", it supplies project managers with "essential information on the cost, time performance parameters of a project and on the interrelationship of these parameters" (Raymond L., 1987).

In the information technology (IT) industry, Gartner Research estimates that 75% of large IT projects managed with the support of a project management information systems will succeed, while 75% of projects without such support projects will fail (Light, *et.al*., 2005). However, literature still shows only a small

number of researches on the utilization of Project Management Information System that highlight the demographics of project management tools and to assessing particular functions of these tools to maintain a particular task during project management life cycle such as planning, communicating and reporting, managing risks, scheduling, estimating costs, and managing documents (Herroelen, 2005; Love and Irani 2003).

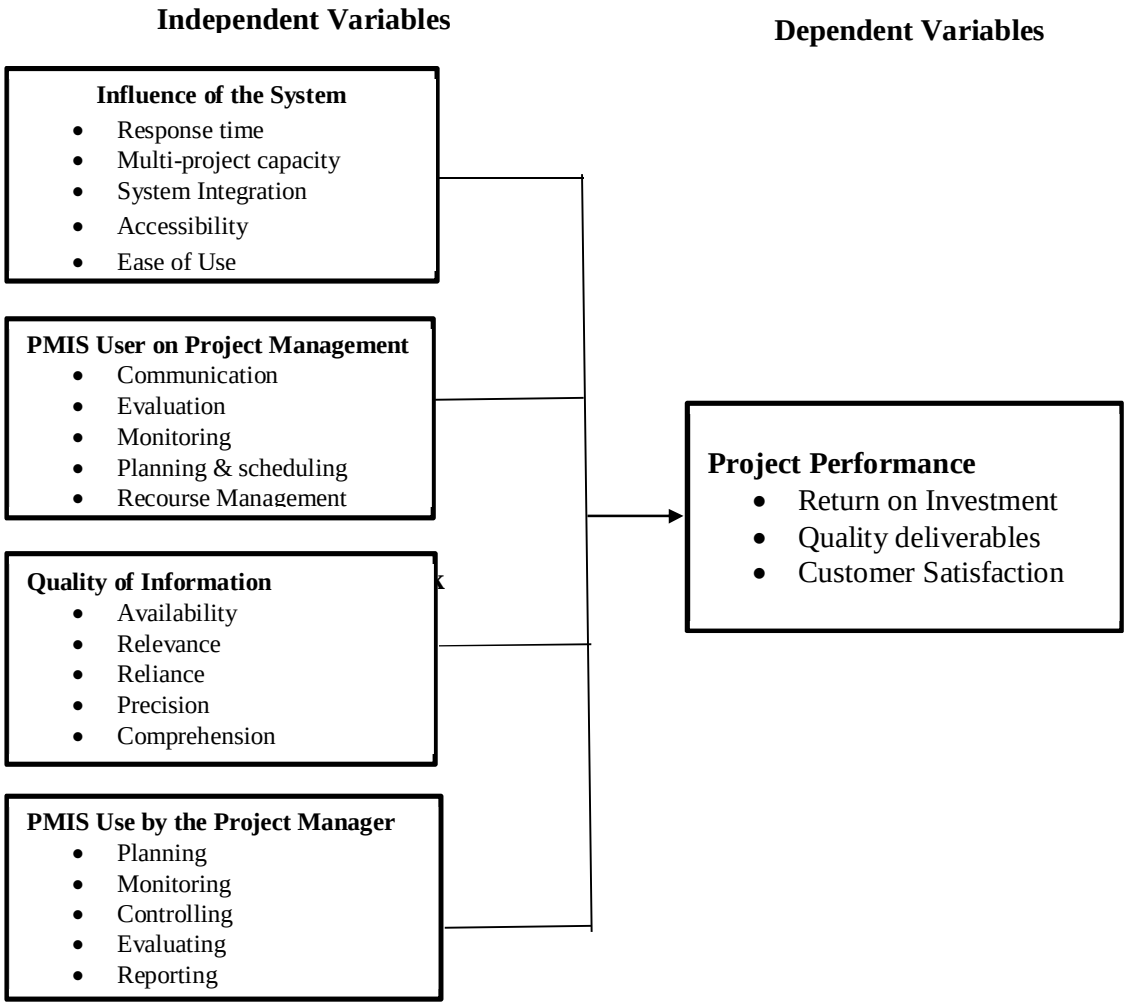
Information systems are developed using Information technology to assist people in performing their tasks. Project Management Information System is an example of these Information Systems and are widely regarded as an important building block in project management. These systems have continued to evolve from just being planning, scheduling and resource management information systems to complex, distributed, multi-functional systems that can easily generate information necessary to make decisions, improve the efficiency of implementation among other functions within the project life cycle. What sets Project Management Information System apart from other classes of information system is the highly volatile nature of their usage context i.e. project environments, and as such they need to be more customizable in their functionality than most other enterprise information systems (Ali *et al*., 2008).

Notwithstanding the theoretical and practical importance of Project Management Information System to the project management field, there have been as of yet few studies on the actual use and impacts of these systems, thus highlighting the need to extend project management theory in relation to the developing practice in this regard. Empirical studies of Project Management Information System have been mostly limited to describing the demographics of project management software usage and to evaluating specific applications of these systems or software modules to support project management tasks such as planning, communicating and reporting, managing risks, scheduling, estimating costs, and managing documents.

Project management software usage has also been found to have many drawbacks and limitations, both in theory when compared to an ideal Project Management Information System by researchers and in practice as perceived by project managers. An IS-based conceptualization and definition of project management software facilitates the import of knowledge from the IS field or discipline, knowledge that can provide a deeper understanding of the Project Management Information System usage phenomenon and help in answering questions on the factors that explain the use and non-use of Project Management Information System, and on the actual impacts of these systems on project managers and project performance.

2.2 Conceptual Framework

Mugenda and Mugenda (2003), define a conceptual framework as a hypothesized model identifying the concepts under study and their relationships. It is a set of broad ideas used to explain the relationship between the independent variables (factors) and the dependent variables (outcome) (Coulthard, 2004). The conceptual frame work of this study is based on four variables namely; Project Management Information System software on the performance of construction project; quality information on the performance of construction project; Project Management Information System user on performance of construction project and Project Management Information System use on performance of construction projects.



This research used descriptive research design. Descriptive design is normally used when collecting information about people's attitudes, habits or opinions on the issues under study (Heppner *et al* 2008). This research design was preferred because it would bring about deeper insights and better understanding of the perceived influence of project management information system in the performance of construction companies in Rwanda. It adopted a case study survey. A case study involves careful and complete observation and analysis of a unit in its relationship to any other unit in the group (Kothari, 2004). A survey design is associated with a guided and quick collection, analysis and interpretation of observation (Mugenda & Mugenda, 1999).

3.2 Target population

The target population of this study comprised of 110 employees of Horizon Construction Company. These included project managers, construction managers, engineers and technicians as well as selected project team under Horizon Construction Company.

3.3 Sample size and sampling procedure

Churchill and Brown (2004) noted that the correct sample size in a study is dependent on factors such as the nature of the population to be studied, the purpose of the study, the number of variables in the study, the type of research design, the method of data analysis and the size of the accessible population. A sample size

of 86 respondents was determined from a total population of 110 individuals using the formula by Yamane (1967). Stratified random sampling technique will used to select the project team members. Stratified random sampling technique ensure that different groups of a population are adequately represented in the sample. Stratified sampling divides the population into homogeneous groups such that the elements within each group are more alike than the elements in the population as a whole (Nachimas and Nachimas 2008).

$$n = \frac{N}{1 + N\,(e)^2}$$

Where n = the desired sample size

e= probability of error (i.e., the desired precision, e.g., 0.05 for 95% confidence level)

N=the estimate of the population size.

$$n = \frac{110}{1 + 110\,(0.05)^2} = 86$$

3.3.1 Sample frame

Sampling frame is a list of all the population subjects that the researcher had targeted during the study. Using the Yamane's formula, the proportions of the sample size the computed sample strata are shown in Table 3.1. The sample size for this study was 86 respondents. The sample size of project managers, construction managers, engineers and technicians as well as selected project team under Horizon Construction Company.

Table 55 Sampling Frame

Area of Operation	**Population**	**Proportions**
Project managers	35	27
Construction managers	15	12
Engineers	14	11
Project team	30	23
Technicians	16	13
Total	**110**	**86**

3.3.2 Sampling Procedure

Purposive sampling was used to select the sample from target the population. Expert judgment and knowledge of roles in the organization was used to select participants that are a representative of the population.

4.0 RESEARCH FINDINGS AND DISCUSSION

4.1 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 company. The results are shown in Table 3 below**.**

Table 3: Respodents views on Project Management Information System Software

	Mean	Range	Standard deviation
Accessibility	3.00	3.245	.869
Response Time	3.00	3.032	.893
Ease of use	3.00	3.114	1.050
Querying use	3.00	3.114	.984
Flexibility	3.00	3.262	.911
Learning Ease	3.00	3.557	1057
System Integration	3.00	3.623	1.002
Multi-project Capability	3.00	3.475	1.177

From 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. This means that the managers agree that PMIS play a key role and therefore integration is vital. The respondents also agree with a mean of 3.475 and a standard deviation of 1.777 that multi-project capability is moderate in the organization. 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. and the general performance of response time was moderate as shown by a mean of 3.032 and a standard deviation of 0.893. The findings reveal that PMIS should be developed to be more user friendly to increase flexibility, querying ease and also enhance multi-project performance.

4.2 Quality of Information

The quality of generated information was measured using six items which included availability, reliability, relevance, precision, comprehensiveness and security. 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 in table 4 below.

Table 4: Respodents views on Quality of Information

	Range	Mean	Std. Dev
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

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.

Availability, reliability, relevance of information which were highly effected by using PMIS are very key aspects of information with regard to making informed decisions for project success. Therefore, the study reveal that PMIS generate all the pivotal aspects of information importance for making informed decisions.

4.3 The System User

The study sought to assess the influence Project Management Information System user on performance of construction project. The respondents were asked to indicate the extent to which they agreed that the quality of information produced by Project Management Information System in use influences Project performance in various activities highlighted. The findings are presented in Table 5 below.

Table 5: Respodents views on the System User

	Range	Mean	S. Deviation
Better communication	3.00	3.278	.733
Better evaluation	3.00	3.377	.756
Improved planning of activities	3.00	3.623	.710
Better monitoring of activities and project schedule	3.00	3.852	.726
More efficient resource allocation	3.00	3.541	.992

The findings indicate, the respondents agreed with a mean of 3.852 and a standard deviation of 0.726 that better monitoring of activities produced by project management information system in use often influences the project performance. Also, the respondents agreed with a mean of 3.688 and a standard deviation of 0.885 that better planning of the project schedule produced by project management information system in use often influences the project performance. Furthermore, the respondents agreed with a mean of 3.541 and a standard deviation of 0.992 that more efficient resource allocation produced by project management information system in use often influences the project performance.

In addition, the respondents agreed with a mean of 3.377 and a standard deviation of .839 that project evaluation using project management information system occasionally influences the project performance. They also agreed with a mean of 3.278 and a standard deviation of 0.819 communication using the system occasionally influences the project performance. The use of PMIS helped project managers to achieve higher project performance in terms of monitoring, allocation of resources, planning and communication which are key elements for project success.

4.4 The System Use

The use of the Project Management Information System was measured by establishing the degree to which various system functions and their associated tools were actually used by project managers (Raymond, Bergeron 2007). The PMIS functions were divided into five categories: planning function tools, monitoring function tools, controlling function tools, evaluating function tools and reporting function tools. The results were as shown below.

4.4.1 Planning Function Tools

The respondents were asked to indicate how often various planning function tools were utilized within the Project Management Information System in project implementation in their organizations. The results are presented in Table 6 below.

Table 6: Respodents views on planning function tools

Planning Function Tools	Range	Mean	S. Deviation
Work Breakdown Structure	4.00	3.409	.972
Resource Estimation	3.00	3.426	.902
Overall Schedule	4.00	3.000	.894
Gantt	3.00	3.573	.717
PERT	4.00	3.377	1.011
CPM	3.00	2.688	1.026

According to the findings, the respondents indicated with a mean of 3.573 and a standard deviation of 0.717 that Gantt was often utilized in project implementation in their organizations. In addition, the respondents indicated with a mean of 3.426 and a standard deviation of 0.902 that resource estimation was occasionally utilized in project implementation in their organizations. Further, the respondents indicated with a mean of 3.409 and a standard deviation of 0.972 that work breakdown structure was occasionally utilized in project implementation in their organizations occasionally. In addition, the respondents indicate with a mean of 3.377 and a standard deviation of 1.019 that PERT was occasionally utilized in project implementation in their organizations. Additionally, the respondents indicated with a mean of 3.000 and a standard deviation of 0.894 that the overall schedule was occasionally utilized in project implementation in their organizations. Lastly, the respondents indicated with a mean of 2.688 and a standard deviation of 1.025 that CPM was occasionally utilized in project implementation in their organizations.

4.4.2 Controlling Function Tools

The respondents were asked to indicate how often various controlling function tools were utilized within the Project Management Information System in project implementation in their organizations. The results are presented in Table 7 below.

Table 7: Respodents views on controlling function tools

	Range	Mean	S. Deviation
Fine-Tune Forecasting	2.00	3.541	.621
Modify Tasks	2.00	2.688	.592
Reassign resources to lower the costs	4.00	2.639	1.316
Cancel tasks	3.00	2.098	1.106
Modify cost of resources	3.00	2.688	1.008

According to the findings, the respondents indicated with a mean of 3.541 and a standard deviation of 0.621 that fine-tune forecasting is often utilized in project implementation in their organizations. Further, the respondents indicated with a mean of 2.688 and a standard deviation of 0.592 that modifying tasks was occasionally utilized in project implementation in their organizations. Additionally, the respondents indicated with a mean of 2.688 and a standard deviation of 1.009 that modifying cost of resources was occasionally utilized in project implementation in their organizations.

The respondents also indicated with a mean of 2.639 and a standard deviation of 1.316 that reassigning resources to lower the costs was occasionally utilized in project implementation in their organizations. Lastly, the respondents indicated with a mean of 2.098 and a standard deviation of 1.106 that cancelling tasks was rarely utilized in project implementation in their organizations

The finding shows that PMIS are an important control tool in project success. This is paramount to ensure projects are completed within the stipulated time, budgets and scope.

4.4.3 Monitoring Function Tools

The respondents were also requested to indicate how often various monitoring function tools were utilized within the Project Management Information System in project implementation in their organizations. The results are shown in Table 8 below.

Table 8: Respodents views on monitoring function tools

	Range	Mean	S. Deviation
Project Reports	3.00	3.852	.980
Completed Tasks	4.00	3.245	1.043
Percent Project Completed	4.00	3.000	1.140
Effective Schedule	4.00	2.557	1.147
Remaining Tasks	4.00	3.442	.992
Remaining days to complete	3.00	3.573	.902

According to the findings, the respondents indicated with a mean of 3.852 and a standard deviation of 0.980 that project reports were often utilized in project implementation in their organization. Also, the respondents indicated with a mean of 3.573 and a standard deviation of 0.902 that the remaining days to complete a project were often utilized in project implementation in their organization. Also, the respondents indicated with a mean of 3.442 and a standard deviation of 0.992 that remaining tasks were occasionally utilized in project implementation in their organizations. In addition, the respondents indicated with a mean of 3.245 and a standard deviation of 1.043 that the completed tasks were occasionally utilized in project implementation in their organizations. Further, the respondents indicated with a mean of 3.000 and a standard deviation of 1.140 that percent project completed was occasionally utilized in project implementation in their organizations. Lastly, the respondents indicated with a mean of 2.557 and a standard deviation of 1.147 that effective schedule was occasionally utilized in project implementation in their organizations.

In monitoring the progress of projects, the findings have proved that PMIS play a crucial role in providing report to managers with regard to remaining time before completion, completed tasks the remaining tasks. This enables the managers to keep truck and make necessary adjustments for project success.

4.4.4 Evaluating Function Tools

The respondents were asked to indicate how often various evaluating function tools are utilized within the Project Management Information System in project implementation in their organizations. The results are presented in Table 9 below.

Table 9: Respodents views on evaluating function tools

	Range	Mean	Std. Dev
Identification of costs	2.00	3.508	.595
Identification of Schedule variation	2.00	3.098	.568
Tracking the use of Resources	2.00	3.065	.853

According to the findings, the respondents indicated with a mean of 3.508 and a standard deviation of 0.595 that identification of costs was often utilized in project implementation in their organizations. In addition, the respondents indicated with a mean of 3.098 and a standard deviation of 0.568 that the identification of schedule variation was occasionally utilized in project implementation in their organizations. Lastly, the respondents indicated with a mean of 3.065 and a standard deviation 0.853 that tracking the use of resources was occasionally utilized in project implementation in their organizations.

4.4.5 Reporting Function Tools

The respondents were also asked to indicate how often various reporting function tools are utilized within the Project Management Information System in project implementation in their organizations. The results are shown in Table 10 below.

Table 10: Respodents views on reporting function tools

	Range	Mean	S. Deviation
Overview of the Project	3.00	3.754	.649
Overview of the work-in-progress	3.00	3.377	.819
Budget overruns	2.00	2.901	.568
Task and schedule slippage	3.00	2.672	.700

From the findings, the respondents indicated with a mean of 3.754 and a standard deviation of 0.649 that the overview of the project was often utilized in project implementation in their organizations. Additionally, the respondents indicated with a mean of 3.377 and a standard deviation of 0.819 that the overview of the work-in-progress was occasionally utilized in project implementation in their organizations. Also, the respondents indicated with a mean of 2.901 and a standard deviation of 0.568 that budget overruns were occasionally utilized in project implementation in their organizations. Lastly, the respondents indicated with a mean of 2.672 and a standard deviation of 0.700 that the task and schedule slippage was occasionally utilized in project implementation in their organizations.

4.5 Project Performance

The respondents were asked to rate the impact of PMIS on the general project performance. The findings are shown in Table 11 below.

Table 11: Respodents views on Impact of PMIS on Project Performance

	Range	Mean	S. Deviation
Return on investment	3.00	3.278	.755
Customer satisfaction	1.00	2.721	.452
Meeting Quality Specification	3.00	2.639	.817

According to the findings, the respondents indicated with a mean of 3.278 and a standard deviation of 0.755 that return on investments was moderate indication of the general project performance. This means that the software contributes greatly in boosting the return on investment for instance by reducing time of completion, efficient resource allocation. Also, the respondents indicated with a mean of 2.721 and a standard deviation of 0.452 that customer satisfaction was moderate indicator of the general project performance. Lastly, the respondents indicated with a mean of 2.639 and a standard deviation of 0.817 that meeting quality specification had a moderate contribution as well on the general project performance.

4.6 Correlation Analysis

A correlation is a number between -1 and +1 that measures the degree of association between two variables. A positive value for the correlation implies a positive. A negative value for the correlation implies a negative or inverse association. The data presented on the system, quality of information, project management information system user and project management information system use were computed into single

variables per factor by obtaining the averages of each factor. Pearson's correlations analysis was then conducted at 99% confidence interval and 1% confidence level 2-tailed. The Table 12 below indicates the correlation matrix between the factors (system, quality of information, PMIS user and PMIS use) and performance of construction projects.

Table 12: Correlation Matrix

		Project Performance	**The system**	**Quality of Information**	**PMIS use**	**PMIS user**
Project performance	Pearson Correlation	1				
	Sig. (2-tailed	.000				
	N	80				
Project management information system	Pearson Correlation	.925**	1			
	Sig. (2-tailed	.000				
	N	80	80			
Quality of Information	Pearson Correlation	.925**	.979**	1		
	Sig. (2-tailed	.000	.000			
	N	80	80	80		
PMIS use	Pearson Correlation	.941**	.977**	.980**	1	
	Sig. (2-tailed	.000	.000	.000		
	N	80	80	80	80	
PMIS user	Pearson Correlation	.914**	.945**	.968**	.953**	1
	Sig. (2-tailed	.000	.000	.000	.000	
	N	80	80	80	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

From the correlation analysis, it can be deduced that there is a positive relationship between the project management information system and project performance, where the correlation coefficient was 0.925 and a p-value of 0.000. The findings indicate that the quality of information and project performance correlate positively with correlation coefficients of 0.925 and p-value of 0.000. The study further established that there is a positive relationship between project management information system use and project performance with a correlation coefficient of 0.941 and p-value of 0.000. Lastly, the study found that there is a positive relationship between the project management information user and project performance with a correlation coefficient of 0.914 and a p-value of 0.000.

These findings clearly show that all the four independent variables (Project management information system, Quality of Information, PMIS use and PMIS user) had a significant influence on the dependent variable (project performance). This is because the p-value in all the relationships was 0.000 which is less than the alpha value (level of significance) 0.01. From these findings we can infer that Project management information system and Quality of Information had the most significant influence on project performance followed by project management information system use and project management information system user.

5.0 Conclusion

PMIS 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. When tasks are best performed project success is achieved. It is recommended that organizations should adopt the use of PMIS in the management of their projects. PMIS guarantees better management of project since it generates quality information needed for the management of the project.

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 Rwanda. 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.

5.1. Recommendations

This research report recommends that since there is significant relationship between project management software, quality of information, system user and system use with regard to project performance, in construction companies:

1. Organization 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 and decision making.
2. The results of this research show that the use of a project management information system is advantageous to project managers (PMIS Users). 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.

5.2. 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 indecision making in a multi-project environment. This is because increasing numbers of organizations are facing the complexity of multi-project management. Research on this subject is scarce, mainly focusing on specific aspects or single project management information support.

REFERENCES

1. Ahlemann F, Backhaus K. (2006) *Project management software systems – requirements, selection processes and products.* Wu¨rzburg: BARC. Caruana, (2002) *Service loyalty: The effects of service quality and the mediating role of customer satisfaction,* European Journal of Marketing 36 (7/8) 811–828.
2. Ali, A.S.B., Anbari, F.T. and Money, W.H. (2008). *Impact of Organizational and Project Factors on Acceptance and Usage of Project Management Software and Perceived Project Success.* Project Management Journal, 39 (2), 5-33.
3. Besner C., Hobbs B. *An Empirical Investigation of Project Management Practice,* A Summary of the Survey Results: PMI.
4. B. Ives, M.H. Olson, *User involvement and MIS success: a review of research, Management Science* 30 (5) (1984) 586–603.
5. Burns, R.B. and Burns, R.A. (2008), *Business Research Methods and Statistics using SPSS*, New Delhi: SAGE Publications Ltd.
6. B.Y. Chung, M.J. Skibniewski, H.C. Lucas, Y.H. Kwak, *Analyzing Enterprise Resource Planning System Implementation Success Factors in the Engineering, Construction Industry,* Journal of Computing in Civil Engineering 22 (6) (2008) 373–382.
7. B.Y. Chung, M.J. Skibniewski, Y.H. Kwak, *Developing ERP Systems Success Model for the Construction Industry,* Journal of Construction Engineering and Management 135 (3) (2009) 207–216.
8. Caldwell, R. 2004, *Project Management Information System: Guidelines for Planning, Implementing, and Managing a DME Project Information System,* 1st edn, CARE, New York.
9. Caniëls, M.C.J., Bakens, R.J.J.M., *The effects of Project Management Information Systems on decision making in a multi project environment,* International Journal of Project Management (2011)
10. Cant, C., Gerber-Nel, D., Nel, M and Kotze, T. (2011). *Marketing Research*, Claremont: New Africa Education.
11. Churchill, G. A. and Brown, T.J. (2004). *Basic Marketing Research*, Ohio: Thompson Corporation. Community Economic Vitality." *Community Development Journal*. 39 (4): 385-400.
12. Cleland, D.I. 2004b, "Project Management Information System" in *Project Management: Strategic Design and Implementation*, 5th edn, McGraw-Hill International Editions, Singapore, pp. 349.
13. C. Howard, R.E. Levitt, B. Paulson, J.G. Pohl, C.B. Tatum, *Computer integration: reducing fragmentation in AEC industry,* Journal of Computing in Civil Engineering 3 (1) (1989) 18–32.
14. Chiesa, V., *Globalizing R&D around centers of excellence. Long Range Planning*, 1995, 28(6),
15. Ciborra, C. U., *The platform organization: recombining strategies, structures, and surprises. Organization Science*, 1996, 7(2), 103±118
16. C.M. Tam, *Use of the Internet to enhance construction communication: Total Information Transfer System*, International Journal of Project Management 17 (2) (1999) 107–110.
17. Cooper, R. G., Scott, J., & Kleinschmidt, E. J. (2001). *New Problems, New Solutions: Making Portfolio Management More Effective*. Journal of Product Innovation Management, 18(1), 52-53.
18. Cooper, D.R & Schindler, P.S (2003). *Business Research Methods.* New York: Mc.
19. Denscombe, M. (2003), *The Good Research* Guide *(2nd Edition)*, Buckingham: Open University Press.
20. E.Y. Li, *Perceived importance of information system success factors: A meta-analysis of group differences, Information Management* 32 (1) (1997) 15–28.

21. Fox, J. and Murray, C. (2003), *Conducting Research Using Web Based Questionnaires: Practical, Methodological, and Ethical Considerations'*, International Journal of Social Research Methodology, 6(2), 167180.
22. Havelka, D., & Rajkumar, T.M. (2006), *Using the troubled project recovery framework: Problem recognition and decision to recover*. eservice Journal, 5(1), 4373.
23. Herroelen W. (2005), *Project scheduling theory and practice*. Prod Oper Manage, 14(4):41332.
24. Hillebrandt, P. (2000), *Economic Theory and the Construction Industry*, Third Edition, Macmillan, London.
25. H.G. Park, *Study on Development and Application case of Web-based Project information management System in SOC project*, KSCE Journal of Civil Engineering 25 (2) (2005) 297–304.
26. J.H. Yoon, S.W. Yoon, S.Y. Chin, Y.S. Kim, *A Survey of the satisfaction level of construction information system from users' viewpoints on construction site*, Journal of Korea Institute of Construction Management 7 (4) (2006) 126–136.
27. Jung, Y., Kim, H., & Joo, M. (2011), *Project Management Information Systems for Construction Managers (CM):* Current Constituents and Future Extensions.
28. Jung, Y., Chin, S., and Kim, K. "*Formalization Index for the Construction Industry*", Journal of Computing in Civil Engineering, 18(3), pp. 267-276, 2004b
29. Kaiser, M. G., & Ahlemann, F. (2010). *Measuring Project Management Information Systems Success:* Towards a Conceptual Model and Survey Instrument.
30. Krejcie, R.V., & Morgan, D.W., (1970). *Determining Sample Size for Research Activities*. Educational and Psychological Measurement.
31. Lee, S. K., & Yu, J. H. (2011). *Critical Success Factors for Project Management Information System in Construction*. KICEM Journal of Construction Engineering and Project Management (2011) Online ISSN 2233-9582.
32. Liberatore M. J, Pollack Johnson B. (2003), *Factors influencing the usage and selection of project management software*. IEEE Trans Eng Manage
33. Light M, Rosser B, Hayward S. (2005), *Realizing the benefits of projects and portfolio management*. Gartner, Research ID G00125673, 131.
34. Love P.E.D and Irani Z. (2003). *'A project management quality cost information system for the construction industry'*. Information and Management, 40(7): 649661.
35. L. Raymond, F. Bergeron, (2008). *Project Management Information Systems: An Empirical Study of Their Impact on Project Managers and Project Success*, International Journal of Project Management 26 (2)
36. Korean Ministry of Land, (2003). *Transport and Maritime Affairs, The construction management guidebook*, 2001 M.C. Hurtado, New survey points to spending growth, ENR 246 (21).
37. M. Fishbein, I. Ajzen, (1975). *understanding attitudes and predicting social behavior*, Prentice-Hall, New Jersey,
38. M. Hjelt, B.C. Björk, (2007) *End-User Attitudes toward EDM Use in Construction Project Work: Case Study*, Journal of Computing in Civil Engineering 21 (4).
39. Milosevic, D. (2003), *Project management toolbox: tools and techniques for the practicing project manager*, Hoboken, NJ: John Wiley and Sons.
40. Mugenda, O., Mugenda, A. (1999). *Research Methods: Quantitative and qualitative approaches. Nairobi*: African center for technology studies.

41. Orodho, A., J (2003). *Essentials of Educational and Social Science Research Methods*. Nairobi: Mazola Publishers. Project Management Knowledge. (2010). *Project management Information Systems (PMIS).*
42. Pinkerton, WJ 2003; *Project Management: achieving project bottom-line success,* McGraw-Hill
43. New York. P. Nitithamyong, M.J. Skibniewski, (2004). *Web-based construction project management systems: how to make them successful?* Automation in Construction 13 (4) 491–506.
44. Raymond, L. & Bergeron, F. (2007). *Project Management Information Systems: An empirical study of their impact on project managers and project success*. International Journal of Project Management Vol. 26 (2008), pp. 213-220 (2007).
45. S.C. Lin, S.S. Tseng, W.G. Tzeng, S.M. Yuan, (2006). *A Framework of High-Confidence e-Healthcare Information System*, Asian Journal of Health and Information Sciences 1 (2) 176–188.
46. Seddon, P., & Kiew, M.-Y. (1994). *A Partial Test and Development of the DeLone and McLean Model of IS Success.* Paper presented at the International Conference on Information Systems (ICIS), University of Melbourne, Australia.
47. Shenhar AJ, Levy O, Dvir D; 1997*Mapping the dimensions of project success.* Project Manage 28(2):5–13.
48. S.K. Lee, H.L. Lee, J.H. Yu, (2010) *The Effect of PMIS Quality on Project Management Success,* Journal of Korea Institute of Building Construction 10 (3) 117–126.
49. S-K. Lee, J-H. Yu, *Success model of project management information system in construction,* Automation in Construction 25 (2012) 82–93.
50. Stewart, R. A and Mohamed, S. *Evaluating 2204, Web – Based Project Information Management in Construction: capturing the Long-term value creation process,* Automation in construction. 13(4), pp.469-473, 2004.
51. White D, Fortune J. 2001. *Current practice in project management – an empirical study*. Int. J Project Manage; 20:1–11.
52. W.H. DeLone, E.R. McLean, *Information system success: The Quest for the Dependent Variable,* Information Systems Research 3 (1) (1992) 60–95.
53. Z.M. Deng, H. Li, C.M. Tam, Q.P. Shen, P.E.D. Love, (2001). *An application of the Internet based project management system,* Automation in Construction 10 (2) 239–246.