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THE EFFECT OF PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS) ON CONSTRUCTION PROJECT SUCCESS: A CASE OF RAMA CONSTRUCTION PLC.

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A Thesis submitted to Addis Ababa University, School of Commerce in partial fulfillment of the requirements of the degree of Master of Arts in Project Management (MAPM)

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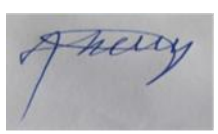
Abdu Muhammed (PhD)		21/7/22
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Declaration

I hereby declare that the project thesis entitled "*The Effect Project Management Information System (PMIS) on Construction Project Success: A Case of Rama Construction Plc.*", has been carried out by me under the guidance and supervision of Wubeshet B. (Ph.D.). The thesis is original and has not been submitted for the award of any degree or diploma to any university or institution.

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Certificate

This is to certify that the thesis entities " *The Effect of Project Management Information System (PMIS) on Construction Project Success: A Case of Rama Construction Plc.*", submitted to Addis Ababa University School of Commerce for the award of degree in Master of Project Management and is a record of bona fide research work carried out by Mr. Surafel Tezera, under my guidance and supervision.

Therefore, I hereby declare that no part of this thesis has been submitted to any other university or institution for the award of any degree or diploma.

Advisor Name	Date	Signature
______________________	______________________	______________________

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Acronyms Used

Abstract

Construction projects usually need proper attention in terms of cost, quality, and time which in turn helps project stakeholders achieve the required success. However, the industry is highly characterized by project delay, failure, and abonnements. Studies in the area showed that in Ethiopia close to 93% of the total projects in the country experienced cost overruns and time overruns. Moreover, the industry by itself calls for the participation of more than two stakeholders. The purpose of this paper was to explore the effect of Project Management Information systems (PMIS) on construction project success; a case of Rama Construction Plc. Moreover, the study considered the influence of System quality, Information quality, and Service quality and PMIS use (Planning, Controlling, Monitoring, Evaluating, and reporting) (independent variables) in success of construction project (dependent variable). A descriptive survey was used for conducting the study. Both quantitative and qualitative survey tools were used to collect the data from respondents. The target population of the study was 71 and a census inquiry was conducted through google format questionnaire. Out of which only 88.7 % of the responded questionnaires were analyzed. The validity and reliability of the research instrument were ascertained using the relevant research instruments. Descriptive statistics and Correlation (using Karl Pearson's coefficient of correlation) were used to analyze the data and establish the relationship between the dependent variables and the set of independent variables using the SPSS version 28 software. The four predicator variables were found to have a positive correlation with the dependent variable (Project Success). Moreover, multiple linear regression analysis revealed that Information quality and PMIS use significantly associated with project success whereas the other two constructs(System quality and Service quality) were not significantly associated. The research also found that Individual and organization readiness did not have any moderating effects on Project success except the interaction variables of PMIS use and Organizational readiness with sig. value .024 .

Key words: PMIS, system quality, Information Quality, Service Quality, PMIS Use, Project success

Chapter 1: Introduction

1.1 Background

Information management, as defined by APMBOK, is the collection, storage, dissemination, archiving, and destruction of information to the appropriate stakeholders. Effective information management has a substantial role in making reliable decisions, which in turn saves the unnecessary cost and time spent in the organization (APM Body of Knowledge,2012). Moreover, it gives an extensive range in the organization arena to use its expertise and other resources efficiently as well. Information can come from different sources, stored in different formats, and also distributed to many concerned individuals. The information delivered to these individuals may be in physical or electronic format. These days, as information becomes the lifeblood of most business organizations, information management is not becoming a question or the put aside issue for any organization (Education Management corporation: EMC education services,2009). Accordingly, information management is a competitive tool for any organization not only to become profitable in its industry but also serves as the baseline for the continuity of the organization in its business environment (Zhang, 2017).

Project management as a discipline undergoes multiple processes which include initiating, planning, executing, controlling and monitoring, and project close-up (Salih, 2020). All these processes need information as input to make projects successful. Project-based tasks must be highly dependent on information management as projects are usually time and cost bounded (Kaiser and Ahlemann, 2010; Teixeira et al., 2016). The project management team needs to collect raw data first and transform the data into information through interpretation analysis and presentation as the information management process starts with data collection and creation and its conversion into information. Moreover, the global immense association with information systems in any sector is becoming the fashion of the day. Hence, adopting a well-suited information management system is also imperative in the project management extent(Bhagwate and Nagare, 2015). It is due to this motive that the project management book of knowledge highly suggested project stakeholders to implement a Project management information system (PMIS) in each process of every project.

Pursuant to PMBOK® Guide 5th edition, a Project Management Information System (PMIS) is an information system consisting of 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 initiating through closing and can include both manual and automated Information Systems Technology (IST) software tools, such as scheduling software tools, work authorization systems, configuration management systems, information collection and distribution systems, as well as interfaces to other online automated systems such as corporate knowledge base repositories. Automated gathering of information, processing and reporting on key performance indicators (KPI) can be part of this system as well. Hence, PMIS defines the program and the projects: cost, time, scope, and quality. It defines the team: people, organizations, and their roles. It helps to manage contracts, agreements, licenses, endorsements, and obligations. It manages documents. It produces ordinary and predictable reports. It presents vital signs on dashboards. It guides collaboration and communicates best practices with policies, workflow diagrams, and document management (Zambare & Dhawale,2017).

It is a well-known fact that organization around the globe is becoming highly dependent on the software application to automate the project management process (Micale et al., 2021). More concerns are also given to improving the accuracy of the data-based project's outputs and reports. In addition, the main responsibilities of project management like maintaining different registers and documenting the lesson learned are becoming simpler by deploying different PMIS applications (Abdul Qadir Obeidat and Hameed Aldulaimi, 2016a). Different organizations also using more sophisticated applications globally to compete and become successful in their industries. The projects managed in each industry are also highly supported by project management software. Due to these mere facts, the project management software market also becoming fierce around the globe, especially between Microsoft, Oracle, Meridian, Autodesk, Aconex, RIB Software, Huddle, and a few others (V. Brown, DeHayes et al.,2012)

The construction industry is one of the many major industries in which various projects are involved in it and the concern of this paper. The industry also experiences extensive time and cost overwhelms as contrasted with other industries' projects (Hareru et al., 2016; Tesfahunegn, 2004). Construction projects are time and cost limited. Each task has foreordained span with characterized start and culmination time and with definite budgeted cost. In this way, projects are expected to be performed in a pre-laid out schedule, defined plan and objectives, reasonable budgeted cost, and with the required quality to keep up with specified variables (issues) and meet stakeholders' demands(Mengistu and Mahesh, 2019) . The undertaking task usually may not go flawlessly as arranged because of many incidents that make it go out of its schedule and beyond the budgeted cost. Delays, which are the significant reason for claims, may happen because of unanticipated site conditions; expansion in extent of work, material price escalation, bureaucratic work styles, and others (Sweis et al., 2008).

In underdeveloped nations, like Ethiopia, the cost and time overrun are becoming expected phenomena but the question may be the length of time the project extends from the normal schedule and the amount of additional budget the project demands from the actual budget (Hareru et al., 2016). In Ethiopia, according to the African Economic Outlook 2021 edition, 6.1 percent growth was driven by the construction and manufacturing industry, followed by services (2.1 points) and agriculture (1.4 points). The sector is also the third major GDP contributor preceded by Agriculture and service sectors (ADB report, 2015). It is also the major industry in which megaprojects of the country are involved in it like the Great Ethiopian Renaissance Dam (GERD), Sugar factories, hydroelectric power plants, Railways, Skyrocketing buildings, Urban and Rural Road projects, and the like. Hence, as a major contributor to the economy, the lengthy time and the significant budget involved in the projects undertaken by the industry and due to other relevant major factors, the use of a Project management information system (PMIS) would be an irrefutable fact to the contractors to make those projects successful (Kang et al., 2020). The use of PMIS enhances the project performance, helps to increase its success rate, and frames the progress of a project starting from the planning stage to the close up of the project (Chitkara, 2014). Moreover, it feeds timely information to the management and helps to speed up the decision-making process to ensure the project completion within the planned time, budgeted cost, and objectives (Lee and Yu, 2011a,). Thus, project contractors must use PMIS to complete the construction projects in time and within the budget limit so that additional expenses will be minimized and project objectives within the required frame and quality will be met.

1.2 Organization Background

Rama Construction is a category one Private Limited Company (PLC) established in 1995 in Addis Ababa, Ethiopia. The Company is registered under Ethiopian law and engaged in building, road, electric power station, real estate development and different project works. The company awards different safety related certification. OHSAS 18001:2007, level certification based on a standard developed by a group of national standards bodies, government agencies and industry associations titled "Occupational health and safety management systems. Requirements" is one of the certification awards in 2017. Moreover, in February 2022. The latest version of Occupational health and safety certification is also awarded to the company.

The company presently have more than 3,500 on a permanent and temporary basis of employment. It works in the construction industry with a vision “to be a world class construction company which could undertake any kind of construction works in Ethiopia and internationally”. The mission of the company is to participate on the country's socio-economic development with highest level of ethical, reliable and professional manner and carry out quality construction services to all stakeholders in a timely and cost-effective manner. Rama has set quality, safety, fairness and respect, continuous improvement, environment, relationship, team work and accountability as its core value.

The company has participated in numerous buildings, roads, power stations, industry projects construction and expansion. As a category one contractor and taking into consideration the current technological advancement, the company adopted MS project and Primavera software in the tasks of project planning, executing and monitoring as IT tools for the last ten years. Primavera is used in the company for planning (scheduling), risk management, resource management and contract management works (in bid process and after awarding the bid). Besides, the MS-project serves to create schedules, project plans, manage resources and keep track of time. Projects progress critical activities, floating activities, project finishing and starting schedule with resource management as well as other CPM activities are done using this software. Since the present day comes up with different sophisticated and user-friendly software that facilitates and make companies to be more competitive, organizations are expected to be alert regarding the software market. Due to this mere fact, Rama is working to bring itself to the state of art technology and is on the process of acquiring cutting edge software, ERP. This software has given positive anticipation to the executives as it enables the company to be closer to the present technology, competitive in the industry and permits to fill the gap realized in the present software.

The company has a transparent organogram which is suitable to integrate the activities undertaken by its employees. Besides, it portrays how the company manages its activities into two major divisions, the construction related part managed by Chief operating Officer (COO) and the functional activities of the company handled by the General Manager. Both units are expected to report to the Managing Director. The following figure shows the company current organogram.

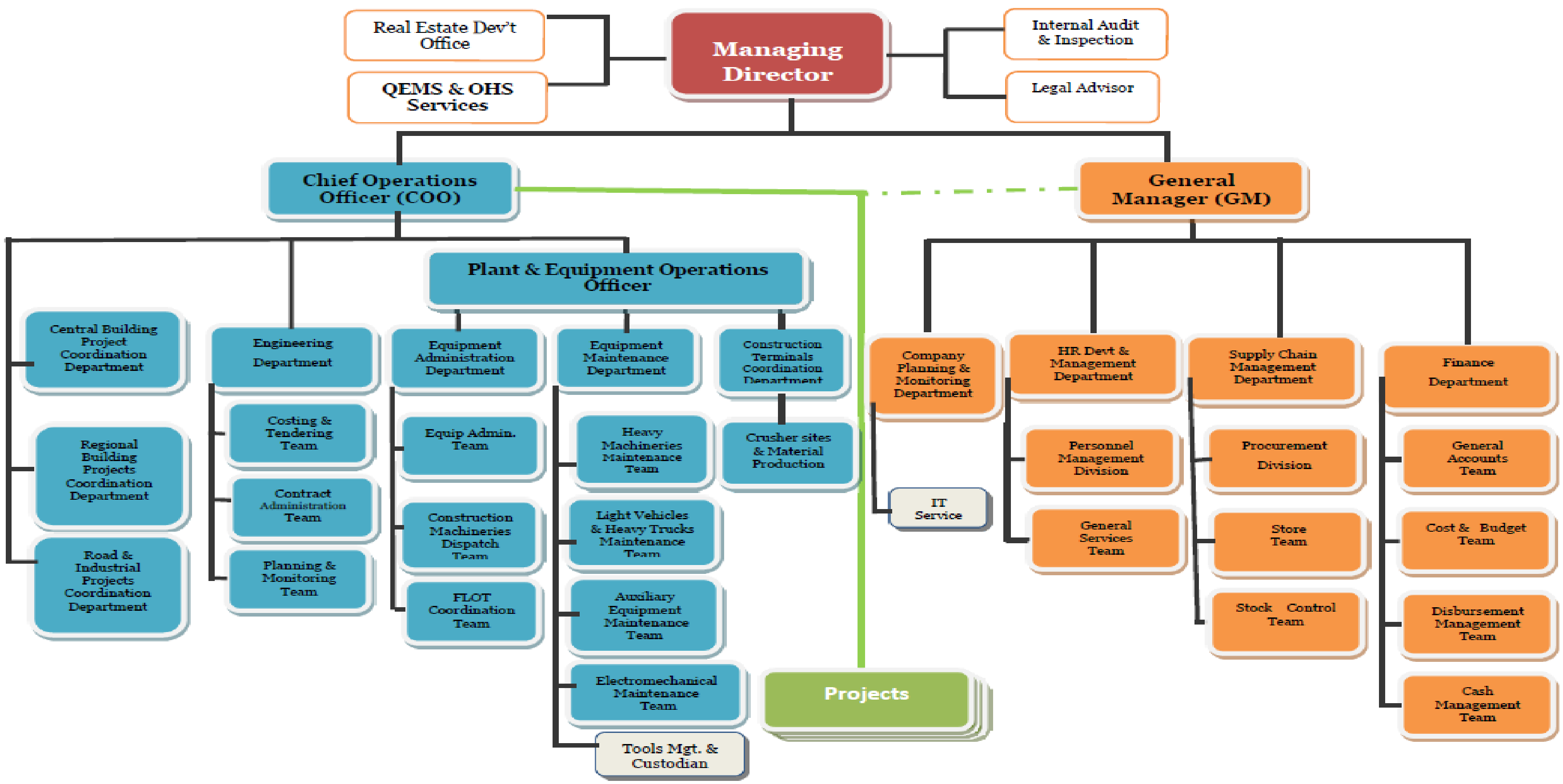

Figure 1.1: Organogram of Rama Construction

1.3 Problem Statement

Projects need to be managed well from their inception to close up. Proper management of projects is the key success factor in project management discipline to make the project successful(Silva, 2016). Mostly, project success is metered in accordance with the avoidance of cost, time overrun, and quality. Companies must deliver projects on time, within budget, meet specifications, and manage project risks that the project confronted (Assaf and Al-Hejji, 2006a). In doing this, the project management team needs to have accurate and timely information (Siles, 2004). The information gathered in turn leads to quality outputs that are consistent in Project planning practice, on-time execution, dependable controlling and monitoring practices, motivated project managers and project team, more satisfied stakeholders, and better close up of the project (Waruguru Peninnah and Paul Samson, 2021).

Many projects in the construction industry usually also exceed the original cost; get canceled prior to completion, while others fail in terms of the delivered functionality (Alaghbari et al., 2007; Assaf and Al-Hejji, 2006a; Sweis et al., 2008). While large amounts of time and resources are dedicated to selecting, designing, contracting and implementing projects, it remains of paramount importance that projects be adequately managed in organizations if they are to achieve their success objectives (Ogero,2014).

The delay of construction projects has been a major issue in the Ethiopian construction industry too (Hareru et al., 2016). In Ethiopia, only 8.25% of projects have been finished to the originally targeted completion date. The remaining 91.75% of projects are delayed 352% of its contractual time (Tesfaye and Asteray, 2021). According to the ministry of urban development and construction, the construction industry policy of Ethiopia, the inefficient and deteriorated state of the construction industry with poor performance has detrimental effects on the development of the industry (Ministry of Urban Development and Construction policy, 2012). And, one of the challenges hampering the performance and development of the industry is the poor technological base of the industry (Mengistu and Mahesh, 2019; Tesfahunegn, 2004). Studies showed that there are also so many factors that are contributed to such kind of delay, abonnements and failure to the project.

Poor financial system, poor project management system, delay in issuance of designs, shortage of imported construction materials on the market, design errors and complexity of designs, price Inflation and the like are widely cited problems (Hareru et al., 2016; Kuhil and Seifu, 2019). Due to these facts, the construction projects are suffering a lot. For instance, the Great Ethiopian Renaissance Dam (GERD) was estimated to cost 4.7 billion dollar (60 billion birr) and scheduled the first two power-generation turbines to become operational after 44 months of construction, or early 2015. However, the construction is still on going and the two turbines are not yet operational and expected to have a double estimated cost , 9.4 billion dollar (120 billion birr), upon completion. The same is true to the housing projects of Addis Ababa city Housing Development Corporation (AAHDC).(Teklemariam, 2018) stated that 140,000 people under 40/60, and over 700,000 people under 20/80 (close to 1.1 million) were registered for the housing program but only over 175,000 houses are transferred to residents in 12 years of time of the housing construction.

Project management information system (PMIS), as a tool and technological base, is an important building block for effective and efficient project management in the construction sector (Abdul Qadir Obeidat and Hameed Aldulaimi, 2016a). In Ethiopian, construction sector, as a major economic engine of the country, PMIS implementation is not well known as compared to other industries. Though many studies conducted regarding causes for delays and failures of construction projects, they did not consider PMIS as one of the causes in the industry (Endris Yadeta, 2020, Fentahun Kassa, 2020). Further, the trend of the construction industry is a recognized system in which it does not disclose itself to the new arrangement in relation to information management and many projects are being handled in a traditional way yet.(Mengistu and Mahesh, 2019). Besides, even though studies related to PMIS practice were conducted in Ethiopia, the research papers did not consider the construction sector and to the best knowledge of the researcher no research conducted regarding PMIS in relation to the project success of the construction industry (Adane et al., 2021; Bedru et al., 2019; Bekele, n.d.; Belay et al., 2014; Kebede et al., 2020; Tesfaye, n.d.; Tiye and Gudeta, 2018).

In this regard, it calls the attention of the researcher to conduct the study with the purpose to explore the PMIS use (Planning. Monitoring, controlling, evaluating, and reporting functions) ,System quality, Information quality, and Service quality with readiness (Individual and Organizational) during the entire project life cycle to increase the project success in construction projects i.e., on time, within the budget, with specification, according to the client needs, and meeting the organizational financial goals in Ethiopia construction Industry with the case of RAMA construction.

1.4 Research Questions

The followings are the research questions that were raised in this study.

a. What are the *purposes of PMIS* from the point of view of project managers?
b. What *PMIS tools*, if any, are used in the organization?
c. How does the *information* supplied by PMIS enable the project team to accomplish their task efficiently and effectively?
d. To what extent do *System quality, Information quality and Service quality* impact construction projects.
e. To what extent does the *Project Management Information System use* influence construction projects?

1.5 Research Objectives

The aim of this project work, but not limited to, is to explore the Project management information system (PMIS) challenges or problems as well as identify the key issues to achieve successful project implementation. Moreover, the study seeks to explain the implementation effects and consequences of PMIS in the organization and its processes. The study will be supported by an in-depth study of the subject taking RAMA construction Plc. into consideration. Besides, the followings were the concern of this study,

I. To evaluate the impact of the Project Management Information System on the project management in relation to the construction project.

II. To assess the outcome of using the Project Management Information System on the organization under consideration and the success of its project

III. To assess the effect of System quality, Information quality and service quality on the success of construction projects of the company;

IV. To assess the result of using the Project Management Information System on the system users to make their project successful.

V. To explore the effect of the Project Management Information System use on the success of construction projects

1.6 Significance of Study

The study, primarily, articulated to pinpoint how PMIS is important in project success and is the main tool to produce quality outputs in the construction sector. Hence, the research results give an opportunity to contractors, especially high-grade contractors, to implement PMIS tools in their companies so as to be competitive in the nationwide and in global industry too. Moreover, it serves as a source of secondary data for further study on the topics for researchers and academicians. IT professionals may see the gap in the Ethiopian construction industry and enable them to come up with a compatible solution of PMIS application software for the industry. Besides, it is also hoped that the paper may contribute to a wider global debate in the area of PMIS in relation to the construction industry. Further, the findings and the recommendations will serve the company under the case to investigate the existing PMIS and serves as a springboard to establish and upgrade the existing PMIS in the company. Apart from that, government officials and the regulatory bodies of the construction industry in Ethiopia, especially the Federal construction Bureau, consider it as an input to formulate policies regarding the subject under consideration.

1.7 Scope of the Study

The study is bounded geographically as it focuses only on Ethiopia and to the narrowest end Addis Ababa. In fact, projects and project offices of the organization under consideration are dispersed in different locations of the country, purely the study bounded to the head office too. Besides, the study only accentuates the construction sector and does not consider other sectors. Moreover, it also narrowed to a single construction company, Rama construction Plc., a category one contractor. Due to these facts, the study paper only essences on the project managers, senior managers, functional managers, and construction/office engineers of the stated construction company. It also focuses specifically on the variables under study, PMIS use (Planning. Monitoring, controlling, evaluating, and reporting functions), System Quality, information quality, and Service quality with the readiness of the System users and Organizational readiness during the entire project life cycle with respect to project success.

1.8 Limitation of the Study

Project management, as a discipline, is an infant and still required different approaches, theories, practices, and systems to be implemented. Due to these, more books, articles, and theoretical analyses for each project knowledge area and project process group are yet expected though many publications are produced under the discipline. PMIS, as one part of the subject of project management, has the same trend as the main theme whereby inadequate and insufficient information, studies, and written materials are available. Thus, finding abundant reference materials in the area of study especially in Ethiopia was one of limiting factor and the major challenge. Further, implementation of PMIS in Ethiopia in the construction sector is not well known, even in any other industry it is not as such promising to say more. Financial constraints are also one of the limiting factors for the study. Moreover, some sites specifically those sites found out of Addis Ababa, may need an on-site appearance to see the status and the progress of the project. However, apart from the financial and the time factors, the security issues are very sensitive and hamper exhaustive study on the area.

1.9 Definition of Terms

Construction Projects: refers to the construction, renovation, and demolition of civil structures such as buildings, roads, hydroelectric power plants, bridges, railways, and other infrastructural facilities (Rußig et al. 1996, Cited by Fachbereich Bauingenieurwesen & Yang, 2009).

Project Management Information System: It 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 initiating through closing and can include both manual and automated systems (PMBOK® Guide 5th and 6th edition).

Project Management Information System tools: It refers to the implemented PMIS functional tools which the project managers, project supervisors, and other stakeholders are using to attain the project's success (PMBOK® Guide 5th and 6th edition PMBOK® Guide 5th and 6th edition).

System Quality: It is the total quality of the system (software)

PMIS Use: It is the functional area where the PMIS is employed (i.e., Planning. Monitoring, controlling, evaluating, and reporting functions).

Project Management Information System Users: It refers to the individual who is benefiting from the use of the PMIS(Raymond and Bergeron, 2008a).

Quality Information: The information maintained through the application of the PMIS serves as the main input to achieving the project's success (Raymond and Bergeron, 2008).

Quality Output: It refers to the project process group tasks (Planning, executing, monitoring, closing up) reports, schedules, records, and other outputs produced using the application of PMIS (Raymond and Bergeron, 2008).

The System: It refers to interrelated PMIS components; with identifiable boundaries which collectively accomplish certain objectives in the construction project's success (PMBOK® Guide 5th and 6th edition).

1.10 Organization of the Study

The study paper will be organized in the following manner. The first chapter includes the problem statement, objective of the study, research questions, significance, limitation, and definition of terms. In the second chapter, review of related literature which includes theoretical, empirical and conceptual literature from views of different scholars are presented. Then, the research methodology employed and facts found from the applied research methodology are analyzed. Results found from the data analysis are discussed and different methods such as graphs, tables, and other data presentation methods are employed to present the results. Finally, based on the findings' summary of the paper, the conclusion and recommendations are given.

Chapter 2: Review of Related Literature

2.1 Introduction

The chapter discusses on a review of related literatures regarding project management information systems (PMIS). The reviews were contributed from books (information system, Project management, Construction, PMIS), previous research done by different scholars, journals, and publishing. In this regard, the basics of project management information system (PMIS) and its elements, the construction industry and its features, and PMIS and its practice in the Construction Industry are discussed. Moreover, the theoretical models done by previous scholars are depicted. Finally, the conceptual model of the researcher is introduced.

2.2 Theoretical Review: Essentials of PMIS

2.2.1 Project, Project Management, IS, MIS and PMIS

2.2.1.1 *Project*

The Project Management Book of Knowledge (PMBOK® Guide 5th ed.) itemized project as a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end.

(The APM Body of Knowledge,2012) stated the definition of a project in the same manner as PMBOK as a unique, transient endeavor, undertaken to achieve planned objectives, which could be defined in terms of outputs, outcomes, or benefits.

(K. Wysocki,2019) has defined project in its common definition and business focused definition. In its common definition, he stated a project as a sequence of unique, complex, and related activities that have one goal or purpose and that must be completed by a specific time, within the budget, and according to the requirement of the stakeholders. He also put the business definition as a sequence of limited dependent activities whose effective completion results in the delivery of the predictable business value that validated doing the project.

2.2.1.2 *Project Management*

The PMBOK® Guide 6th edition stated that Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. Project management is accomplished through the appropriate application and integration of the project management processes identified for the project. Project management enables organizations to execute projects effectively and efficiently.

Table 2.1: Comparison of Project Management and General Management

Dimension	**Project Management**	**General Management**
Type of Work Activity	Unique	Routine
Management Approach	Ability to adapt to change	Manage by exception
Planning	Critical	Important
Budgeting	Start from scratch, multiple budget periods	Modify budget from previous budget period
Sequence of Activities	Must be determined	Often predetermined
Location of Work	Crosses organizational units	Within an organizational unit
Reporting Relationships	Informal	Well defined

Source:project Management in Practice (Jack R. Meredith Broyhill,Scott M. Shafer and Samuel J. Mantel, 7th ed.,2017)

2.2.1.3 *Information System (IS)*

Information System (IS) is a set of interrelated components that collect, process, store, and disseminate data and information; an information system provides a feedback mechanism to monitor and control its operation to make sure it continues to meet its goals and objectives. The feedback mechanism is critical to helping organizations achieve their goals, such as increasing profits or improving customer service (Stair and Reynolds, 2018).

(V. Brown, DeHayes et al., 2012), defined, primarily, a system as a set of interrelated components that must work together to achieve some common purpose. Then, demarcated Information systems in a more advanced way that is highly related to IT elements. Moreover, the components of the IT elements have been set to make the system more reliable. Thus, IS is defined as the collection of IT, procedures, and people responsible for the other systems, it is crucial that the components of an IS work well together. That is, the components must be consistent, minimally redundant, complete, and well connected with one another.

(Stair and Reynolds,2018) A computer-based information system (CBIS) is a single set of computer hardware, software program, databases, networks, people, and procedures that are configured to collect, manipulate, store, and process data into information. Increasingly, companies are incorporating computer-based information systems into their products and services. There are various types of information systems commonly used in organizations. It appears to be more sensible, however, to depict briefly different kinds of systems with the goal that enabling us to better comprehend what we mean by the term information system. The accompanying table portrayed the kinds of Information systems.

Table 2.2:Categories of information systems used in organizations

Category of System	Purpose	Sample Application(s)
Transaction processing system	Process day-to-day business event data at the operational level of the organization	Grocery store checkout cash register with connection to network, student registration system
Management information system	Produce detailed information to help manage a firm or part of a firm	Inventory management and planning system, student enrollment management
Decision support system	Provide analysis tools and access to data-bases in order to support quantitative decision making	Product demand forecasting system, loan and investment analysis
Intelligent system	Emulate or enhance human capabilities	Automated system for analyzing bank loan applications, self-driving car
Business intelligence system	Analyze Big Data to better understand vari-ous aspects of a business	Online analytical processing (OLAP) system
Office automation system (personal productivity software)	Support a wide range of predefined day-to-day work activities of individuals and small groups	Word processor, spreadsheet, presentation software, e-mail client
Collaboration system	Enable people to communicate, collaborate, and coordinate with each other	E-mail system with automated, shared calendar
Knowledge management system	Enable the generation, storage, sharing, and management of knowledge assets	Knowledge portal for finding answers to common questions
Social software	Facilitate collaboration and knowledge sharing	Social network, connecting colleagues and friends
Geographic information system	Create, store, analyze, and manage geograph-ically referenced data	Site selection for new shopping mall
Functional area information system	Support the activities within a specific func-tional area of the firm	Planning system for personnel training and work assignments
Customer relationship management system	Support interaction between the firm and its customers	Sales force automation, lead generation
Enterprise resource planning system	Support and integrate all facets of the busi-ness, including planning, manufacturing, sales, marketing, and so on	Financial, operations, and human resource management
Supply chain management system	Support the coordination of suppliers, prod-uct or service production, and distribution	Procurement planning
Electronic commerce system	Enable customers to buy goods and services from a firm's website	Amazon.com, eBay.com, Nordstrom.com
Mobile app	Perform a particular, well-defined function, typically on a mobile device	Instagram, Snapchat, WhatsApp, Facebook app

Source: Information System Today Managing the Digital World

2.2.1.4 *Management Information System (MIS)*

According to Stair and Reynolds (2018), Management Information System (MIS) is an organized collection of individuals, procedures, software package, databases, and devices that provides routine information to managers and decision-makers. MISs were first developed in the 1960s and were typically used to produce managerial reports. In many cases, these early reports were produced periodically—daily, weekly, monthly, or yearly. Because of their value to managers, MISs proliferated throughout the management ranks. The evolution of MIS can be divided into three periods: data processing, management information systems, and strategic information systems (Somogyi & Galliers, 1987 cited by Abdallah Hassan Salaheldin Abdelaziz Ajban 2017)). The first era, data processing, is primarily viewed as the era when the main focus was on improving the efficiency of business through automation of basic information processes. The second era, management information system, focused on the improvement of managerial effectiveness by satisfying widespread information needs. In the final era, known as strategic information systems, attempts are made to improve organizational or departmental competitiveness by affecting the overall business strategies (Beaumaster et al., 1999). According to Laudon and Laudon (2012), MIS deals with behavioral issues as well as technical issues surrounding the development, use, and impact of information systems used by managers and employees in the firm.

2.2.1.5 *Project Management Information System (PMIS)*

Chitkara (2014), has defined PMIS and its function. He stated that PMIS is an integrated user-machine system that provides information to support operations, management, and decision-making functions, which are related to planning and controlling the project's objectives. The main functions include developing a PMIS strategy in consultation with the project team and stakeholders and communicating this to all concerned authorities, establishing an initial database, setting standards and baselines, organizing efficient means of measuring, collecting, verifying, and quantifying the data that reflect performance with respect to time, cost, resources, and quality and the like.

The PMBOK® Guide 5th and 6th edition stated that Project Management Information System (PMIS) is an information system consisting of the tools and techniques used to collect inputs, process it, and disseminate the outputs of project management processes. It is used to support all facets of the project from initiating to closing the project and can include both manual and computerized systems. Information technology (IT) software tools, such as scheduling software tools, work authorization systems, configuration management systems, information collection and distribution systems, as well as interfaces to other online automated systems such as corporate knowledge base repositories. Automated gathering and reporting on key performance indicators (KPI) can be part of this system as well.

(Perumal Raja et al., 2015) detailed PMIS as a system for collecting, organizing, storing, processing, and disseminating the collected information, the term “PMIS” can pertain to a manual or computer-based system, but most commonly it refers to the latter with the growing importance of computers in management and the proliferation of computer-based PMIS software and hardware system available, and appreciate the issues in selecting and implementing these systems.

A PMIS provides information so that the team has a mutual understanding of the facts and due to this fact, it is a precondition for teamwork. It’s the cheapest way to collect information because it’s only done once. And it’s the most dependable way to host information because many eyes examine centralized data and mistakes are more likely to be found and corrected (Siles, 2004). It’s the first line of security against political or legal attacks. It’s a clear window into the project that leaders can use instead of relying on overdue or biased reports filtered through layers of management. It improves performance because it measures it so that it serves as a report card for both team members and management. And most important, it teaches the team and makes better managers because it tells true facts (Dhawale & Zambare 2016).

PMIS can update the management of data required for project planning, executing and monitoring, to increase competitiveness and the chances of project success (Van Besouw and Bond-Barnard, 2021). A Project Management Information System (PMIS) is generally a single or a collection of computerized software applications, which provide relaxed, well-organized, and combined methods for managing projects from their inception through to their completion (Riņģis and Bērziša, 2016). Project Management Information systems (PMIS) are system tools and techniques used in project management to deliver information. Project managers use the techniques and tools to collect, combine and distribute information through electronic and manual means.

Project Management Information System (PMIS) helps to plan, execute, and close project management goals. During the planning process, project managers use PMIS for budget frameworks such as estimating costs (Chitkara, 2014). The Project Management Information System is also used to generate a specific schedule and define the scope starting point. At the execution of the project management goals, the project management team collects information into one database. The PMIS is used to compare the baseline with the actual achievement of each activity, manage materials, collect financial data, and keep a record for reporting purposes (Kostalova et al., 2015). During the close of the project, the Project Management Information System is used to review the goals to check if the tasks were accomplished. Then, it is used to create a final report of the project close (Bhagwate & Nagare 2015). PMIS has become a mandatory tool and a characteristic for successful companies (Raymond and Bergeron, 2008).

2.3 PMIS application in projects

(Seirs,2017) stated that the success of a project depends greatly on the smooth and timely acquisition of information, preparation, exchange, dissemination, storage, and retrieval of information when needed, and to enable all these functions to be carried out efficiently. An information system protected in an information policy plan is an essential ingredient of the project management plan

Pursuant to PMBOK® Guide 6th edition, PMIS provides access to information technology (IT) software tools, such as scheduling software tools, work authorization systems, configuration management systems, information collection and distribution systems, as well as interfaces to other online automated systems such as corporate knowledge base repositories. Automated gathering and reporting on key performance indicators (KPI) can be part of this system. Hence, the following areas where PMIS could be are proposed;

Scheduling projects tools

PMIS includes scheduling software that has the competence to aid plan, organize, and adjust the sequence of the actions; insert the logical relationships, lead and lag values;

and differentiate the different types of dependencies. Besides, it accelerates the process of building a schedule model by generating start and finish dates based on the inputs of activities, network diagrams, resources, and activity times.

Cost estimation and monitoring tool

The project management information system can include databases, replication software, and statistical analysis tools to assist with cost estimating. Such tools simplify the use of some cost-estimating techniques and thereby ease rapid consideration of cost estimate alternatives. Project management information systems are often used to control the three Earned value Management (EVM) scopes (PV, EV, and AC), to display graphic trends, and to forecast a range of possible final project results.

Resource management tools

Project management information systems can include resource management software that can help plan, organize, and manage resource pools and develop resource estimates. Depending on the complexity of the software, resource breakdown constructions, resource availability, resource rates, and various resource charts can be defined to assist in optimizing resource consumption. Project management information systems can include resource management or scheduling software that can be used for managing and organizing team members across project activities. Project management information systems can include resource management or scheduling software that can be used to monitor resource utilization which helps ensure that the right resources are working on the right activities at the right time and place.

Communication tools for stakeholders and Project managers

Project management information systems can ensure that stakeholders can easily regain the information they need in a timely way. Project information is managed and distributed using different types of tools including electronic project management tools. Project management software, meeting and virtual office support software, web interfaces, specialized project portals and dashboards, and collaborative work management tools. Electronic communications management, email, fax, and voice mail;

audio, video and web conferencing; websites and web publishing, blogs and applications, offer the opportunity to engage with stakeholders and form online communities.

PMIS provides a set of standard tools for the project manager to capture, store, and distribute information to internal and external stakeholders with the information they need according to the communications plan. The information contained in the system is checked to assess its validity and effectiveness. Project management information systems can include schedule, resource, and cost software to ensure that agreed-upon risk response plans and their associated activities are integrated into the project alongside other project activities.

(Chitkara, 2014) stated that Project Management Information System (PMIS) in a project generally covers the information related to planning and controlling of scope, time, resources, and cost of a project. PMIS coverage can be extended to cover the needs of functional managers of a project organization and enterprise departments. In a multi-project environment of a corporate, it can be designated as Enterprise Projects Management Information System (EPMIS). Project Management Information System involves developing the PMIS framework, establishing baselines and standards for monitoring performance, economically capturing and processing monitored planning data during implementation, retrieving information from monitored data, communicating this information to the right person to facilitate decision-making, storing the relevant information documents, protecting information, and managing the information resources

2.4 Features of Construction Projects

2.4.1 Construction Projects

The construction industry is the part of the economy that deals with the design, construction, maintenance, and utilization as well as with the modulation, modification, and demolition or deconstruction of constructs (Rußig et al. 1996, Cited by Fachbereich Bauingenieurwesen & Yang, 2009). It is a major sector in most national economies and a major contributor to environmental changes, both in terms of designing the built environment as well as in terms of anthropogenic effects on the environment(Levy, 2007).

(Sears, A. Sears et al.,2015), Construction projects are intricate, time-consuming undertakings. The total development of a project normally consists of several phases requiring a diverse range of specialized services. In progressing from initial planning to project completion, the typical job passes through successive and distinct stages that demand input from such disparate areas as financial organizations, governmental agencies, engineers, architects, lawyers, insurance and surety companies, contractors, material manufacturers, and suppliers, and building tradesmen.

2.4.2 Features of Construction projects

According to S. Sears, Glenn A. Sears et al. (2015), construction is subject to the influence of highly variable and sometimes unpredictable factors. The construction team, which includes architects, engineers, craft workers, specialty contractors, material suppliers, and others, changes from one job to the next. All the complexities inherent in different construction sites such as subsoil conditions, surface topography, weather, transportation, material supply, utilities and services, local specialty contractors, labor conditions, and available technologies—are an innate part of the construction.

Pursuant to the book of PMI Construction Extension to PMBOK® Guide, Construction projects typically carry large penalties or damages for projects that are completed late. The risks inherent in construction projects, coupled with these time-related damages, have generated the need for several of the Knowledge Areas to be implemented with enhanced visibility as specialty services. This subset of construction management, referred to as project controls, includes technically advanced disciplines of planning and scheduling, cost management, risk management, document controls, and forensic analysis. Strong project control services have proven to be a strong component in the success of a project.

Generally speaking, construction projects are carried out inside an operational facility, constructed as a new facility (a "greenfield" project), or constructed in a previously developed or abandoned site (a "brownfield" project) (Soon Han et al., 2011). Construction projects produce deliverables such as: manufacturing or assembly complexes, public facilities (dams, highways, bridges, wastewater, and the like), Service facilities (medical centers, educational campuses for schools and colleges, seaports, and rail stations),High-rise office towers; Specific infrastructures and Megaprojects (Salih, 2020). In order to produce these deliverables, construction projects adhere to regulations and jurisdictional (local, global, or industry-specific) requirements where the product will be constructed, for example, civic laws and building codes. In addition, the construction industry is concerned with improving the social, economic, and environmental factors of sustainability, reliability, and the welfare of the affected communities. A multidisciplinary team of financial, insurance, legal, design, safety and engineering specialists; construction teams of various trades; and an efficient supply chain for materials and equipment are needed in order to deliver the project (Chitkara, 2014)

A system for construction is a collection of many processes effectively working together for producing a specific deliverable, which is usually defined in the program or project's contract. This system has a series of detailed inputs and outputs, which are what the client expects from the company or companies executing the task (Briesemeister,2018). Modern public construction projects involve multiple stakeholders, such as contractors, subcontractors, project managers, consultants, and specialists from different disciplines. In a multi-agency work environment, it is natural to have clash of objectives and interests among the different stakeholders (Tabish & Jha,2011).

Large construction projects are inherently complex and dynamic (Nguyen et al., 2004). In the construction Industry, distinct characteristics were identified and ranked in relation to Health and Safety as well as their relationships (Peckitt et al. cited by Boadu, Wang and Sunindijo 2020) emphasized this point by identifying the characteristics of the construction industries in the UK (a developed country) that negatively impact on the industry's H & S culture. Amongst others, the characteristics identified included a complex regulatory system, focus on cost, intense competition, division between design and construction, mistrust and blame, short-termism, the dominance of small contractors, the prevalence of subcontracting, complex fragmented relationships, and lack of consideration of H & S in design.

In the Ethiopian situation, according to the report of the National Bank of Ethiopia (NBE), the Industrial sector showed a 7.3 percent annual growth and constituted a 29.3

percent share in total Gross domestic product (GDP) and it contributed 33.6 percent to the overall GDP growth (see table 2.3). With 5.1 percent growth, the manufacturing accounted for 23.4 percent of the industrial output. The construction industry registered 6.6 percent expansion with 72.2 percent share in industrial output, with roads, railways, dams and residential houses construction, playing a significant role.

NBE also itemized that on the total investment projects, 30.8 percent were engaged in manufacturing, 30.3 percent in real estate, renting, and business activities, 28.5 percent in construction, 4.3 percent in tour operation, transport and communication, 2.3 percent in hotel and restaurant, 1.1 percent in health and social work and 2.7 percent in other sectors. As for investment capital, manufacturing constituted 35.5 percent followed by real estate renting and business activities (30.6 percent), hotel and restaurant (17.3 percent), construction (5.3 percent), health and social work (2.5 percent), tour operation, transport and communication (2 percent) and the remaining sectors accounted for 6.8 percent (NBE 2020/21 report, see tables below)

Table 2.3:Growth and Percentage distribution of major Agriculture, Industry, and Service Sub sectors

		Sectors	2016/17	2017/18	2018/19	2019/20	2020/21
Agriculture	Growth rate	Crop	8.2	4.7	3.0	4.7	5.7
		Animal Farming and Hunting	4.2	0.6	6.0	3.3	5.8
		Forestry	3.6	3.5	3.8	3.9	3.9
		Fishing	0.5	11.3	2.3	2.8	1.7
	Share in Agriculture	Crop	64.5	65.3	64.8	65.0	65.1
		Animal Farming and Hunting	26.4	25.6	26.2	25.9	26.0
		Forestry	8.8	8.8	8.8	8.8	8.6
		Fishing	0.2	0.3	0.3	0.3	0.2
Industry	rowth rate	Mining and Quarrying	-29.8	-20.8	-21.9	91.4	115.4
		Manufacturing	24.7	5.5	7.7	7.5	5.1
		Electricity and Water	4.9	3.3	4.0	7.2	8.9
		Construction	20.7	15.7	15.0	9.9	6.6
	Share in Industry	Mining and Quarrying	1.0	0.7	0.5	0.9	1.8
		Manufacturing	26.9	25.3	24.3	23.9	23.4
		Electricity and Water	2.8	2.6	2.7	2.6	2.7
		Construction	69.3	71.4	72.5	72.6	72.2
Service	Growth rate	Whole Sale and Retail Trade	6.5	12.3	11.7	6.4	6.3
		Hotels and Restaurants	0.1	6.5	9.0	2.2	2.6
		Transport and Communications	15.1	6.4	21.0	1.2	7.0
		Real Estate, Renting and Business Activities	4.4	6.2	7.5	9.5	8.9
		Public Administration and Defense	13.2	8.9	9.0	2.3	4.9
		Others*	6.4	6.8	7.5	6.4	6.2
	Share in Service	Whole Sale and Retail Trade	34.8	35.9	35.9	36.3	36.3
		Hotels and Restaurants	6.7	6.6	6.5	6.3	6.0
		Transport and Communications	13.1	12.8	14.0	13.4	13.5
		Real Estate, Renting and Business Activities	11.3	11.0	10.7	11.1	11.4
		Public Administration and Defense	11.4	11.4	11.2	10.9	10.7
		Others*	22.7	22.3	21.7	22.1	22.0

Source: NBE National Report 2020/2021

Table 2.4: Numbers and Capital of operational Investment Projects by sector

(Capital in millions of Birr)

Sectors	2018/19 No. of Projects	2018/19 Investment Capital	2019/20 No. of Projects	2019/20 Investment Capital	2020/21 No. of Projects	2020/21 Investment Capital	Percentage share No. of Projects	Percentage share Investment Capital
Manufacturing	337	4,647.0	42	710.1	242	12,097.0	30.8	35.5
Agriculture, hunting and forestry	27	297.7	1	10.5	6	114.5	0.8	0.3
Real estate, renting and Business activities	404	1,909.3	15	98.3	238	10,426.5	30.3	30.6
Hotel and restaurants	7	39.5	3	307.9	18	5,887.4	2.3	17.3
Education	6	68.2	1	2.5	2	13.0	0.3	0.0
Health and social work	5	25.3	3	18.0	9	864.1	1.1	2.5
Construction	176	1,745.7	15	135.5	224	1,799.1	28.5	5.3
Tour operation, transport and communication	5	20.0	2	17.9	34	669.2	4.3	2.0
Whole sale, retail trade and repair service	-	-	-	-	3	381.5	0.4	1.1
Mining and quarrying	4	38.2	-	-	-	-	-	-
Electricity, gas, steam and water supply	-	-	-	-	-	-	-	-
Other community, social and personal service activities	2	82.0	-	-	1	5.0	0.1	-
Others	3	78.8	2	19.6	8	1,816.1	1.0	5.3
Grand Total	**976**	**8,951.7**	**84**	**1,320.3**	**785**	**34,073.4**	**100.0**	**100.0**

Source: Ethiopian Investment Commission.

Source: NBE National Report 2020/2021

Sector	2006(2013/14)		2007(2014/15)		2008(2015/16)		2009(2016/17)		2010(2017/18)		2011(2018/19)		2012(2019/20)		2013(2020/21)	
	Perm. Empl.	Temp. Emp	Perm. Empl.	Temp. Emp	Perm. Empl.	Temp. Emp	Perm. Empl.	Temp. Emp	Perm. Empl.	Temp. Emp	Perm. Empl.	Temp. Emp	Perm. Empl.	Temp. Emp	Perm. Empl.	Temp. Emp
Agriculture, hunting and forestry	156	3,432	1,265	6,458	290	2,834	6,082	859	259	2428	536	1,862	3	5	27	2
Construction	441	1148	508	1,154	1,073	2,412	3,346	5,232	1664	2738	3,368	1,788	100	168.0	1,837	961
Education	189	12	9	8	49	13	89	0	16	23	200	154	2	2.0		
Electricity, gas, steam and water supply									0	250						
Fishing																
Health and social work	2	5	79	2			20	5	44	220	43	8	6	6	74	23
Hotels and restaurants	181	150	100	55	400	80	23	35	97	64	173	75	35	20	391	192
Manufacturing	2642	872	7,586	1,189	7,007	3,753	6,016	3,143	123,353	8,070	15,918	5,142	2,858	1,387	6,657	2,116
Mining and quarrying	10	30			85	203	74	299	96	414	35	92				
Other community, social and personal service activities	21	268	13	3	25	26	37	8	125,002	109	19	12				
Real estate, renting and business activities	276	496	1,649	1,596	3,761	3,372	4,989	187	81,347	21,710	2,269	1,303	52	41	1868	2362
Transport, Storage and Communication	13	2	18	40	34	17	28	7	23	28	44		121	0	807	388
Wholesale, retail trade & repair service	5	10							2	0					23	66
Others*							8		100	160	26	105	34	5	84	22
Grand Total	**3,936**	**6,425**	**11,227**	**10,505**	**12,724**	**12,710**	**20,712**	**9,775**	**332,003**	**36,214**	**22,631**	**10,541**	**3,211**	**1,634**	**11,768**	**6,132**

Table 2.5: Employment Created by Domestic & Foreign Investment Projects Which Have Commenced Operation, by Sector

Source: NBE report 2020/2021

Table 2.6: Number and Investment capital of the domestic and foreign projects

Sector	**2006(2013/14)**		**2007(2014/15)**		**2008(2015/16)**		**2009(2016/17)**		**2010(2017/18)**		**2011(2018/19)**		**2012(20189120)**		**2013(2020/2021)**	
	No. of Projects	**nvestment Capital**	**No. of Projects**	**nvestment Capital**	**No. of Projects**	**nvestment Capital**	**No. of Projects**	**nvestment Capital**	**No. of Projects**	**nvestment Capital**	**No. of Projects**	**nvestment Capital**	**No. of Projects**	**nvestment Capital**	**No. of Projects**	**nvestment Capital**
Agriculture, hunting and forestry	13	70.1	107	521.7	35	66.0	14	119.6	42	322.8	27	297.7	1	10.5	6	114.5
Construction	58	2,811.2	50	132.8	75	506.7	199	1,081.9	344	3,002.1	176	1,745.7	15	135.5	224	1,799.1
Education	2	25.4	1	79.8	3	7.1	4	6.1	7	67.8	6	68	1	2.5	2	13.0
Electricity, gas, steam and water supply									1.0	100.0						
Fishing																
Health and social work	1	0.2	1	4.0			3	13.7	15	276.4	5	25	3	18.0	9	864.1
Hotels and restaurants	6	44.1	5	105.8	3	10.8	2	9.5	5	57.8	7	39.5	3	307.9	18	5,887.4
Manufacturing	38	516.8	39	2,707.2	85	2,539.5	149	1,888.0	578	14,494.8	337	4,647.0	42	710.1	242	12,097.0
Mining and quarrying	1	1.1			6	12.1	8	18.7	7	81.0	4	38				
Other community, social and personal service activities	3	9.1	4	14.5	3	4.9	4	5.2	46	245.8	2	82			1	5.0
Real estate, renting and business activities	36	2,135.3	197	563	637	3,551	81	5,737.4	496	7,204.8	404	1909.3053	15	98.3	238	10,426.5
Transport, Storage and Communication	4	12.1	3	5.8	5	10.7	3	14.7	5	11.4	5	20.0	2	17.9	34	669.2
Wholesale, retail trade & repair service	1	10.9							1	2.0					3	381.5
Others*							1	1.9	3	9.5	3	79	2	19.6	8	1,816.1
Grand Total	163.0	5636.2	407.0	4135.0	**852**	**6,708.6**	**468**	**8,896.9**	**1,550**	**25,876.2**	**976**	**8,952**	**84**	**1,320**	**785**	**34,073**

Source: NBE Report 2020/21

The industry's significant impact on the Ethiopian economy can be demonstrated by reviewing construction's proportion of the total value of goods and services, as well as the number of people employed in construction as a proportion of the total workforce and the number of construction firms compared with the total businesses in all industries.

Despite all these facts, according to Desalegn Girma (2019), the industry has faced major challenges are identified as delay in construction industry development (CID) policy execution and corruption; weak capacity of contractors and consultants; lack of collaboration and professionalism; and lack of metrics CID practice from role of government, resource-related variables, nature of the industry and industry's vision for its own growth, respectively. Findings provide information that stakeholders can use to make informed decisions and critical interventions for the effective development of the industry. *https://www.researchgate.net/publication/336368914_Challenges_in_developing_the_Ethiopian_construction_industry).*

(Endris Yadeta, 2020) also stated that insufficient schedule, equipment and labor productivity (construction risks), payment delay, submittals and approvals of construction documents (financial risks), price inflation (economic risk), bribe and corruption (political risk), changes in design practices and standards (design risk), and power of the engineer, project supervision, and subcontractors' performance (management risks), are the major risks in construction projects in the Ethiopian construction industry.

2.4.3 Construction Project Management and Process

Jackson (2010), stated construction as a big business in which a total of $3.9 trillion annually worldwide circulated in it, and there is no slowdown in sight. The industry employs about 7 million people directly (plumbers, carpenters, welders, and so on) and hundreds of thousands more indirectly. It gives a rise to many industries such as the steel, the lumber, the carpet, the furniture, the paint , the concrete , the paving , and further for the trucking, shipping, manufacturing, and mining industries. Architects, engineers, drafts people, building inspectors, code officials, and other professionals would not have jobs if it weren't for construction. As construction projects become increasingly more complex, the challenges associated with managing these projects become more complicated. The need for qualified construction managers is tremendous, and opportunities abound for those interested in the work

Charles Patrick's Construction Project Planning and Scheduling book demarcated that Construction management (CM) entails the planning, scheduling, evaluation, and controlling of construction tasks or activities to accomplish specific objectives by effectively allocating and utilizing appropriate labor, material, and time resources in a manner that minimizes costs and maximizes customer/owner satisfaction.

(Sears & Sears et al., 2015), stated that construction project is based on controlling site functions such as the construction function, surveying function, design team function and planning function. It is the project manager's role to pull these functions together and develop a competent project team. The development of a united team spirit will often lead to a successful project. Team building within a construction company is essential for the continued success of the business

(Brian Cooke, 2015), viewed construction project management, however, as applies to a given project, the various phases of which usually are accomplished by different organizations. Therefore, the management of a construction project is not so much a process of managing the internal affairs of a single company as it is one of coordinating and regulating all of the elements needed to accomplish the job at hand. Thus, the typical project manager must work extensively with organizations other than his own. In such circumstances, much of his authority is conferred by contractual terms or power of agency and is, therefore, less direct than that of the usual business manager. Project management is accomplished largely through the personnel of different employers working closely together.

According to S. Sears, A. Sears et al. (2015), a construction project proceeds in a rather definite order; the stages of development that follow are typical. These are:

Planning and Definition: Once an owner has identified the need for a new facility, he or she must define the requirements and delineate the budgetary constraints. Project definition involves establishing broad project characteristics, such as location, performance criteria, size, configuration, layout, equipment, services, and other owner requirements needed to establish the general aspects of the project. Conceptual planning stops short of detailed design, although a considerable amount of preliminary architectural or engineering work may be required. The definition of the work is basically the responsibility of the owner, although a design professional may be called in to provide technical assistance and advice.

Design Phase: The design phase involves the architectural and engineering design of the entire project. It culminates in the preparation of final working drawings and specifications for the total construction program. In practice, design, procurement, and construction often overlap, with procurement and construction beginning on certain segments as soon as the design is completed and drawings and specifications become available for those segments. With the advent of high-speed computing and massive data management capabilities, the various design components can now be incorporated into a single database producing integrated design in a digital format.

Production information is being added to the database, resulting in a Building Information Modeling (BIM) model of the project that contains all information on the project in a unique digital format. The use of BIM is still in the early stages, but its use is evolving rapidly throughout the construction industry.

Procurement Phase: Procurement refers to the ordering, expediting, and delivery of key project equipment and materials, especially those that may involve long delivery periods. This function may or may not be handled separately from the construction process itself. Construction is, of course, the process of physically erecting the project and putting the materials and equipment into place, and this involves providing the manpower, construction equipment, materials, supplies, supervision, and management necessary to accomplish the work.

(Chitkara, 2014), discussed that in a construction project, works are divided into phases for exercising control. A typical construction project comprises four phases, i.e., project concept analysis phase, planning, and construction procurement phase, construction (execution and control) phase, and close-up (including demobilization) phase. These phases are generally sequential but may overlap in some situations. Each process is fed with inputs; these inputs are processed using tools and techniques to produce outputs. The output of a process is generally followed by the start of one or more of the subsequent generally sequential processes.

Chitkara further discussed the processes in a construction project can be generally divided into two categories, i.e., project management-related processes and technical management-related processes. Project management processes have similarity but the technical management process differ from project to project.

2.5 PMIS in Construction projects

Project Management Information systems in construction can be largely categorized into two types of information systems: In general, there are two types of PMISs in the construction field: One is that which is developed and used by individual construction companies and the other is the Application Service Provider (ASP) based PMIS 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. Thus, the critical success factors (CSFs) for this type of PMIS are similar to those of the general information systems of the company. However, the latter is generally used by various project participants such as clients, architects, contractors, sub-contractors, and construction managers, and their quality is considerably more dependent on the capability of service providers(Lee and Yu, 2011).

The importance of information technology in the construction industry has grown exponentially over the past few decades (Yu and Lee 2006). As one of the key IT applications, the project management information system (PMIS) has played a significant role in construction management processes. The reason for this is that PMIS is an information system for gathering, integrating, and disseminating the output of project management processes among project participants, and is used to support all aspects of a project from initiating through to closing.

(Chitkara, 2014), stated that the market is flooded with project management software. A search for project management software on the worldwide web displays or lists down hundreds of software solutions related to project management. Oracle-Primavera, products including Primavera P6, Enterprise Project Portfolio Management (P6 EPPM), Primavera Professional Project Management (P6), Primavera Project Planner (P3), Primavera SureTrak, and many others.

Primavera also introduced a new generation of intelligent construction platforms which accelerates performance by predicting outcomes, optimizing processes, and continuously improving the way to build and manage projects focusing on three principles a better way to collaborate, Predictive analytics to empower decision-makers, and a unified project on a synchronized schedule. There are different versions of primavera system (software) (visit:http://www.oracle.com/primavera

(Chitkara, 2014) also added other project management software including MS Project Management, Project Scheduler, Artemis Prestige, and Power Project. Each software manufacturer claims to be the best for functions provided by them. MS Project is a widely used computerized project management tool, but Primavera products are the most sophisticated. MS Excel is a useful tool for work-sheet analysis. It may be noted that there is no single project management software that meets all the needs of all the projects. The ultra-high-tech sophisticated software is also difficult to implement, learn, and support. The application of the project management software depends upon the level of use, types of uses, level of training received by the respondents, and adequacy of the software.

In order to continuously increase the efficacy of PMIS, we need to know the critical success factors (CSFs) for PMIS. This means that what users feel of important should be identified and managed more significantly. In a similar context, there has been a great deal of research on general information system (IS) success factors and success models. However, there has been neither significant research on CSFs for PMIS (Yu and Lee 2004) nor studies on the actual use and impacts of these systems (Raymond and Bergeron 2008).

A PMIS is built around documentation and communication of project-specific information so most of the engine is devoted to that purpose. Basic project information includes the project location, a current calendar, and project goals. There may be web cameras that record on-site activities for public relations or for evidence in case of conflict. There may be general public relations web pages with access for the community, users, or other stakeholders. The PMIS maintains project status from the initial idea for a new facility to its completion. Such project data may be rolled up for portfolio management and for planning future projects (Dhawale & Zambare 2016).

As stated by (Lee & Yu 2011), construction PMIS is a new form of business and construction management where the client, supervisor, contractor, and subcontractors synthesize and share various information (for example, documents, drawings, pictures, and job records) to communicate promptly and accurately. This system leads to effective management and work efficiencies, such as short construction periods and cost reduction.

The main agents in each phase are independent and the form of information differs in construction projects compared with the general manufacturing industry. Therefore, the seamless exchange of information is quite difficult. To overcome this problem, there is an increase in the need for construction PMIS as a supporting tool that allows main agents to share large amounts of information in real-time. (Parks, 2005), for efficient work performance between the project related participants (client, contractor, and architect), PMIS supports three basic functions: Communication (supports work efficiency through smooth communication), Collaboration (supports an active cooperative management system among related participants), and Community (supports the accumulation of related information and data).

2.5.1 PMIS use

(Raymond and Bergeron, 2008) stated that the use of the PMIS was measured by determining the extent to which various system functions and their related tools were actually used by project managers. The PMIS functions were divided into five categories.

The planning function tools aim at making the complete project plan; they include work breakdown structure, resource estimation, total schedule, Gantt, PERT, and CPM.

The monitoring function tools are used to frequently evaluate project progress; they are used for progress reports and curves, and to update operational reports such as completed tasks, percent of project completed, effective schedule, remaining tasks, and outstanding days to complete.

The controlling function tools are used to make precise changes to the project; they allow the project manager to fine-tune forecasts, adjust tasks, reallocate resources to lower the costs, cancel tasks, and modify the cost of resources.

The evaluating function tools are targeted toward project inspecting; these tools allow the documentation of cost and timetable variations and tracking of the use of resources.

The reporting function tools give information on the most straightforward aspects of the project; they include an overview of the project as well as reports on work-in-progress, budget overruns, and task and schedule slippages.

(Perumal Raja et al., 2015) regarded the purpose of a PMIS is to support project management decisions and to provide information necessary to conduct the project and the function of PMIS closely parallels those of project management in most projects, these are Planning and scheduling, budgeting, work authorization and control, control of changes and communicating all of these functions.

It is important to note that currently, many computer-based PMIS software systems are able to support only the first, and to a limited range, the last functions on this list, this is because the software that is able to perform the control function requires features beyond those for planning, accept actual start and finish dates with revision of task duration, accept actual costs incurred and track actual resource usage

Quality factors were mainly formed following the DeLone and McLean IS Success Model (1992, 2003), which is composed of System Quality, Information Quality, and Service Quality. Most works of literature discussed the issues and collected items that explain the three factors: system quality, information quality, and service quality as proposed by DeLone and McLean. As per the review made regarding each component important elements are included in each respective PMIS portion: -

2.5.2 PMIS System Quality

(Lee and Yu, 2011) stated that System quality means the performance of the information processing system itself. As an essential quality element in the processing of tasks through computer-based information systems, it has been established as a critical factor for the success of information systems. Detailed items for assessing System Quality are *accessibility, usability, efficiency, and accuracy*.

2.5.3 PMIS Information Quality

Information systems are created to provide useful decision-making information to individuals and groups by storing, keeping, processing, and managing information resources. Their values are realized when the information provided is applied to operations ((Swanson ,1974) cited by Lee & Yu 2011)) claimed that information quality is a critical factor that determines the success of information systems, and defined detailed factors for assessing information quality such as the rapidity of information, resource acquisition, and the usefulness of information resources. Meanwhile, ((Zmud (1979) cited by Lee & Yu 2011) insisted that accuracy and timeliness are the critical factors that determine information quality after he developed and empirically analyzed various information quality assessment factors.

2.5.4 PMIS Service Quality

ASP-based PMIS is a type of outsourcing service for information systems that provides various services for products, hardware and software installation, maintenance, and after sight (A/S) services. Thus, service quality is an important success factor for information systems and must be assessed. Information system service quality is actively researched in marketing and business administration areas. Widely used Service Quality assessment tools include SERVQUAL developed by Parasuraman et al. (1998) and SERVPERF which was derived from criticism of SERVQUAL.

2.6 CSFs in Construction Industry

Project success, project management success, and project performance are sometimes a bit confusing because these words have been used in different ways by different researchers in the literature. Project performance often refers to project management success. Semantically, project success is measurable only after the project is completed (Morries and Hough;1987, Han et al., 2012 as cited in Silva 2016), while project performance is measured during the life of the project (Cook-Davies, 2002; Han et al., 2012 as cited in Silva 2016). Project success factors are different in each field of the project.

Pursuant to (Kronbichler et al., 2009) some of the success factors include top management support, team composition and teamwork, (Inter departmental) cooperation and communication, business plan and vision, vendor support architecture choices, technical implementation, technological infrastructure, software development, testing and troubleshooting, user involvement/ training, business process reengineering, change management, partnership, legacy systems knowledge and the like.

Project success criteria is also characterized by ambiguity but there is agreement that international development project success criteria include relevance, efficiency, effectiveness, impact, and sustainability. Relevance refers to the extent to which the project suits the urgencies of the target group, the recipient, and the giver. Efficiency refers to the degree to which the project uses the least costly resources possible to attain the anticipated results. Effectiveness refers to the extent to which the project meets its objectives. Impact refers to the positive and negative variations produced by the project, directly or indirectly, intentionally or not. Sustainability refers to whether the benefits of the project are likely to continue after benefactor funding has been withdrawn (Ika et al., 2012).

A study conducted in Malaysia regarding the success factor of construction projects and cited by (Yong and Mustaffa, 2011), viewed project success and critical success factors (CSFs) are often considered as one of the vital ways to improve the effectiveness of project delivery. One of the reasons for the difficulties in managing a construction project, especially in the government sector is due to the failure in determining the CSFs across project phases (Takim et al., 2004). On the other hand, there are also distinctions between success criteria (the measure by which success or failure of a project will be judged) and success factors (those inputs to the management system that lead directly or indirectly to the success of the project) (De Wit, 1988; Cooke-Davies, 2002).

Success factors can be further classified under two main categories, one is hard, and objectives, tangible and measurable while the other is soft, subjective, intangible, and less measurable. As for the former, the criteria of *time, cost, and quality* were widely recognized, but others such as health and safety, environmental sustainability, and technical performance are factors with growing importance. As for the later, attainment of goals such as satisfaction, effective communication, the relationship between project participants, and absence of conflicts are considered a sign of project success. It is also recommended that more emphasis should be given to improving the human-related factors such as competence, commitment, and communication in order to ensure the successful implementation of a construction project in the future (Andersen and Jessen, 2000; Chan et al., 2004; Anderson et al., 2006). It is evident that the industry itself recognized the existence of an adversarial relationship and opportunistic behavior in the industry's practice, and they are now demanding a change from the current situation.(Yong and Mustaffa, 2011).

Project consists of the integration efforts of a number of various parties, each of these parties has its own criteria for the success of the project as follows (Khaleefah et al., 2016):

1-***Owner's criteria for measuring success***: function for intended use (satisfy the users and customers); on budget; on schedule; quality (workmanship, products); end result as envisioned; return on investment (responsiveness to the audiences); aesthetically pleasing minimize aggravation in producing a building and building must be marketable (image and financial).

2-***Designer's criteria for measuring success****:* quality architectural product; satisfied client (develop the potential to obtain repeated work); professional staff fulfillment (learn new skills, gain experience); met design fee and profit goal; met the project schedule and budget; marketable product/ process; easy to operate, constructible design; no "ghosts," liability, claims; socially accepted; well-defined scope of work; and the client pays (reliability).

3-***Contractor's criteria for measuring success***: profit; underestimated budget (savings obtained for the owner and/or contractor); meet the schedule of (preconstruction, construction, design); no claims (owners, subcontractors); safety; quality specification met or exceeded; good sub-contractor buy out; client satisfaction (personal relationships); and minimal or no surprises during the project executing.

List of CSFs for various construction operations, and academia can benefit from identifying the potential topics for future studies. It was found that upper management support, commitment, constructability reviews, teamwork, communication, and building trust are the key elements of success in most construction projects (Yong and Mustaffa, 2011). A number of studies were carried out to determine the project's critical success factors while some scholars prefer to study the project failure factors or causes of failure. Some studies investigated the impact of technical factors such as scope and work definition as well as planning or external factors that might affect the project success, such as; political conflicts and corruption, harsh climate conditions and environment, and unforeseen conditions ((Gunduz & Yahya 2018) cited Chan et al. 2004; Tabish, Jha 2012; Chua et al. 1999; Songer, Molenaar 1997; Yu et al. 2006; Pinto 1985, et al.)).

According to ((Sadeh A, Dvir D, and Shenhar A. (2000) cited by (Esmaeili et al., 2016)) there are four separate dimensions of CSFs in project success. The first dimension is meeting the design's goals which refer to the contract that was signed with the client. The second dimension is the benefit to the end-users which refers to the benefit to the customers from the project end products. The third dimension is a benefit to the developing organization and refers to the benefit gained by the developing organization as a result of executing the project. The last dimension is the benefit to the national technological infrastructure, as well as to the technological infrastructure of the firm that was engaged in the development process. The combination of all these dimensions gives the overall assessment of project success.

Zainal Abidin Bin Akash et.al cited by Meervat Alt aie, Parijat Upadhyay, and Mohamed Askar (2017) conducted a review of factors affecting the success of building maintenance projects. Building maintenance is much more difficult and complex than other projects. Since they are related to service work and help to interact with people. They identified 84 factors affecting the success of the project in building maintenance which is further grouped into 8 main groups. They are Project participants, Project Management, Quality, Time, Health and Safety, Finance, Environment and Site, and others. A project which is delivered on time, in good quality, and managed within budget is considered as a successful project. As a result, Project management and Project participants play a vital role in assessing the success of the project when compared to other factors.

Having conferred the success factors alone, project success would not be perfect without the success criteria. Turner, (1999) suggests there is no point in determining success factors until one has identified the success criteria in the first place. In addition, the project success seems to be more complete with both project success factors and success criteria are taken into consideration as a whole (Ika, 2009). Within the context of the construction industry, its complexity draws most attention to project success by looking at measuring and assessing projects dependent on perceived criteria.

2.7 Empirical Review

Studies, not many, were conducted regarding project management information systems and its element in relation to project successes. (Baccarini, 1999) viewed project success as the success of the whole management team as well as the project product success. He added the metrics of project success should include the satisfaction of the stakeholders and the quality of the project. He also proposed that project success consists of two components—product success and project management success. Product success deals with goal and purpose; project management success deals with outputs and inputs.

Information systems are created to provide useful decision-making information to individuals and groups by storing, keeping, processing, and managing information resources (Lee and Yu, 2011b). According to Kim (2007), Park (2004), Joe and Lee (1997),Han and Lim (1997) and Wilcox, M, Bourne, M. (2002) and Swanson(1974) claimed that information quality is a critical factor that determines the success of information systems, and defined detailed factors for assessing information quality such as the rapidity of information resource acquisition and the usefulness of information resources. Meanwhile, ((Zmud (1979), cited by (Lee and Yu, 2011a) insisted that accuracy and timeliness are the critical factors that determine information quality after he developed and empirically analyzed various information quality assessment factors and showed that all decision making in the system is about the future.

(Chung et al., 2008) developed a success model in a construction company in relation to ERP. The model was developed through extensive studies. They studied different factors related to end-user attitudes toward EDM (Electronic data management). Regressive studies have been conducted regarding PMIS, the system use. (Raymond & Bergeron 2008) cited by many authors and contributed a lot to the area of study.

They also suggested and developed models of PMIS in relation to different project success, especially to project managers to have a timely decision.

(Karim, 2011 cited by Abdul Qadir Obeidat & Hameed Aldulaimi, 2016) stated that the current advancement of the world in technology compelled the organization to acquire more advanced information technology. Due to this pressure, acquiring PMIS is becoming a means for top managers to select, plan, organize and control projects so that it aids to make essential; decisions. Moreover, it increases the success rate of the projects in terms of relevance, cost-benefit analysis, and timeliness.

(Kahura ,2013) found that PMIS helped in the achievement of project success but only when the project constraints and objectives are well known. Raymond and Bergeron (2008) observed that modern projects without PMIS tools remain problematic even though they are completed on time most projects exceed their budget and are subject to cost overruns.

(Kahura, 2013) stated that PMIS is becoming a management tool that ensures efficiency, effectiveness, and performance of contemporary projects and IT-based software solutions are becoming an important building block for the project management team in accomplishing projects on time. ((Douglas M. Brito and Emerson A. M. Ferreira,(2015) cited by Dhawale & Zambare, 2016)) stated that the application of IT in construction projects is very crucial so as to complete the projects on time within budgets and the required quality. However, the problem has become in picturing the planning and work progress in space and integrating information between stakeholders.

(Management Information Systems, 2015) an article prepared by PMI Stated that the lack of availability of an integrated information system with a proper communication process will lead to the lack of the information provided by it which consequently impacts the project's success and lead to its failure.

(Scott et al., n.d.) stated that web-based construction information management systems can assist construction project managers to complete work on time and within budget.(K. A. Saeed and S. Abdinnour-Helm cited by Dheyaa & Al-Zubaidi, 2019) stated that high-quality information is vital in an information system as it encourages customer decision making ability and thus increases the project manager's job efficacy. On the other hand, the usefulness of information schemes that provide people with unreliable and incorrect information is adversely impacted. These instruments are usually included in PMIS software applications such as Primavera and Microsoft Project to assist and enhance decision-making, such as risk impact assessment and risk classification and rating. Based on current literature, we expect that the performance of PMIS information will be related to a successful choice. ((Jung, 2011 cited by Elijah Bor & Erick Chepnoen, 2018)) In Korea and Japan web-based Project Management Information Systems is one of the most widely used tools that back and improve the teamwork and communication between construction project stakeholders.

In Ethiopia, (Adane et al., 2021; Bedru et al., 2019; Belay et al., 2014; Kebede et al., 2020; Tiye and Gudeta, 2018) viewed project management information system in relation to health issues. The system quality and use of management information system in primary health care in primary health care units of wollega investigated(Kebede et al., 2020). The study emphasized on health issues and it was specific to one region. The same is true to other studies regarding health issues, which is concentrated in HIV and health related logistics issues and the study sited to Jimma, SNNPR and Western Hararge .

(Bekele, n.d.) conducted study to assess the contribution of PMIS in the bank sector taking the case of Awash and Dashen Bank. (Shegaw,2021) also evaluated the major function of project management information system and assess its contribution towards project success in Bank of Abyssinia S.C. (Z. G. Tesfaye, 2021). Both studies are focused in the bank industry and failed to deal with construction industry. (Z. G. Tesfaye (2020) also studied the challenges and opportunities of using PMIS in Ethiopian Women's Lawyers Association (EWLA).

PMIS is an essential tool for construction projects in Ethiopia and has become a strategic resource available for project managers when seeking the needed project success in construction projects. Moreover, the PMIS availed should maintain quality for handling construction projects and the functional area employed for the projects which is the PMIS use in project success need to have an established deductive reasonings and has not investigated in-depth and not well validated, supported, or questioned by the empirical researches yet. This gap needs to be seen as the focal point of this study.

2.8 Theoretical Model

2.8.1 DeLone and McLean Model (1992)

After studying over 180 papers on IT investment assessment factors in the 1870's and 1980's, DeLone and McLean (1992) presented an IS Success Model with six features linked to the success of information systems: System Quality, Information Quality, User Satisfaction, System Use, Individual Impact, and Organizational Impact.

While the model integrates the complete dependent variables used by IS researchers, there have been several criticisms. First, IS Use in the DeLone and McLean model contains too many meanings for it to be appropriately examined. IS Use is also argued to play a problematic and provocative role in modeling system success. Second, because User Satisfaction represents individual impacts of IS in an organizational setting, investigating the cause goes from User Satisfaction to individual impacts is fruitless. Finally, and most importantly, the model does not explain clearly and fully the connection between User Satisfaction and Individual/Organizational impacts (Edward et al. 2005).

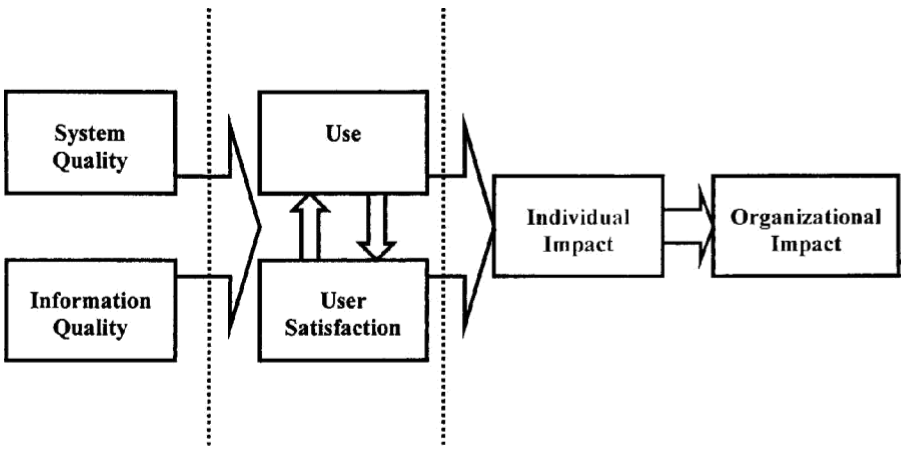

Figure 2.2.1: IS Model of, DeLone and McLean (1992)

2.8.2 Updated DeLone and McLean (D&M success model 2003)

After the publication of D & M model, Seddon studied this model and modified the variable use to Usefulness, Seddon also argued that this model is confusing because of the combination of process and variance in the same model. Researchers also suggested to include Service Quality construct also. Individual impact and organizational impact were replaced by Net Benefits (Manchanda, n.d.).

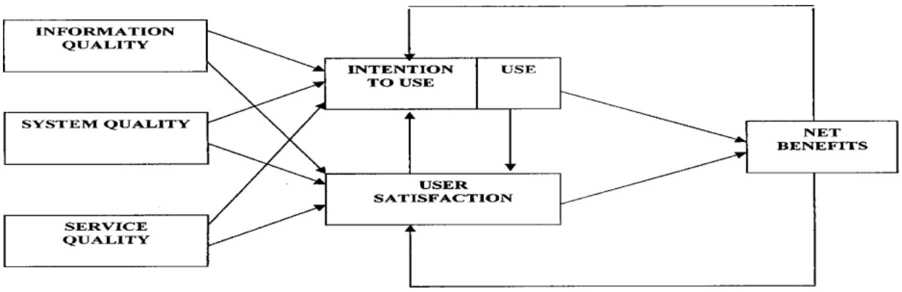

Figure 2.2.2: IS model of DELone and McLean (2003)

2.8.3 Gable IS impact Model

The model is based on the D & M model in a way it overcomes many issues related to past research. It is the model to measure IS success or impact. It is used to measure the IS-impact of an Information System (IS) is "a measure at a point in time, of the stream of net benefits from the IS, to date and anticipated, as perceived by all key-user groups" (Gable gable, Sedera dsedera & Chan chan 2008)

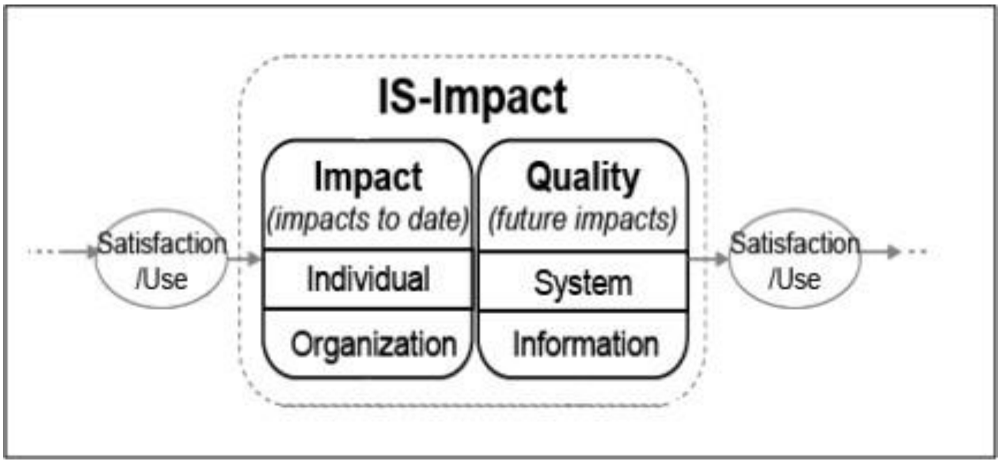

Figure 2.2.3: Gable IS impact Model

2.8.4 Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM), for modeling user acceptance of information systems. TAM starts by proposing external variables as the basis for tracing the impact of external factors on two main internal beliefs, which are perceived usefulness and perceived ease of use, while perceived ease of use also affects perceived usefulness over and above external variables. These two beliefs both influence users' attitude toward using IS. Attitude toward using IS, sequentially has influence on behavior intention to use, which is the key factor for determining actual conditions of system use(Davis, 1989)

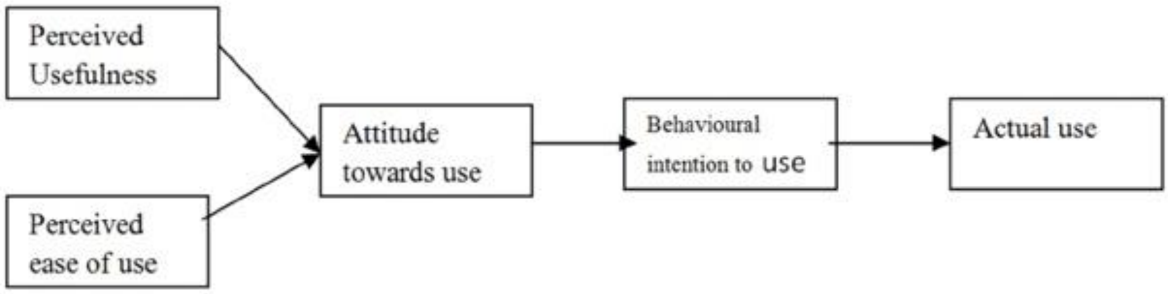

Figure 2.2.4: Technology Acceptance Model (TAM)

2.9 Conceptual Model

Based on the literature review, the following relationship between the independent variables and dependent variables proposed as a conceptual framework.

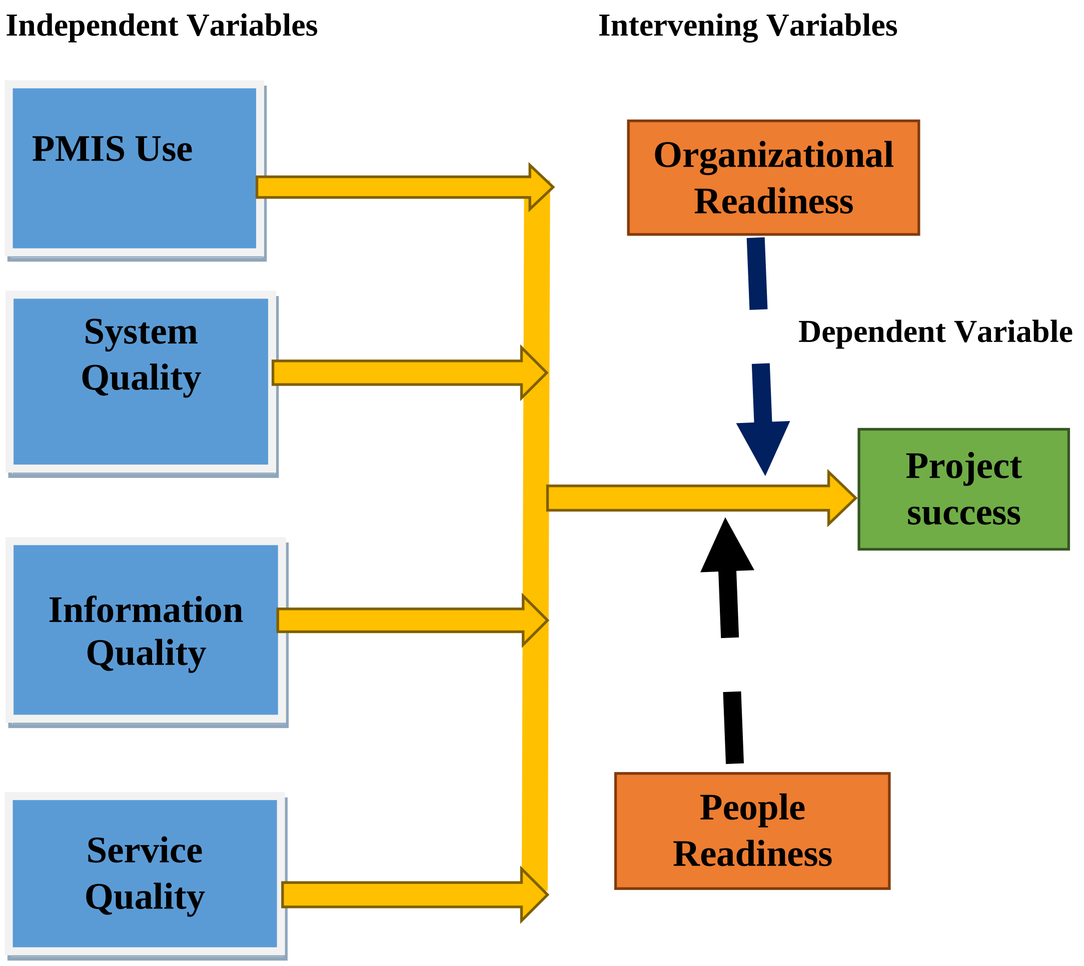

Figure 2.2.5: Conceptual PMIS model (Source: Own Developed)

Chapter 3: Research Methodology and Data Analysis

3.1 Introduction

The chapter is dedicated to discussions about the research methodology employed in conducting the study. The variables (both independent and dependent) are identified. The research model employed is defined and the type of data with the source of data to complete this study is explained in this chapter. Moreover, the population for the study, the sampling technique employed, and the way the sample size was selected with the number of samples are described. The system of data collection with measurement parameters of the variables together with the data analysis method is described in this chapter. The validity and reliability tests and the way both parameters are tested are reflected in this section.

3.2 Research Design, Variables, and Research Model

3.2.1 Research Design

Since the study required to relate the dependent variables with the independent variables, within the scope of Ethiopian construction projects in the case study of Rama Construction Plc. The study has employed both quantitative and qualitative research methods. Thus, it has employed mixed-type data in the collection. The study underwent with the purpose of studying the cause-and-effect relationship of the given variables which put the study under the category of explanatory research. Moreover, the data is collected through a cross-sectional time frame using the google formatted questionnaire and structured interview.

The instruments of the quantitative research methodology used included mainly questionnaires for the Project Managers, Senior Managers, and Construction/office engineers, and Functional Managers. Each of the items was measured on a varying five-point scale. Likert scales (1-5), with anchors ranging from “Very Low” to “Very high” for evaluating PMIS software quality, Quality of the information, and Impact of project success. A range from " Very Poor" to "Excellent" was used to evaluate the service quality and a range from "Never" to "Very often" were used for information system use in the questions. The questionnaire link was sent by e-mail /telegram to each respondent’s address after converting the hard copy to a google form.

A total of 22 projects were selected both from completed and ongoing projects in building and road construction contracted by Rama Construction Plc. These projects are the total projects undertaken by Rama construction and ongoing projects for the last ten years.

3.2.2 Description of study variables

Based on the research problem, there are several variables that define the current gap in knowledge. To determine the PMIS practice in the construction industry: in the case of Rama construction, there are different variables that have to be considered. In fact, it is obvious that the user who employs PMIS has a great influence on the project's success. Pursuant to (Abdul Qadir Obeidat and Hameed Aldulaimi, 2016b), noting that PMIS is often customized by an organization to best serve its needs with context, specific effectiveness and efficiency, then any evaluation of PMIS influence on project success needs to be user-based. Accordingly, the study holds two independent variables while it also investigates a single dependent variable, namely project success. The variables for the present study are listed below:

Independent variables: A total of four independent variables for the present study are a stated

i. **PMIS use**: It is the functional area where the PMIS is employed *(i.e., Planning. Monitoring, controlling, evaluating, and reporting functions).*
ii. **System Quality**: the performance of the information processing system itself (i.e., *accessibility, usability, efficiency, and accuracy)*
iii. **Information Quality**: created to provide useful decision-making information to individuals and groups by storing, keeping, processing, and managing information resources *(i.e. accuracy and timeliness*)
iv. **Service Quality**: a type of outsourcing service for information systems that provides various services for products, hardware and software installation, maintenance, and A/S services.

Dependent variable: The only but wide-ranging dependent variable (that was significantly influenced by the independent variables) was:

- **Project Success** (Time, Quality, Cost, Customer Satisfaction, and Project Profitability)

Intervening Variables: Readiness

- **People readiness:** refers to the emotional, attitudinal, mental, and other personal readiness in response to the PMIS and the skill and educational readiness to adapt themselves to the system in use
- **Organizational readiness:** refers to the organization's financial capability to adopt through purchase different kinds of software that could add some value to the project's success. Moreover, the capability to give training, maintain, and continuously cover the costs related to updating the PMIS

Hence, the variables employed in this study are Project Management Information system -PMIS use, System Quality, Information Quality and Service Quality *(independent variables)*, the Project success *(dependent variable)*, and Readiness: people and Organizational *(Intervening Variables).*

3.2.3 Research Model

The study employed the General Linear Model (GLM), which is the very background of nearly all statistical analysis models in modern statistical analysis, particularly in the social and applied research (Christensen, 2002; Friston et al., 1995). GLM was chosen as the most appropriate model in the study, given that there was only one dependent variable under analysis and thus required a linear regression analysis (Christensen, 2002). GLM represents a generalization of the linear model of regression analysis, where the study has one or several dependent variables. GLM is calculated with the equation stated below:

$$\mathbf{Y= b_0 + b_1X_1 + e}$$

Accordingly, the equation for treating the variables given in the study depicted as follows:

$$\boldsymbol{Y= b_0 + b_1X_1 + b_2X_{2+} b_3X_3 + b_4X_{4+} e}$$

In the equation,

- Y represents the set of outcome variables, which in the study was the one dependent variable (project success).
- X_1 represents the set of pre-program variables or covariates (PMIS Use).
- X_2 represents the set of pre-program variables or covariates (System Quality)
- X_3 represents the set of pre-program variables or covariates (Information Quality)
- X_4 represents the set of pre-program variables or covariates (Service Quality)
- The b_0 represents the set of intercepts where the value of each Y when X is at 0, and b_i represents a set of coefficients for each X_i (Wichura, 2006).
- e is the error term and is assumed to be independently, identically, and normally distributed (mean 0 and variance σ^2)

The study had two independent variables and one outcome variable (dependent), and the Y-value was calculated as an outcome of several X-values, separately, to determine the X/Y relationship (Christensen, 2002).

3.3 Population, Sampling method, and Sample size

The study has employed both primary and secondary types of data sources in order to make the study complete and avoid data insufficiency. A total of 71 questionnaires are distributed (9 for senior managers, 20 for project managers, 30 for construction/office engineers, and 12 for functional managers). The size of population was determined by investigating employees who are highly attached with the PMIS activities which was the focus of the study. Further, structured interview questions were also prepared and launched for the Managing Director, Planning and Programing Head, Road construction Projects Coordinator Head, and Building construction Projects Coordinator Head who know in-depth the organization's future plan regarding the PMIS and the completed and ongoing projects. The Interview served to fill the gap of data that was not covered by the designed questionnaire. Secondary data has been also collected from different Articles, Journals, books, websites, company policy book, etc. that have relevant information to conduct the study.

3.3.1 Population

The target population for the case study included Senior Managers, all project managers previously and currently using PMIS, Construction/Office engineers, and Functional Managers of the company who have the knowledge of the construction projects under consideration. The total number of populations is 71.

3.3.2 Sampling Method

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

3.3.3 Sample Size/ Census Inquiry

(Dunn et al., n.d.; Taherdoost, 2016) 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. Kohtari (2004) defines census as all items in any field of inquiry that constitute a 'Universe' or 'Population.' A complete enumeration of all items in the 'population' is known as a census inquiry. It can be presumed that in such an inquiry, when all items are covered, no element of chance is left and the highest accuracy is obtained. Under this method, data is collected for each and every unit. Thus, this study applied census inquiry due to the small number of respondents, seventy-one, as those respondents were only engaged directly and/or indirectly with the PMIS related functions.

Table 3.1: Sampling Frame

Constituency	Target Population
Senior Managers	9
Project Managers	20
Construction/ Office Engineers	30
Functional Managers	12
Total	**71**

Source: Survey 2022

3.4 Method of Data collection

Questionnaires were used to collect information from the all Senior management, Project Managers, Construction /office engineers, and Functional Managers. The total number of respondents were 71. Besides, structured interview was designed and the Managing Director, the Planning and Monitoring dept. Head, building project coordination department head, and Road and Industrial projects coordinating department head were requested to responded the interview.

The aim of the questionnaire that was sent to the respondents was to evaluate PMIS use, System quality, Information Quality. Service Quality, Readiness (Individual and People) and Project success. Likert scale was used in the questionnaire to measure attitudes presented by the respondents as recommended by Babbie (2011). The questions and the format were adopted from Elijah Bor & Erick Chepnoen,2018; Raymond & Bergeron 2008 (for PMIS use) from Elijah Bor & Erick Chepnoen,2018; Abdul Qadir Obeidat & Hameed Aldulaimi,2016; An, Lee, Lee & Yu,2012 (for the System Quality, Information and Service Quality). Moreover, the individual and Organizational readiness questionnaire was adopted from Touré et al., 2012. The project success Questionnaire adopted from Ika et al., 2012,Esmaeili et al., 2016; Iram et al., 2016; Nguyen et al., 2004.

The questionnaire sent through google form to the respondents was divided into two sections: Section one collected the demographic characteristics of the target population i.e., the age, sex, level of education, etc., while section two was divided into six parts based on the themes of study;

Section Two: Main constructs

- Part A: The system quality was measured with ten items: accessibility, compatibility (with other software), connectivity (with IT tools), response time, flexibility, ease of use, querying ease, learning ease, systems integration, and multi-project capability. Each of the items was measured on a five-point scale varying from 1 (low quality) to 5 (high quality).

- Part B: Information quality was measured with six items: availability, relevance, reliability, precision, comprehensiveness, and security. Each of these items was measured on a five-point scale varying from 1 (low quality) to 5 (high quality).

- Part C: Service Quality was measured with eight items: the service provider's reaction to maintenance, technical support, education, user manual and advice, feeling and security, capability, and faithfulness. Each of these items was measured on a five-point scale varying from 1 (Very poor) to 5 (Excellent).

- Part D: The use of the PMIS was measured by using the previously developed and validated questions and ascertaining the extent to which various system functions and their associated tools were actually used by project managers. The PMIS functions were divided into five categories (Raymond and Bergeron, 2008a).

    - The planning function tools aim at preparing the overall project plan; they include work breakdown structure, resource estimation, overall schedule, Gantt, PERT, and CPM.
    - The monitoring function tools are used to regularly assess project progress; they are used for progress reports and curves, and to update operational reports such as completed tasks, percent of project completed, effective schedule, remaining tasks, and remaining days to complete.
    - The controlling function tools are used to make specific changes to the project; they allow the project manager to fine-tune forecasts, modify tasks, reassign resources to lower the costs, cancel tasks, and modify

the cost of resources.

- The evaluating function tools are targeted toward project auditing; these tools allow the identification of cost and schedule variations, and tracking of the use of resources.
- The reporting function tools give information on the most basic aspects of the project; they include an overview of the project as well as reports on work-in-progress, budget overruns, and task and schedule slippages.

A score for each category was obtained by averaging the project managers' use of specific tools. The five categories and their specific number of tools are planning, monitoring, controlling, evaluating, and reporting. Five-point scales were employed: 1 (never used), 2 (rarely used), 3 (occasionally used), 4 (often used), and 5 (very often used).

- Part E: Impact of PMIS in Use were measured by the hypothetical effect of the PMIS on the following 10 items: improvement of productivity at work, increase in the quality of decisions, reduction of the time required for decision making, reduction of the time required to complete a task, improved control of activity costs, better management of budgets, improved planning of activities, better monitoring of activities, more efficient resource allocation, and better monitoring of the project schedule. A five-point Likert scale was used, varying from 1 (completely disagree) to 5 (completely agree).

- Part F: impacts of the PMIS on project success was based on the perceived contribution of the PMIS with regard to five project success criteria: respecting deadlines (time), respecting budgets (cost), respecting expected specifications (quality), meeting customer's needs (client satisfaction), and achieving organizational objectives (Profit maximization and technology transfer using a five-point scale varying from 1 (Very Low contribution) to 5 (very high contribution).

- Part G: Individual readiness regarding the implementation of PMIS perceived in Individual thought oneself as a champion/leader for PMIS technology organization, try hard to learn how to use new PMIS technology if availed, work with my team together to implement the present PMIS/if new PMIS technology will be availed/, satisfied with the currently available PMIS technology in the organization, find the PMIS technology generally complex, prefer to use PMIS technologies that one is confident will not change, and effort he/she contributes to the use of PMIS technology matches the benefit I receive. Likert scale was used, varying from 1 (completely disagree) to 5 (completely agree).

- Part H: Organizational Readiness regarding the implementation of PMIS from the perspective of the employees rated based on communicated what was expected of oneself related to PMIS technology, has a champion/leader for PMIS technology, effectively shares information with other construction organizations, has clear policies and procedures related to PMIS technology, shares descriptions of experiences related to the implementation of PMIS technology with other teams, effectively communicates information about upcoming PMIS technology changes, can manage several ongoing PMIS technology-based projects at the same time, has experienced too much change over the past year, has access to experts who understand both PMIS technology and the construction Industry, has the flexibility to reorganize resources to address changing PMIS needs, has a strategic plan that reflects PMIS technology in the value and goals, and overall thinking of the employee PMIS technology in the organization performs at an adequate speed, flexible, and allowing for growth and change. Likert scale was used, varying from 1 (completely disagree) to 5 (completely agree).

3.5 Methods of Data Analysis

The Statistical Package for Social Sciences (SPSS) version 28 was used in the analysis of the data collected. After data collection, the data was organized and rechecked against the respondents' intention using different communication tools to remove any inconsistencies, repetitions, or errors that made analysis difficult. The cleaned data collected was analyzed using both quantitative and qualitative methods.

The quantitative data was coded, this enabled the responses to be grouped into various categories. Qualitative data are based on meaning expressed through words. It involves the collection of non-standardized data that require classification and are analyzed through the use of conceptualization. The conceptual content analysis involved the development of data categories, allocating units of data, and recognizing relationships within and between categories of data to produce well-grounded conclusions. The data were analyzed in the most logical and meaningful way and relevant comments were made appropriately.

Descriptive statistics such as mean, standard deviation, and frequency distribution were used to analyze the data. Frequency tables were used to present the data collected for ease of understanding and analysis. Karl Pearson's Product moment correlation was conducted to determine the relationship between the independent variables against the dependent variable, Project success. The correlation was established using the Karl Pearson's coefficient of correlation. Lastly, multiple regression analysis conducted after testing the data sufficiency for such analysis.

After implementing the correlational design, the next step was analyzing the findings. The study was focused on testing whether the PMIS Use Information quality, System quality, and Service quality are correlated to the project's success. First, the study collected primary data from the censused senior management, project managers, construction/office engineers and functional managers on the system quality, information quality, service quality, PMIS use, impact of PMIS in use and Impact of PMIS on project success using measures of central tendency. Thereafter, a correlation coefficient was conducted using Pearson Product Moment Correlation, to depict the statistical/numerical representation of the direction and or strength of the relationship between the variables (Jones, 2000; Cohen et al., 2002).

3.6 Validity and Reliability

3.6.1 Validity

There are two ways of establishing construct validity analysis convergent or divergent validity and factor analysis. First method is convergent/divergent validity. An item selected can be said demonstrating convergent validity if it has a high correlation with another item under the similar construct, while a low correlation with an item that measures a different construct illustrating divergent validity. The second method calls for factor analysis, which can be applied to assess the construct validity of items or indicators.

Out of those two validation approaches, this study employs the correlation which investigating the strength of relationships between the studied variables. According to (Hair et al., 2007) "measures the linear association between two metric variables" Correlations were calculated in two stages as measures of relationships between the independent (predictor) variables and (outcome variable) dependent variable. This test gives an indication of both directions, positive (when one variable increase and so does the other one), or negative (when one variable increase and the other one decreases) (Pallant, 2010). The test also indicates the strength of a relationship between variables by a value that can range from -1.00 to 1.00; when 0 indicates no relationship, -1.00 indicates a negative correlation, and 1.00 indicates a perfect positive correlation (ibid). For the rest of the values is used the following guideline: small correlation for value 0.1 to 0.29; medium for 0.3 to 0.49; and large for 0.50 to 1.0 (ibid). The test is valid if the correlation value (Pearson correlation >r), on the other hand invalid if the correlation value (Pearson correlation <r).

The sample size is n = 43, so then the number of degrees of freedom is

$$df = n-2$$
$$= 63 - 2 = 61$$

The corresponding critical correlation value r_c for a significance level of alpha= .05 α=.05, for a two-tailed test is:

$$rc = 0.2500$$

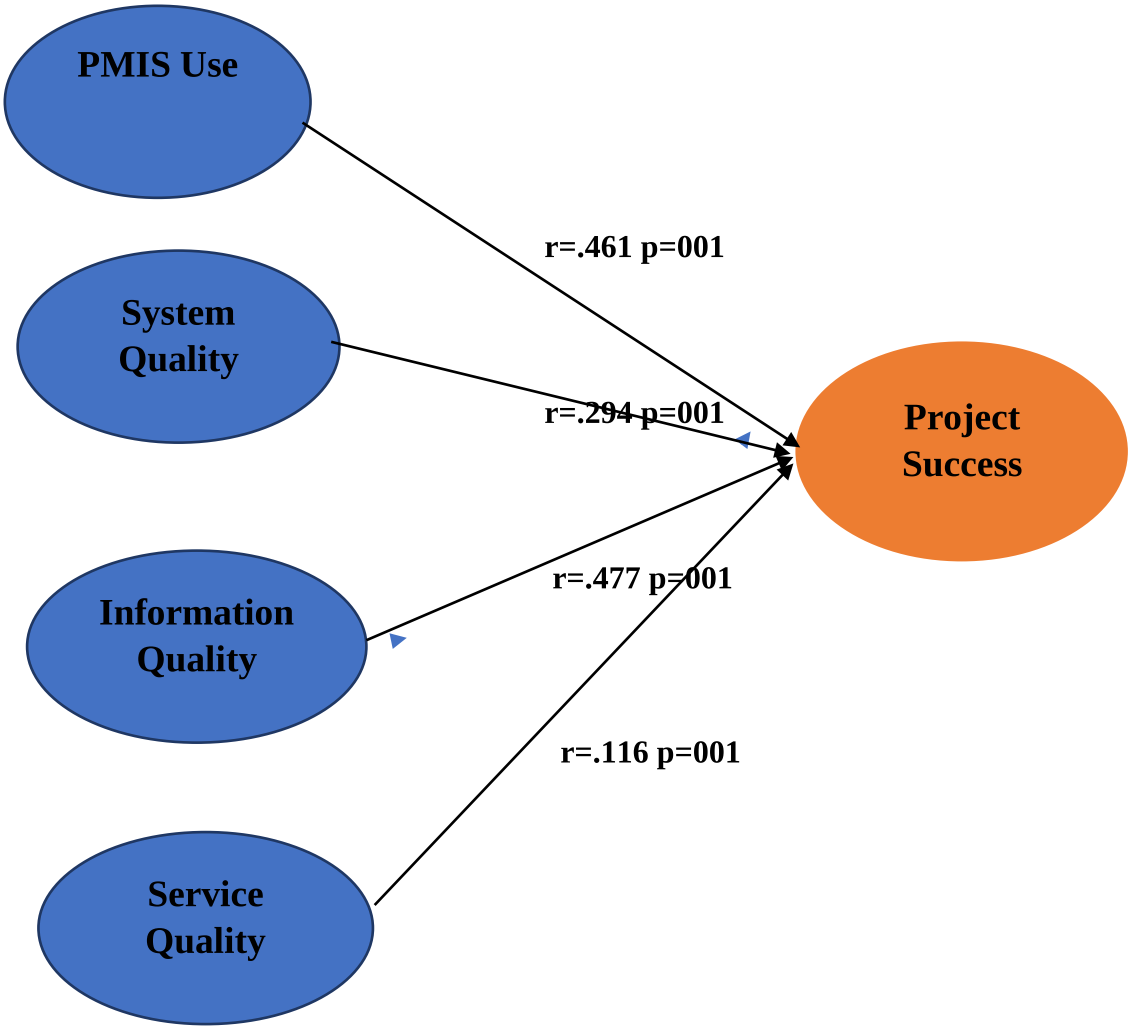

Figure 3.1: PMIS Use, System Quality, Information Quality and Service Quality correlation to Project Success

PMIS Use =0**. 461** (medium correlation) >**0.2500=> Valid**

System Quality =0**.294** (medium correlation) >**0.2500 =>Valid**

Information Quality =0**.477** (medium correlation) >**0.2500 =>Valid**

Service Quality =0**.116** (Small correlation) < **0.2500 =>Invalid**

3.6.2 Reliability

Cronbach's alpha test was used to check the reliability of the instrument on the adopted questionnaires based on the internal consistency of the research instruments. The Cronbach's Alpha test showed that the result is more than 0.6 which is considered as high reliability and acceptable. According to Zikmundet al. (2010) coefficient alpha ranges from 0 (no internal consistency) to 1 (complete consistency). Scales with coefficient alpha between 0.8 and 0.95 are considered to have very good quality, scales with coefficient alpha between 0.7 and 0.8 are considered to have good reliability, and coefficient alpha between 0.6 and 0.7 indicates fair reliability (ibid). For this study, the rules of thumb about Strength of Association is based on Hair Jr. et al. (2007) categorization [(Alpha Coefficient Range,**)** **(**< 0.6= Poor**), (**0.6 to < 0.7= Moderate**), (**0.7 to < 0.8= Good**) , (** 0.8 to < 0.9= Very Good**)** and **(**> 0.9= Excellent**)].**

Table 3.2: Cronbach's Alpha Value

Variables	**Cronbach's Alpha**	**Number of Items**	**Strength Association**
System Quality	0.961	10	Excellent
Information Quality	0.913	6	Excellent
Service Quality	0.966	8	Excellent
PMIS Use	0.947	24	Excellent
Individual Readiness	0.741	7	Good
Organizational Readiness	0.907	13	Excellent
Project Success	0.918	5	Excellent

From the findings of Table 3.2, The independent variables treated have shown results which showed the test of the instrument were excellent. The 'Service quality' construct was found with an Alpha value 0.966. Further, the construct 'Information quality' and 'System quality' were found to have an Alpha value of 0.913 and 0.961 respectively. In addition, 'Project management information system use' construct had an Alpha value of 0.947, 'Individual Readiness' had an Alpha value of 0.741, 'Organizational readiness' was found 0.907 and 'Project success had an alpha value of 0.918. A co-efficient of 0.6 and above is a commonly accepted rule of thumb that indicates acceptable reliability, (Churchill and Brown 2004), and this threshold of Alpha value 0.6 formed the study's benchmark. The findings show that the research instrument used was reliable.

3.7 Ethical Consideration

The primary research required the participation of human subjects (project managers) from Rama Construction Plc. The respondents have very important and sensitive jobs and social positions, and it was, therefore, important to consider their image and reputation in the manner they were depicted as participants in the study.

The researcher thus ensured that all participants were treated with respect and dignity, after being informed that the study was voluntary and no discrimination was triggered by failure to participate. Further, the participants were accorded complete anonymity. All business names, participants' names, job titles, and positions were omitted in all the study's documentation. The filled questionnaires were assigned identification codes, rather than participant names, to ensure that the participants received absolute confidentiality. During the data collection process, the researcher provided adequate time for respondents to fill and return the survey questionnaires due to their busy schedules using the electronic format. All participants were consulted and requested to participate voluntarily prior to the study through email/telegram message.

The research purpose, objectives, and research questions were provided to all respondents in preparation for the data collection process so that they were adequately aware of what was required of their participation. It was hoped that these measures would help protect their reputation since none of their contributions is traceable to any participant. The data generated from respondents was used exclusively for the purposes of the study and will not be availed to third parties for any other purpose.

Chapter 4: Results and Discussion

4.1 Introduction

The chapter is devoted to covering the presentation and interpretation of the findings of the study. The purpose of this study was to establish and to assess PMIS practice in the construction industry: A case of Rama Construction Plc. Besides, the study focused to study the cause-and-effect relation between Project Management Information System, quality information, system quality, service quality, Project Management Information System user, Project Management Information systems use, and construction projects' success. The findings are presented in tables.

4.2 Questionnaire Response Rate

A total of 71 questionnaire was distributed to the respondents (Senior Managers, project managers, Construction/Office engineer, and Functional Managers) through google forms by creating a pool in telegram channel and using the email of the respondents who are not using telegram. Out of the total respondents of 71, Only 63 responses were obtained. This represents a response rate of 88.73 %. According to Babbie (2002), any response of 50% and above is adequate for analysis thus 88. 73 is more superb figure.

4.3 Demographic Characteristics of Respondents

The questionnaire is initiated in such a way to have the background information of every respondent which comprises the respondent's sex, age range, level of education, position in the company, and a role the respondent has in the project. The total findings summarized as follows in table 4.1

Table 4.1 Demographic Data of the respondents

Sex		**Age**			**Educational Level**		**Role in Organization**				**Experience**		
Male	Female	31-40 years	41-50 years	Above 50 years	BA/ BSc.	Master's Degree	Senior Management	Project Mangrs.	Construction /Office Engineer	Functional Managers	Less than 5 years	10-15 years	Above 15
45	18	40	19	4	35	28	9	16	28	10	25	31	7

Source: Survey 2022

4.3.1 Sex Distribution of Respondents

The study considered the sex as a demographic characteristic so as to confirm a fair and balanced representation of the respondents.

Table 4.2: Distribution of Respondents by Sex

Sex	**Frequency**	**Percent**
Male	45	71.4
Female	18	28.6
Total	**63**	**100**

Source: Survey 2022

As shown in table 4.1 majority (71.4 %) of the respondents were male while females contributed only 28.6 % of the respondents. This is not very good representation of sex and shows that both sexes are not well represented. Though it needs further investigation to conclude the causes but the finding showed that close to 3/4 the majority is male and indicates that there is no sex equity. The findings also indicate that most project managers as well as office/construction engineers were male.

4.3.2 Age range of the respondents

The study also considered the age range of the respondents. The age range was taken with the intention of knowing which age range formed the majority of those who utilized the system in project management and the level of understanding of PMIS. The findings were as shown in the table below.

Table 4.3: Distribution of Respondents by Age

Age Range	**Frequency**	**Percent**
21-30 years	0	0
31-40 years	40	63.5
41-50 years	19	30.2
Above 50 years	4	6.3
Total	**63**	**100**

Source: Survey 2022

From the study findings, 63.5 % of the respondents were aged between 31-40 years 30.2 % were aged between 41-50 years, and 6.3 % were aged above 50 years. From these findings, it can be deduced that most of the project managers were aged between 31 and 40 years and there were none respondents between the age range of 21-30.

4.3.3 Level of Education of the respondents

The other demographic factor that was considered in the study was the respondents' highest level of education. The level of education was important in order to determine the competence and the readiness of the respondents to utilize the Project Management information system.

Table 4.4: Distribution of Respondents by their highest level of education

Educational Level	Frequency	Percent
BA/ BSc.	35	55.6
Master's Degree	28	44.4
Diploma	0	0
Others	0	0
Total	**63**	

Source: Survey 2022

From the findings in table 4.3, 44.4 % of the respondents indicated that their level of education was a master's degree, 55.6 % indicated it was undergraduate (BA/BSc.) level, and non is indicated in diploma or under the undergraduate level and above master degree These findings show that most of the project managers had a master's degree as their highest level of education and they can understand how to utilize PMIS.

4.3.4 Role in organization

The respondents were requested to indicate their role in the organization. The researcher obtained the following results.

Table 4.5: Distribution of Respondents by their role in the organization

Role in Organization	Frequency	Percent
Senior Manager	9	14.3
Project Managers	16	25.4
Construction/Office Engineer	28	44.4
Functional Managers	10	15.9
Total	**63**	**100.0**

Source: Survey 2022

From the findings in table 4.4, 25.4 % of the respondents were Project managers, 44.4 % indicated that they were Construction/office engineers, 14.3 % were senior managers and the rest 15.9 % were functional managers. These findings show that most of the respondents are project managers and construction/office engineers, 69.8 % who are highly involved in the construction project works and use the present PMIS.

4.3.5 Experience in the company

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

Table 4.6: Distribution of Respondents by their experience in the organization

Experience	Frequency	Percentage
Less than 5	25	39.7
6-10	31	48.8
11-15	7	11.1
Total	**63**	**100.0**

Source: Survey 2022

From the findings, 48.8 % of the respondents indicated that they had an experience of between 6 to 10 years in the company. 39.7 % indicated that they had an experience of less than 5 years, 11.1 % indicated that they had an experience of between 11 and 15 years. These findings show that most the respondents and project managers had an experience of between 6 and 10 years in project management.

4.4 Descriptive analysis of variables: System Quality

Every variable in the questionnaire has been examined by several statements. For the purpose of this study the statements investigating the same variable were transformed into a variable index by computing mean and standard deviation values of the responses. The standard deviation is defined as the spread or variability of the sample distribution values from the mean (Hair et al., 2007). If the estimated standard deviation is large, meaning that response distribution values do not fall close to the mean of the distribution, the responses are inconsistent. On the other hand, if the estimated standard deviation is small, meaning that response distributions are close to the mean, the responses are consistent (Sclove, 2001). The level of standard deviation boundary is supposed to vary according to the applied range of scale. For the purpose of this study, the boundary for 5-point Likert scale defined by (ibid) is employed. Thus, response distributions with sigma less than 1 are considered as consistent; while response distributions with sigma more than 1 are considered as inconsistent. After modifying the data as explained previously, high means express high agreement with the statement, while low means stand for lower agreement. Therefore, in the study to provide an overview on the entire major constructs under investigation mean values and standard deviation of the studies variables are presented as follows in Table 4:6

Table 4.7: Mean and Standard deviation of the constructs

	System Quality	Information Quality	Service Quality	PMIS Use	Organizational Readiness	Individual Readiness
Type of Variables	**Independent**	**Independent**	**Independent**	**Independent**	**Intervening**	**Intervening**
Mean	3.0507	3.5563	3.1439	3.9216	3.1939	3.2354
Std. Deviation	.98123	.93814	1.11490	.64245	.71346	.74470
Range	3.60	3.17	4.00	2.32	2.38	2.57

Source : Survey 2022

The study, correspondingly, considered the influence of Project Management Information System software quality as independent variable to assess the success of Projects. The respondents were requested to rate various aspects of the Project Management Information System quality in their organization. The results are shown in Table 4.7 below.

Table 4.8: Project Management Information System quality

	Range	Min.	Max	Mean	Std. Deviation
Accessibility	4	1	5	3.31	1.260
Compatibility (with other SW; Excel, CAD, ERP, P3…)	4	1	5	3.55	.997
Connectivity (with IT tools; PDA, RFID, USN…)	4	1	5	2.68	1.118
Response Time	4	1	5	2.72	1.136
Flexibility	4	1	5	3.06	1.094
Ease of use (like up/download, printing…)	4	1	5	3.24	1.189
Querying (Request Data or information) Ease	4	1	5	3.06	1.120
Learning Ease	4	1	5	2.94	1.120
System Integration	4	1	5	2.90	1.071
Multi-project Capability	4	1	5	3.06	1.206

Source: Survey 2022

Pursuant to the findings, the respondents rated compatibility in their organization as moderate as shown by a mean of 3.55 and a standard deviation of .997. The respondents also indicated with a mean of 3.31 and a standard deviation of 1.260 that the PMIS system quality accessibility was moderate. In addition, the general performance of ease of use was rated as moderate as indicated by a mean of 3.24 and a standard deviation of 1.189. Besides, the respondents rated the general performance of flexibility in their organization as moderate as shown by a mean of 3.06 and a standard deviation of 1.094. As well, the respondents indicated with a mean of 3.06 and a standard deviation of 1.120 that the general performance of querying ease was moderate. Also, the respondents indicated with a mean of 2.90 and a standard deviation of 1.071 that the general contribution of system integration as a PMIS system quality in their organization was moderate and the general performance of response time was moderate as shown by a mean of 2.72 and a standard deviation of 1.136.

4.5 Quality of Information

The study examined the quality of information also as one of the independent variables. Quality of information was examined so as to find the influence of quality information on the project success of construction projects. The respondents were additionally inquired to rate the impact of various aspects of quality of information produced by the PMIS in project implementation in their organizations. The findings are shown in table 4.8 below.

Table 4.9: Quality of Information

	Range	Min.	Max.	Mean	Std. Deviation
Availability	4	1	5	3.35	1.135
Relevance	3	2	5	3.82	1.112
Reliability	3	2	5	3.56	1.105
Precision	3	2	5	3.61	1.127
Comprehensiveness	3	2	5	3.59	1.141
Security	4	1	5	3.41	1.022

Source : Survey 2022

The findings showed that the respondents indicated with a mean of 3.82 and a standard deviation of 1.112 that relevance of information produced by Project Management Information System in project implementation in their organizations was high. The precision of information produced by the Project Management Information System was also rated as moderate as shown by a mean of 3.61 and a standard deviation of 1.127. Furthermore, the respondents indicated with a mean of 3.59 and a standard deviation of 1.141 that the comprehensiveness of information produced by Project Management Information System in project implementation in their organizations was high. Also, the reliability of information produced by the Project Management Information System in project implementation was rated as high as shown by a mean of 3.56 and a standard deviation of 1.105.

Moreover, the respondents indicated with a mean of 3.41 and a standard deviation of -1.022 that the security of information produced by Project Management Information System in project implementation in their organizations was moderate. Finally, the respondents indicated with a mean of 3.35 and a standard deviation of 1.135 that the security of information produced by Project Management Information System in project implementation in their organizations was moderate.

4.6 Service Quality

The study examined service quality as one of the independent variables. The respondents were inquired to rate the impact of the service provider on the project implementation in their organizations. The findings are shown in table 4.9 below.

Table 4.10: Service Quality

	Range	Min.	Max.	Mean	Standard Deviation
Reaction of PMIS service provider	4	1	5	3.06	1.252
Technical support service (maintenance and repair)	4	1	5	3.04	1.336
Education for PMIS users provided	4	1	5	3.08	1.262
User's manual and advice provided	4	1	5	2.99	1.270
Service provider knowledge of the construction field	4	1	5	3.37	1.186
Feel of data security	4	1	5	3.07	1.083
User trust in the capability of PMIS service provider	4	1	5	3.17	1.230
Service provider faithfulness	4	1	5	3.35	1.220

Source: Survey 2022

The findings showed that the respondents indicated with a mean of 3.37 and a standard deviation of 1.186 that Service provider's knowledge of the industry produced by PMIS service in project implementation in their organizations was average. Furthermore, the service provider faithfulness produced by the PMIS service quality was rated as average as shown by a mean of 3.35 and a standard deviation of 1.220. Also, the respondents indicated with a mean of 3.07 and a standard deviation of 1.083 that they feel of data security produced by Project Management Information System service was average.

Moreover, the respondents indicated with a mean of 3.17 and a standard deviation of 1.230 that user trust in the capability of PMIS service provider in their organizations was average. The education for PMIS user provided by Project Management Information System was rated as average as shown by a mean of 3.08 and a standard deviation of 1.262. It also noted that reaction of PMIS service provider was average in the organization with a mean of 3.06 and standard deviation of 1.252. The technical support of the of the PMIS service was rated with the mean of 3.04 and standard deviation 1.356 as an average. Finally, the respondents indicated with a mean of 2.99 a standard deviation of 1.270 that user manual provided and advice rendered by Project Management Information System service in project implementation in their organizations was average.

4.7 PMIS Use

4.7.1 Planning Function Tools

The respondents were asked to specify how often several planning function tools were employed within the Project Management Information System in project implementation in their organizations. The results are presented in table 4.10 below.

Table 4.11: Planning Function Tools

Planning Function Tools	Range	Min.	Max.	Mean	Standard Deviation
Work Breakdown Structure	4	1	5	3.99	1.153
Resource Estimation	3	2	5	4.04	.901
Overall Schedule	2	3	5	4.32	.858
Gantt	3	2	5	4.23	.882
PERT	4	1	5	3.15	1.104
CPM	4	1	5	3.62	1.151

Source: Survey 2022

According to the findings, the respondents indicated with a mean of 4.32 and a standard deviation of .858 that overall schedule was very often utilized in project implementation in their organizations. In addition, the respondents indicated with a mean of 4.23 and a standard deviation of .882 that Gantt chart was often utilized in project implementation in their organizations. Further, the respondents indicated with a mean of 3.99 and a standard deviation of 1.153 that work breakdown structure was occasionally utilized in project implementation in their organizations. In addition, the respondents indicated with a mean of 4.32 and a standard deviation of .858 that the overall schedule was often utilized in project implementation in their organizations. Moreover, the respondents indicate with a mean of 3.15 and a standard deviation of 1.104 that PERT was occasionally utilized in project implementation in their organizations. Finally, the respondents indicated with a mean of 3.62 and a standard deviation of 1.151 that CPM was occasionally utilized in project implementation in their organizations

4.7.2 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 4.11 below.

Table 4.12: Controlling Function Tools

	Range	Min.	Max.	Mean	Std. Deviation
Fine-Tune Forecasting	4	1	5	3.10	1.002
Modify Tasks	4	1	5	3.35	.972
Reassign resources to lower the costs	4	1	5	3.49	.826
Cancel tasks	4	1	5	2.75	1.105
Modify cost of resources	3	2	5	3.58	.873

Source: Survey 2022

According to the findings, the respondents indicated with a mean of 3.58 and a standard deviation of 0.873 that modify cost of resources is often utilized in project implementation in their organizations. The respondents also indicated with a mean of 3.49 and a standard deviation of .826 that reassigning resources to lower the costs was occasionally utilized in project implementation in their organizations. Further, the respondents indicated with a mean of 3.35 and a standard deviation of 0.972 that modifying tasks was occasionally utilized in project implementation in their organizations. Furthermore, the respondents indicated with a mean of 3.10 and a standard deviation of 1.002 that fine tune forecasting was occasionally utilized in project implementation in their organizations. Lastly, the respondents indicated with a mean of 2.75 and a standard deviation of 1.153 that cancelling tasks was rarely utilized in project implementation in their organizations.

4.7.3 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 4.12 below.

Table 4.13: Monitoring Function Tools

	Range	Min.	Max	Mean	Std. Deviation
Project Reports	2	3	5	4.37	.760
Completed Tasks	4	1	5	4.18	1.060
Percent Project Completed	3	2	5	4.32	1.025
Effective Schedule	3	2	5	3.99	.993
Remaining Tasks	3	2	5	4.17	.894
Remaining days to complete	3	2	5	4.24	.948

Source : Survey 2022

According to the findings, the respondents indicated with a mean of 4.37 and a standard deviation of .760 that project reports were very often utilized in project implementation in their organization. Further, the respondents indicated with a mean of 4.32 and a standard deviation of 1.025 that percent project completed was occasionally utilized in project implementation in their organizations. Also, the respondents indicated with a mean of 4.24 and a standard deviation of .948 that the remaining days to complete a project were often utilized in project implementation in their organization. In addition, the respondents indicated with a mean of 4.18 and a standard deviation of 1.060 that the completed tasks were occasionally utilized in project implementation in their organizations. Also, the respondents indicated with a mean of 4.17 and a standard deviation of .894 that remaining tasks were occasionally utilized in project implementation in their organizations. Lastly, the respondents indicated with a mean of 3.99 and a standard deviation 0.993 that effective schedule was occasionally utilized in project implementation in their organizations.

4.7.4 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 4.13 below.

Table 4.14: Evaluating Function Tools

	Range	Min.	Max.	Mean	Std. Deviation
Identification of costs	3	2	5	4.11	.838
Identification of Schedule variation	3	2	5	4.17	.845
Tracking the use of Resources	3	2	5	4.03	1.014

Source: Survey 2022

According to the findings, the respondents indicated with a mean of 4.17 and a standard deviation of 0.845 that the identification of schedule variation was often utilized in project implementation in their organizations. In addition, the respondents indicated with a mean of 4.11 and a standard deviation of 0.838 that identification of costs was often utilized in project implementation in their organizations. Lastly, the respondents indicated with a mean of 4.03 and a standard deviation 1.014 that tracking the use of resources was often utilized in project implementation in their organizations.

4.7.5 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 4.14 below.

Table 4.15: Reporting Function Tools

	Range	Mean	Min.	Max.	Std. Deviation
Overview of the Project	3	2	5	4.31	.785
Overview of the work-in-progress	2	3	5	4.25	.691
Budget overruns	3	2	5	3.92	.906
Task and schedule slippage	3	2	5	4.11	.854

Source: Survey 2022

From the findings, the respondents indicated with a mean of 4.31 and a standard deviation of 0.785 that the overview of the project was very often utilized in project implementation in their organizations. Additionally, the respondents indicated with a mean of 4.25 and a standard deviation of 0.691 that the overview of the work-in-progress was often utilized in project implementation in their organizations. Also, the respondents indicated with a mean of 4.11 and a standard deviation of 0.854 that the task and schedule slippage was often utilized in project implementation in their organizations Lastly, the respondents indicated with a mean of 3.92 and a standard deviation of 0.906 that budget overruns were often utilized in project implementation in their organizations.

4.8 Moderating Variables: Individual Readiness

The study also tried to assess the impact of individual readiness with regard to Project Management Information System in project success as an intervening variable. The respondents asked how much they are ready to accept or reject the change that comes with implementation of PMIS. The findings are presented in table 4.15 below

Table 4.16: Individual Readiness

	Range	Min.	Max.	Mean	Std. Deviation
I see myself as a champion/leader for PMIS technology in my organization	4	1	5	3.72	1.161
I usually try hard to learn how to use new PMIS technology if availed	4	1	5	3.82	1.223
I work with my team together to implement the present PMIS/ if new PMIS technology will be availed/	4	1	5	3.96	1.439
I am satisfied with the currently available PMIS technology in my organization	4	1	5	2.90	1.209
I find the PMIS technology generally complex	3	1	4	2.23	.796
I prefer to use PMIS technologies that I am confident will not change	4	1	5	2.56	.967
The effort I contribute to the use of PMIS technology matches the benefit I receive	4	1	5	3.46	1.433

Source: Survey 2022

Pursuant to the findings, the respondents often agree that they work with their team regarding the existing PMIS technology in their organization and shown by a mean of 3.96 and a standard deviation of 1.439. The respondents also indicated with a mean of 3.82 and a standard deviation of 1.223 often agree they tried hard to learn the use of new PMIS technology in the organization. Additionally, the respondents often agree that they consider themselves as a champion of the new PMIS system was shown by a mean of 3.72 and a standard deviation of 1.161. Also, the respondents indicated with a mean of 3.46 and a standard deviation of 1.433 often agreed that the benefits they gain from the PMIS technology matches with the effort they exerted. In addition, respondents with mean of 2.90 and a standard deviation of 1.209 occasionally agreed with the satisfaction of the present PMIS. As well, the respondents indicated with a mean of 2.56 and a standard deviation of .967 rarely disagree and confident that the PMIS technologies that they use now will change. Lastly, respondents with a mean of 2.23 and a standard deviation of 0.796 rarely disagree that they are satisfied with the present PMIS technology.

4.9 Moderating Variables: Organizational Readiness

The study also tried to assess the impact of organizational readiness with regard to Project Management Information System in project success as an intervening variable. The respondents asked how much the organization is ready to make aware of it employees, included in its policies and facilitate the change environment in relation to the PMIS user so that the implementation of PMIS could be the contributor of Project success. The findings are presented in table 4.16 below

Table 4.17: Organizational Readiness

	Range	Min.	Max.	Mean	Std. Deviation
Communicated what was expected of me related to PMIS technology	4	1	5	3.07	1.138
Has a champion/leader for PMIS technology	4	1	5	3.17	1.146
Effectively shares information with other construction organizations	4	1	5	3.03	1.219
Has clear policies and procedures related to PMIS technology	3	1	4	2.87	1.081
Shares descriptions of experiences related to the implementation of PMIS technology with other teams	3	2	5	3.06	.954
Effectively communicates information about upcoming PMIS technology changes	3	1	4	2.89	.964
Can manage several ongoing PMIS technology-based projects at the same time	3	2	5	3.45	.858
Has experienced too much change over the past year	4	1	5	2.76	1.035
Has access to experts who understand both PMIS technology and the construction Industry	3	2	5	3.42	.951
Has the flexibility to reorganize resources to address changing PMIS needs	4	1	5	3.56	1.168

Source: Survey 2022

From the findings of Table 4.16, the respondents often agreed that the organization has the flexibility to reorganize resources to address changing PMIS need with a mean of 3.56 and a standard deviation of 1.168. Respondents with a mean of 3.42 and a standard deviation 0.951 occasionally agree that the organization has access to experts who understand both PMIS technology and the construction Industry. Also, respondents with a mean of 3.45 and a standard deviation 0.858 occasionally agree that the organization can manage several ongoing PMIS technology-based projects at the same time. The respondents also occasionally agreed that the organization communicated what was expected of them regarding the PMIS technology with a mean of 3.07 and a standard deviation of 1.138. Furthermore, the respondents also occasionally agreed that the organization shares descriptions of experiences related to the implementation of PMIS technology with other teams with a mean of 3.06 and a standard deviation of 0.954.

In addition, the respondents occasionally agreed with a mean of 3.03 and a standard deviation of 1.219 that the organization effectively shares information with other construction organizations. The respondents also occasionally agreed with a mean of 2.89 and a standard deviation of 0.964 that the organization effectively communicates information about upcoming PMIS technology changes. They also occasionally agreed with a mean of 2.87 and a standard deviation of 1.081 that the organization has clear policies and procedures related to PMIS technology. Lastly., the respondents occasionally agreed that the organization has experienced too much change over the past year with a mean of 2.76 and a standard deviation of 1.035.

4.10 Impact of the existing PMIS on the System User

The study assesses the influence Project Management Information System user on the success 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 success in various activities highlighted. The findings are presented. The findings are presented in table 4.17 below.

Table 4.18: Impact the System User

	Range	**Min.**	**Max.**	**Mean**	**Std. Deviation**
Improvement of productivity of work	3	2	5	4.25	1.010
Increase in the quality of decisions	3	2	5	4.34	.970
Reduction of the time required for decision making	4	1	5	4.18	1.060
Reduction of the time required to complete a task	4	1	5	4.10	1.136
Improved control of activity costs	4	1	5	4.13	1.120
Better management of budgets	4	1	5	4.17	1.242
Improved planning of activities	4	1	5	4.18	1.086
Better monitoring of activities	4	1	5	4.13	1.230
More efficient resource allocation	4	1	5	4.17	1.207
Better monitoring of the project schedule	4	1	5	4.20	1.214

Source: Survey 2022

From the findings, the respondents often agreed with a mean of 4.34 and a standard deviation of .970 that the increase in the quality of decisions produced by the project management information system in use influences the project success. In addition, the respondents indicated with a mean of 4.25 and a standard deviation of 1.010 often agreed that the project management information system in use impacts by improving the productivity of the work in the project success. Further, respondents often agreed with a mean of 4.18 and a standard deviation of 1.060 that the reduction of time required for decision making produced by project management information system in use influences the project success. Also, the respondents often agreed with a mean of 4.17 and a standard deviation of 1.207 that more efficient resource allocation produced by the project management information system in use influences the project's success. Further, the respondents often agreed with a mean of 4.13 and a standard deviation 1.230 that better monitoring of the project schedule produced by the project management information system in use influences the project success. The respondents also often agreed with a mean of 4.18 and a standard deviation of 1.086 that improved planning of activities produced by the project management information system in use influences the Project's success.

In addition, the respondents often agreed with a mean of 4.10 and a standard deviation of 1.136 that reduction of the time required to complete a task produced by project management information system in use occasionally influences the project success. The respondents also often agreed with a mean of 4.13 and a standard deviation of 1.120 that improved control of activity costs produced by project management information system in use influences the project success. Lastly, the respondents indicated with a mean of 4.17 and a standard deviation of 1.242 often agreed that better management of budgets produced by project management information system in use influences the project success.

4.11 Project Success

The respondents were asked to rate the impact of PMIS on the general project Success The findings are shown in table 4.18 below.

Table 4.19: Impact of PMIS on Project success

	Range	Min.	Max.	Mean	Standard Deviation
Meeting Deadlines	3	2	5	3.93	.976
Respecting Budgets	4	1	5	3.85	1.215
Meeting Quality	4	1	5	3.99	.933

Specification					
Meeting customer needs	3	2	5	4.01	1.089
Gain Profitability	4	1	5	4.06	1.107

Source: Survey 2022

According to the findings, the respondents indicated with a mean of 4.06 and a standard deviation of 1.107 that gaining profit had a high contribution as well on the general project success. Further, respondents indicated with a mean of 4.01 and a standard deviation of 1.089 that meeting customer's needs had high contribution on the general project success. Respondents indicated with a mean of 3.99 and a standard deviation of 0.933 that meeting quality specifications had high contribution on the general project success. The respondents indicated with a mean of 3.93 and a standard deviation of .976 that meeting deadlines had high contribution on the general project success. Finally, respondents indicated with a mean of 3.85 and a standard deviation of 1.215 that respecting budgets had high contribution on the general project success.

4.12 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 and a negative value for the correlation implies a negative or inverse association.

The data presented on the system quality, quality of information, service quality and PMIS use also computed as a predictor variables. Then, Pearson's correlations analysis was conducted at 99% confidence interval and 1% confidence level 2-tailed. The table below indicates the correlation matrix between the factors system quality, quality of information, and service quality and PMIS use and Construction Project success. Moreover, it indicates the intervening variables, Individual and Organizational readiness, with respect to project success.

Table 4.20: Correlational Matrix of System quality, Information quality , service quality , PMIS use and Project success

		System Quality	Information Quality	Service Quality	PMIS Use	Individual Readiness	Organizational Readiness	Project Success
System Quality	Pearson Correlation	1	.635**	.740**	.613**	.041	.336**	.294*
	Sig. (2-tailed)		<.001	<.001	<.001	.734	.004	.013
	N	63	63	63	63	63	63	63
Information Quality	Pearson Correlation	.635**	1	.439**	.558**	-.183	.123	.477**
	Sig. (2-tailed)	<.001		<.001	<.001	.126	.307	<.001
	N	63	63	63	63	63	63	63
Service Quality	Pearson Correlation	.740**	.439**	1	.526**	.025	.216	.116
	Sig. (2-tailed)	<.001	<.001		<.001	.838	.070	.336
	N	63	63	63	63	63	63	63
PMIS Use	Pearson Correlation	.613**	.558**	.526**	1	-.020	.201	.461**
	Sig. (2-tailed)	<.001	<.001	<.001		.866	.093	<.001
	N	63	63	63	63	63	63	63
Individual Readiness	Pearson Correlation	.041	-.183	.025	-.020	1	.628**	-.119
	Sig. (2-tailed)	.734	.126	.838	.866		<.001	.323
	N	63	63	63	63	63	63	63
Organizational Readiness	Pearson Correlation	.336**	.123	.216	.201	.628**	1	-.054
	Sig. (2-tailed)	.004	.307	.070	.093	<.001		.653
	N	63	63	63	63	63	63	63
Project Success	Pearson Correlation	.294*	.477**	.116	.461**	-.119	-.054	1
	Sig. (2-tailed)	.013	<.001	.336	<.001	.323	.653	
	N	63	63	63	63	63	63	63
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

Source: Survey 2022

From the correlation analysis, the study found that there is a positive relationship between the project management information system use and project success, where the correlation coefficients was 0.461 and a p-value of <.001. The study also found that the Information quality and project success correlate positively with correlation coefficients of .477 and p-value of <.001. the system quality and project success correlate positively with correlation coefficients of .294 and p-value of <.001. Lastly, the service quality and project success correlate slightly with positive correlation coefficients of .116 and p-value of <.001. The study, moreover, found that there was negative relationship between the individual readiness and organizational readiness to project success with a correlation coefficient of -0.119 and a p-value of -.054 respectively.

These findings clearly shows that the four independent variables (Project management information system use, Information quality, system quality and service quality) had influence on the dependent variable (project success) whereas, the moderating variables had no any significant influence. All the independent variables had significant influence on the dependent variable since the p-value in all the relationships was less than 0.001 which is less than the alpha value (level of significance) 0.01.

From these findings, we can infer also that, Project management information system use and Information Quality had the most significant influence on project success followed by project management information system quality and Service quality respectively.

4.13 Regression test assumptions

Regression analysis requires assumptions that has to be made to prove the data collected was valid and reliable. These includes linearity, multicollinearity, independence of residuals, homoscedasticity, normality of residuals, and outliers. Normal Probability Plot (P-P) of the regression standardized residual and a scatter plot of the standardized residuals examined to test regression assumption. There were no major violations of assumptions in this study. A detailed discussion of assumption testing follows prior to a description of the regression results.

Linearity

To run the multiple regression analysis, the first regression assumption test was to check the independent variables System quality, Information quality, service quality and PMIS Use against the dependent variable (project success). Variables should be linear and it is a problem if the dispersion of points indicates otherwise (Burns & Burns 2008).

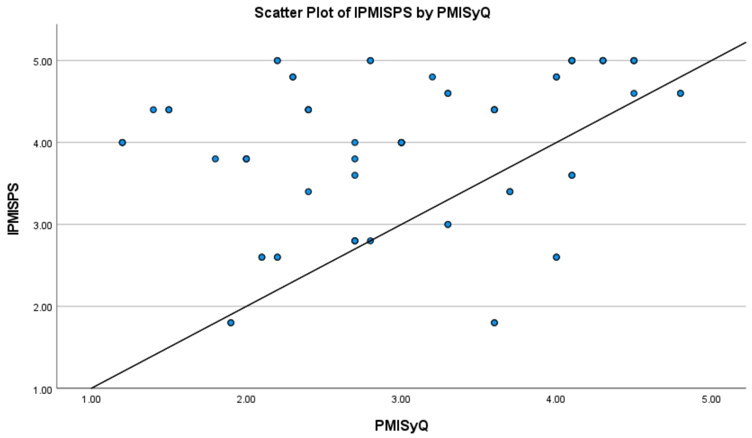

Figure 4.1: Linearity test of System quality and PMIS success

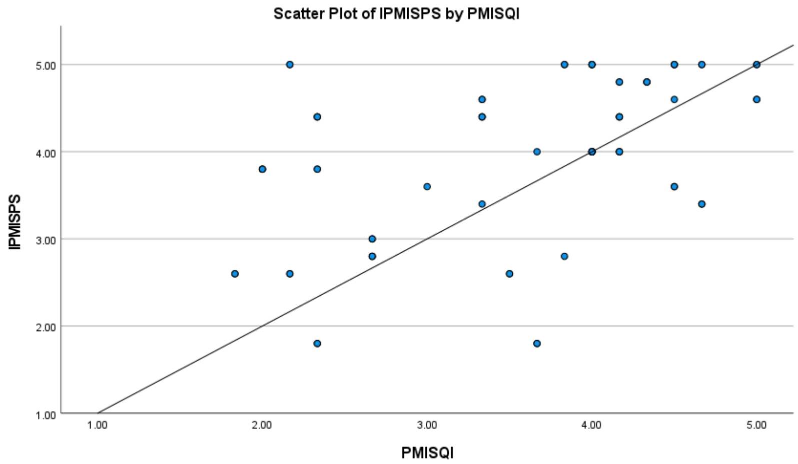

Figure 4.2: : Linearity test of Information quality and PMIS success

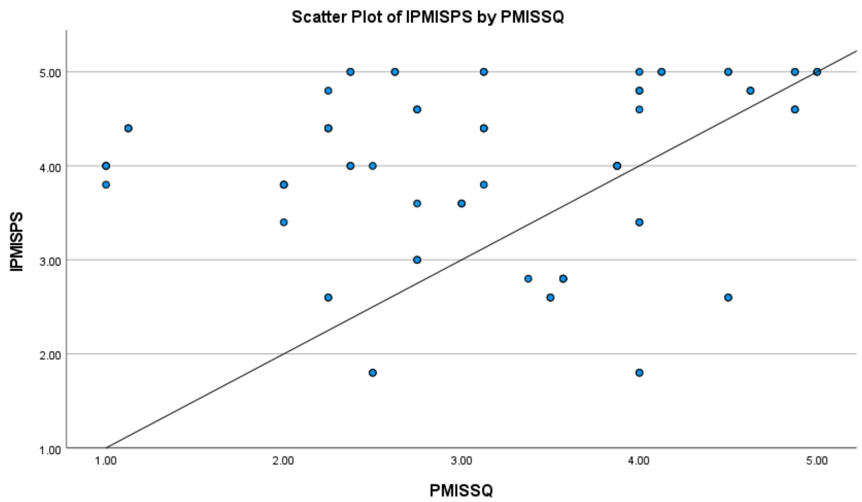

Figure 4.3: : Linearity test of Service quality and PMIS success

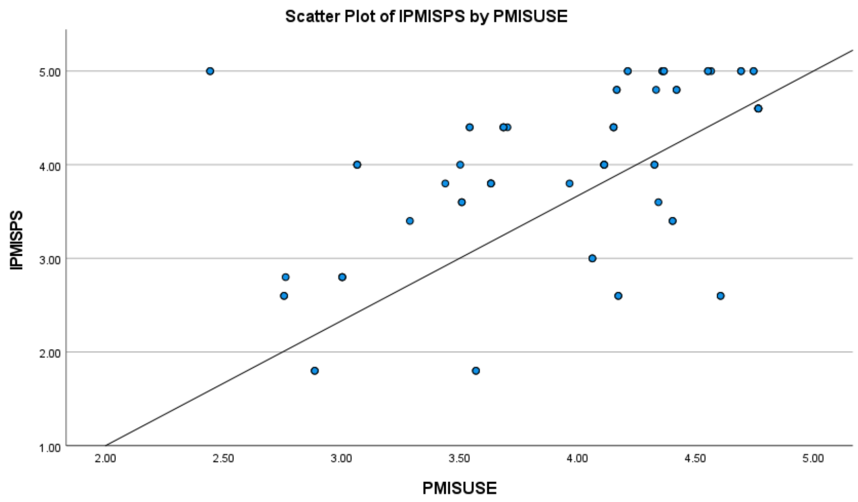

Figure 4.4: Linearity test of PMIS Use and PMIS success

Pursuant to the above figure, the scatter plot shows that the plot has settled on the linear line and residual values were not seen a lot. Thus, there were no major violations of assumptions in this study.

Residual independence

The second test that has to be done in the regression analysis assumption was to test residuals are independent (or uncorrelated). This was done based on Durbin Watson test for autocorrelation coefficients and by examining the variance inflation factor (VIF). The Durbin Watson statistic will always have a value ranging between 0 to 4. A value of 2.0 detected indicates that there is no autocorrelation detected in the sample. The test done showed a value of 2.171 which is close to 2, and good sign for no multicollinearity between the predictors and dependent variables.

Table 4.21: Durbin Watson test of auto correlation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.628[a]	.395	.285	.79553	2.171
a. Predictors: (Constant), PMIS USE, System Quality, Information Quality, and Service Quality					
b. Dependent Variable: IPMISPS					

Source: Survey 2022

Multicollinearity

The second assumption checks if there are high correlations between the four independent variables dimensions. The most common approach to evaluating multicollinearity is by examining the correlation coefficients and the variance inflation factor (VIF). Fritz and Morris (2012) stated that a small correlation is less than 10 and tolerance scores to be above 0.2. Analysis of collinearity statistics show this assumption has been met, as all VIF scores were below 10, and tolerance scores above 0.2.

Table 4.22: VIF: test of autocorrelation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.098	.600		1.832	.072		
	System Quality	.018	.172	.019	.107	.915	.317	3.152
	Information Quality	.366	.137	.365	2.670	.010	.545	1.833
	Service Quality	-.220	.129	-.260	-1.708	.092	.440	2.272
	PMIS Use	.561	.197	.383	2.840	.006	.562	1.780
a. Dependent Variable: Project Success								

Source: Survey 2022

Homoscedasticity

The other assumption made was assumption of homoscedasticity, which is the assumption that the variation in the residuals (or amount of error in the model) is similar at each point of the model.

The graph plotted below showed the standardized values of the model would predict, against the standardized residuals obtained. As the predicted values increase (along the X-axis), the variation in the residuals should be roughly similar. If everything is good, the dot scatter graph looks like a random array of dots. If the graph looks like a funnel shape, then it is likely that this assumption has been violated.

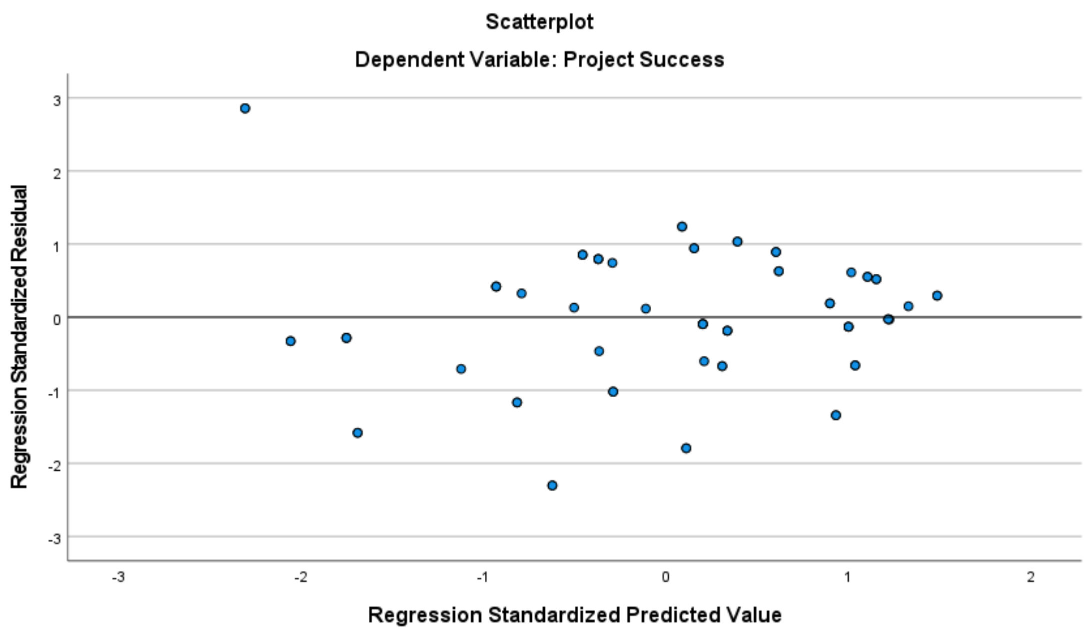

Figure 4.5: homoscedasticity test

The plot (above) of standardized residuals vs standardized predicted values showed no obvious signs of funneling, suggesting the assumption of homoscedasticity has been met.

Normality of residuals

The other values that have to be tested to check regression is whether the value of the residuals is normally distributed. This assumption can be tested by looking at the P-P plot for the model. The closer the dots lie to the diagonal line, the closer to normal the residuals are distributed.

In the case of the study data conducted, points hardly touch the line at all, indicating that assumption may be violated. However, as only extreme deviations from normality are likely to have a significant impact on your findings, the results are probably still valid.

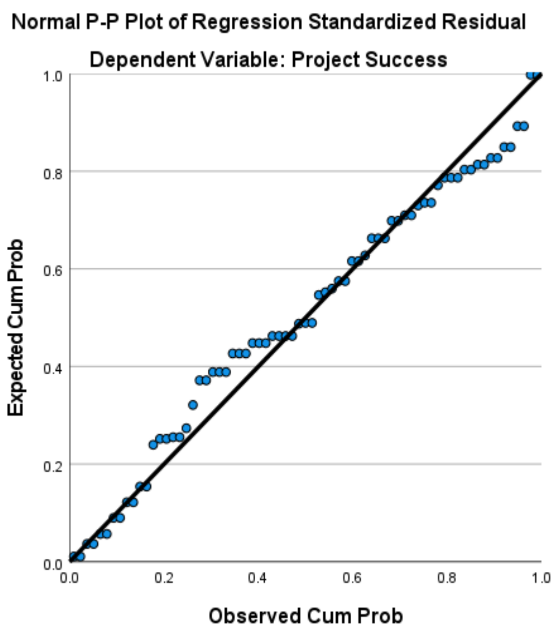

Figure 4.6: P-P plot for the model

Outlier

The last assumption of regression that has to be tested is the checking the outlier variables if any using cook's distance statics for each participant. Any values over 1 are likely to be significant outliers, which may place undue influence on the model, and should therefore be removed and your analysis rerun.
The test done on the cook's distance statics showed that values were all under 1, suggesting individual cases were not unduly influencing the model.

4.14 The effect of predicted variables on Project success

In this study standard multiple regression =.05 (two-tailed), were conducted in order to examine effect of the predicted variables on the Project success**.** The results of this analysis indicate how well the four predicted variables dimensions are able to predict Project success. Furthermore, it shows how much unique variance in the dependent variable, project success is explained by each of independent variables. The independent variables in the study were system quality, information quality, service quality, and PMIS use. The dependent variable was project success.

Table 4.23: The effect of System quality, information Quality, Service Quality and PMIS Use on Project success

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.628[a]	.395	.285	.79553	2.171
a. Predictors: (Constant), PMIS USE, System Quality, Information Quality, and Service Quality					
b. Dependent Variable: IPMISPS					

Source: Survey 2022

As stated previously, preliminary analysis of multicollinearity, outliers, normality, linearity, homoscedasticity, and independence of residuals showed no serious violations of the regression assumptions. The regression analysis showed that the model was able to significantly predict project success. As shown in table 4.21 above, the result of regression analysis multiple coefficients of determination or R square (R^2=0.395) indicates that 39.5% of variance in the measurement (Project success) function can be explained by system, Information, service quality, and PMIS use, while the remaining 60.5% are explained by other variables out of this model. The possible explanation for this may be the other factors like size of the project, contractual completion time of the project, budget allocated and other factors beyond the scope of this study.

Table 4.24: The effect of System Quality, Information Quality, Service Quality and PMIs use on Project success ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.230	4	5.057	7.991	<.001[b]
	Residual	41.769	59	.633		
	Total	61.999	63			
a. Dependent Variable: IPMISPS						
b. Predictors: (Constant), *PMIS USE, System Quality, Information Quality, and Service Quality*						

Source: Survey 2022

The ANOVA tells us whether the model, overall, results in a significantly good degree of prediction of the outcome variable. (Field, 2005). As shown in Table 4.24 above the significance result on the ANOVA table is 0.001 which is $p < 0.05$, the regression analysis indicates good degree of prediction.

Individual parameter significant test shows how strong an independent variable individually affecting dependent variable. Moreover, these study aims to identify which of the variables contributed the most to prediction of the dependent variable. This can be investigated via Standardized coefficient Beta. The standardized coefficients mean that "values for each of the different variables have been converted to the same scale so they can be compared" (Pallant, 2010). Thus, the next phase requires the function of Beta coefficient (*b*) or standardized regression coefficient of each predictor or independent variable. The regression coefficient explains the average amount of change in dependent variable that caused by a unit of change in the independent variable. The larger value of Beta coefficient that an independent variable has, brings the more support to the independent variable as the more important determinant in predicting the dependent variable.

Table 4.25: Regression Analysis Summary for Predictor Variables

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.098	.600		1.832	.072
	System Quality	.018	.172	.019	.107	.915
	Information Quality	.366	.137	.365	2.670	.010
	Service Quality	-.220	.129	-.260	-1.708	.092
	PMIS Use	.561	.197	.383	2.840	.006
a. Dependent Variable: Project Success						

Source: Survey 2022

Among the four constructs, multiple linear regression analysis revealed that Service quality showed not significantly associated with project success. The nature of the relationship for system quality, Information quality and PMIS use was positive with Beta equal to .018, .366, and .561. Whereas, negative relationship was showed for Service quality with Beta is equal to -.220. The positive slope indicates that Project success increases as PMIS use construct increases. Statistically, there is a .561 increase in project success for each one-unit increase in PMIS use and .366 increase in project success for each one unit increase in Information quality. This means that the more the organization used PMIS use and Information quality as strategies the more the project success will be maintained. However, this will not work (applied) for service quality construct and system quality too since the sig>.05. This was more revealed on the respondent's response in relation to the impact assessment questions in relation to the current PMIS against the PMIS use activities such as improvement of productivity at work, increase in the quality of decisions, reduction of the time required for decision making, reduction of the time required to complete a task, improved control of activity costs, better management of budgets, improved planning of activities, better monitoring of activities, more efficient resource allocation, and better monitoring of the project schedule showed an average mean of 4.139, by which most respondents agreed that PMIS use has got more relation with project success.

4.15 Test of Moderatin sig Variables

The moderating variables assumed were readiness (Individual and Organizational). The test conducted to check the moderating variables against the independent variable showed that both moderating variables do not enhance (improve) or lessen the project success rate except organizational readiness showed moderating effect on PMIS use.

Table 4.26: Moderation effect of Readiness

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.461	.846		1.727	.090
System Quality	-.161	.208	-.168	-.777	.441
Information Quality	.515	.201	.514	2.562	.013
Service Quality	-.125	.148	-.148	-.840	.405
Individual Readiness	.273	.210	.216	1.302	.198
Organizational Readiness	-.453	.238	-.344	-1.907	.062
PMIS Use	.538	.255	.367	2.111	.039
System Quality x Individual Readiness	-.112	.516	-.084	-.217	.829
Information Quality x Individual Readiness	.181	.347	.139	.521	.605
Service Quality x Individual Readiness	.404	.433	.328	.935	.354

PMIS Use x Individual Readiness	-1.141	.582	-.562	-1.959	.055
System Quality x Organizational Readiness	-.141	.686	-.107	-.205	.838
Information Quality x Organizational Readiness	.493	.322	.379	1.531	.131
Service Quality x Organizational Readiness	-.653	.477	-.520	-1.368	.177
PMIS Use x Organizational Readiness	**1.336**	**.576**	**.700**	**2.318**	**.024**
Dependent Variable: Project Success					

Source: Survey 2022

The effect of the interaction of individual readiness was not significant for the constructs of system quality as the β= −.084, $p > .05$ and PMIS use as β= -.562, $p > .05$, but the interaction term was positively significant both for Information quality model (β= .139, $p < .01$) and service quality (β= .328, $p < .01$). Moreover, the effect of the interaction of the organizational readiness also not significant in the model except positively significant with PMIS use in the model (β= .700, $p < .01$). The results for moderation effects both Individual and organizational readiness also presented in Table 4.24 above. The results showed that the direct effect of individual and organizational readiness does not find in project success except on PMIS Use. Though reviews showed that project success is highly affected by the organizational readiness (Cost, training, maintenance of the system, Information management policy and the like) and Individual readiness (attitude, skills, technology adaptability of the individual), the study showed that only organizational readiness in relation PMIS use has impact on the project success. This shows that the outcome variable project success is predicted by PMIS use was amplified or decreased with the readiness of the organization. If the organization well prepared and implement the PMIS use functions (which planning, controlling, monitoring, evaluating and reporting functions) the project success would be amplified and the reverse was true if the organization was not ready to implement the PMIS use. Thus, the finding showed that effect of the project success was moderated by the PMIS use.

Chapter 5: Summary of Findings, Discussions, Conclusions and Recommendations

5.1 Introduction

This chapter presents discussion summary on the key data findings, the conclusions drawn from the findings highlighted and recommendations made. The conclusions and recommendations drawn were focused on addressing the objectives of the study.

5.2 Summary of Findings

The study required to examine project management information systems and practice in project success with a specific area of construction. It assesses the impact of Quality of the system, Quality of information, and service quality and PMIS use with intervening variables of readiness (people and organization) in the project's success.

Pursuant to the findings, the system quality, information quality, service quality, and PMIS use had correlation with the project success as per the analysis made on the person correlation analysis. The respondents on the PMIS use of the various function tools i.e., planning, monitoring, Evaluation and reporting tools within the system witnessed that the PMIS use had helped the organization Senior management, Project managers, office engineers and functional managers in relation to projects to improve their project task in turn contributed the probability of project success. The analysis made using statistical tools also showed this fact.

Table 5.1: Dependent and Independent Variables mean and Standard deviation

Constructs	Minimum	Maximum	Mean	Std. Deviation
System Quality	1.20	4.80	3.0507	.98123
Information Quality	1.83	5.00	3.5563	.93814
Service Quality	1.00	5.00	3.1439	1.11490
PMIS Use	2.44	4.77	3.9216	.64245
Project Success	1.80	5.00	3.9662	.94112

Source: Survey 2022

According to the finding regarding the system compatibility had an excellent response in their organization with a mean of 3.55 and a standard deviation of .997. 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 project success. From the findings of information quality, the relevance and precision of the information generated by the system (software) were the characteristics that were rated highly with means of 3.82 and 3.61 respectively. This meant that the information was readily relevant and precise for the task at hand. In the service quality, the service provider knowledge of the construction field and the service provider faithfulness had mean of 3.37 and 3.35 respectively. This showed that the respondents believed the respondents knowledge regarding the industry is good and they do trust the service provider.

5.2.1 Readiness

From the finding the interaction terms of constructs with the moderating variables Individual and Organizational readiness showed that PMIS use and Organizational readiness had an impact on increasing and decreasing of the project success .Whereas, the interaction on the other variables both with individual readiness and organizational readiness showed that the interaction neither improved or worsen the project success by intervening with the independent variables.

5.3 Discussion of Findings

The objective of this research was to have a better understanding of the elements PMIS Use, system software, quality of information, and the system use contribute to the success of construction projects. The study results are discussed in terms of the objectives and their direct and indirect effects of project management information system on project success. As stated previously, the PMIS tools used by the company under consideration are MS- Project and Primavera. The company also on process of acquiring ERP software so as to ease and support the existing systems.

One of the element evaluated in the study was the quality of the system in relation to the ease of software use, flexibility, response time, learning ease and system integration and it was found that the system quality did not play an important role in project success. Respondents more concerned on the produced quality information in relation to project success as perceived by the project manager and other respondents. Cleland agrees that the best information loses its value if it is not available to people who need it to make decisions and direct actions (Cleland, 2004)

Thus, the information generated by the system believed that have many facets to the project success. Moreover, the quality of service given to the system also designed in relation to the industry but with trust (faithful service). However, respondents alleged that quality service did not have any positive impact on the project success. Thus, the PMIS system implemented in the organization had sufficient relation to impact the project success if it is highly worked with producing Quality information and PMIS use.

Better quality of information output increases the reliability and dependability of the project management information system being used, which in turn allows the system to have a positive impact on the project management. It was also noted the PMIS use has indicated strong impacts of the Project Management Information System followed by quality information upon the successful completion of their projects, while system quality and service quality not. The results of this study also indicate that, in general, the low use of Project Management Information System depended upon a system of lower quality that produced lower quality information; hence they used their system less and were less supported in their project management task. Whereas project managers who used Project Management Information System use highly were those who the sufficient conditions were met, that is, system quality, information quality, project management information system use and positive impacts on managerial work.

In summary, if it is to make a significant contribution to the attainment of project objectives, i.e., to make an impact in terms of project budget, schedule, specifications, customer satisfaction and profit gaining project management information system must first be sufficiently sophisticated and serviced to produce information of sufficient quality and use. It must then be used with sufficient depth and breadth by the users and it must have a sufficiently beneficial impact on their work.

5.4 Conclusions of the Study

The research aim of this study primarily was to evaluate the impact of the Project Management Information System on the project management in relation to the construction project. The finding of the research showed that PMIS has impact on construction projects and is success also showed correlation with the predictor variables. The other objective was to assess the outcome of using the Project Management Information System on the organization under consideration and the success of its project. The finding showed that the outcome of using PMIS in the organization under consideration was positive relationship especially in the functional area where PMIS implemented, PMIS Use (Planning, controlling, Monitoring, evaluating and reporting). It was also set as a purpose to assess the effect of Project Management Information System quality on the success of construction projects of the company. Though, previous research findings showed that PMIS system quality had an impact on the success of projects, in the case of our study, the findings showed that PMIS system quality did not show any positive relation. However, the Information quality produced by the system showed positive impact on project success. Besides, the company management believed that unless there is no the skilled manpower and capability to work on the system as well as the initiative of the employees to implement the system properly, having system quality alone do not bring any project success. Moreover, the objective set by the study was to assess the result of using the Project Management Information System on the system users to make their project successful. The finding showed that PMIS is important to project successes. The company under consideration has already understood this and is on the move to acquire the new ERP system. Finally, the objective set was to explore the impact of the Project Management Information System use on the success of construction projects. As stated above the study showed that PMIS Use in the company has positive impact. Improvements in effectiveness and efficiency in managerial tasks were observed in terms of better project planning, controlling, monitoring, evaluating and controlling. 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 success.

Following these conclusions, project management information system success models should continue to be validated and challenged in the future, the results of this research showed that the use of a project management information system is in fact advantageous to construction projects. It should be also noted that the systems must provide quality PMIS elements that will enable the project team to perform their tasks efficiently and effectively. However, it is not the complexity of the software rather the quality of the information generated by the system that matters and the ability of the user to use the information to manage the project is important. This was also extremely believed by the higher officials of the organization under study. 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 makes a substantial contribution to project success and should continue to be the entity of project management research.

5.5 Recommendations of the Study

It is recommended that:

- The results of this research showed that organizations should assume the use of Project Management Information System in the management of their projects. They should get themselves out from the traditional way of handling projects as it is not convenient to manage a project in a better way.
- PMIS generates quality information needed for the effective and efficient management of the project. Thus, adopting the state of the art of PMIS software (system) but with skilled manpower who could operate on the system would be the competitive advantage of firms operating in the industry and demanding fact to the industry. Thus, organization should work on upgrading themselves to the cutting-edge technology of PMIS.
- One of the problems of Rama construction to acquire advanced software was unavailability of the system in the local software market, inefficiency and repeated system software failures of the local system provider. Moreover, acquiring the system from abroad also has security and cost issues. Thus, local software developers should work to come up with well-developed, construction oriented, integrated and cost-effective system software.
- The quality of the system and easy maintenance of system failures can be understood by the users with extensive, repeated practice and better skills to customize the system. Thus, organizations should allocate budget for training of their employees on using of the system efficiently.
- Organizations should set up and practice evaluation methods and criteria for their

performance and success in comparison with the previous stands they had when they practiced PMIS in their company.

5.6 Suggested areas for further Research

As this study is bounded itself with a single company and limited with geographical boundary, future studies of the Practice of Project Management Information System towards project success could:

- PMIS and practices in construction project success in Ethiopia should be studied with wide scale to assess in depth the relation of System, Information, service quality and PMIU Use in relation to project success.
- Evaluate project success from the client's and the consultant's perspectives so that Impacts of the Project Management Information System on project outcomes provide an adequate solution to the client's problem and win-win advantages both to the organization and the client in terms of quality of product/services offered, greater output volume, quicker delivery, and provide tangible benefits such as gaining profits.
- The PMIS in relation to multi-project environment should be evaluated and the effects of the use of Project Management Information Systems in decision making also should be investigated.

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Annex I

Questionnaire for Senior managers, project Managers and Office Engineer

Surafel Tezera ,

Email:- surafeltez21@gmail.com

Addis Ababa

Dear Sir/Madam

RE: REQUEST FOR PARTICIPATION IN A RESEARCH STUDY

I am a Postgraduate student at Addis Ababa University, pursuing a Master's degree in Project Management. As partial fulfillment for the degree, I am conducting a research study on "Project Management Information System and practice in construction Project Success: A Case of Rama Construction Plc."

Therefore, I would appreciate it if you could spare a few minutes of your time to answer the following questions regarding how the Project Management Information system (PMIS) influences project Success in your organization and your project works. All the information provided will be purely used for academic purposes and your identity will be treated with the utmost confidentiality.

Your assistance will be highly appreciated and thank you in advance.

Yours faithfully,

Surafel Tezera

Mobile Number: 0911-721241
0900-648777

IMPORTANT NOTE:

Information provided through the questionnaire will be treated with confidentiality and will be exclusively for academic purposes. All answers will be considered right.

INSTRUCTION:

i. Do not write your name on the questionnaire.
ii. Please read each question carefully.
iii. Kindly answer all the questions by ticking or filling in the spaces provided.

SECTION ONE: BACKGROUND INFORMATION

1. Sex: Male ☐ Female ☐

2. Age: i) 21- 30years ☐ 31-40 years ☐ ii) 41 – 50years ☐

   iii) Over 51 years ☐

3. Position held in the Organization: ____________________
4. For how long have you held the position____________________
5. What is/was your role in the Organization? ____________________

   i.Senior Manager ☐ ii) Project Mgr. ☐ iii) Construction/office Eng. ☐

6. Level of Education

   i.Masters ☐ ii) BA/Bsc. ☐ iii) Diploma ☐

   iii) other please specify ____________________
7. In which construction projects did/are you participate/ing?

   (If it is more than one at least sate three projects from recent to earliest)

   i. ____________________
   ii. ____________________
   iii. ____________________

SECTION TWO: PROJECT MANAGEMENT INFORMATION SYSTEM IN USE AT THE ORGANISATION

Project Management Information System (PMIS) *is an information system consisting of 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 initiating through closing and can include both manual and automated systems. technology (IT) software tools*, such as scheduling software tools, work authorization systems, configuration management systems, information collection and distribution systems, as well as interfaces to other online automated systems such as corporate knowledge base repositories. Automated gathering and reporting on key performance indicators (KPI) can be part of this system as well.*

*N.B: These software of PMIS may include MS-excel, MS-Project, Primavera, and the like.

Please mark with a Tick in the applicable box with regard to the current Project Management Information System used in your organization (Please read the above definition).

A. Project Management Information System (Software) quality

How would you rate the general performance of the Project Management Information System (PMIS) in your organization in the following areas? Please Tick

	Very Low	Low	Moderate	High	Very High
	1	2	3	4	5
Accessibility					
Compatibility (with other SW; Excel, CAD, ERP, P3…)					
Connectivity (with IT tools; PDA, RFID, USN…)					
Response Time					
Flexibility					
Ease of use (like up/download, printing…)					
Querying (Request Data or information) Ease					
Learning Ease					
System Integration					
Multi-project Capability					

B. Quality of Information

In your opinion, how would you rate the impact of the quality of information produced by the Project Management Information System in project implementation? Please Tick

	Very Low	Low	Moderate	High	Very High
	1	**2**	**3**	**4**	**5**
Availability					
Relevance					
Reliability					
Precision					
Comprehensiveness					
Security					

C. Service Quality

In your opinion, how would you rate the service provider of the Project Management Information System in the process of project implementation? Please Tick

	Very poor	Poor	Average	Above Average	Excellent
	1	**2**	**3**	**4**	**5**
Reaction of PMIS service provider					
Technical support service (maintenance and repair)					
Education for PMIS users provided					
User's manual and advice provided					
Service provider knowledge of the construction field					
Feel of data security					
User trust in the capability of PMIS service provider					
Service provider faithfulness					

D. The Project Management Information System Use

In your opinion, how often are the following functions within the Project Management Information System utilized in project implementation? Please Tick

Planning Function Tools	**Never**	**Rarely**	**Occasional**	**Often**	**Very Often**
	1	**2**	**3**	**4**	**5**
Work Breakdown Structure (WBS)					
Resource Allocation					
Overall Schedule					
Gantt Chart					
PERT					
CPM					
Controlling Function Tools	**Never**	**Rarely**	**Occasional**	**Often**	**Very Often**
	1	**2**	**3**	**4**	**5**
Fine-Tune Forecast					
Modify Tasks					
Reassign resources to low cost					
Cancel Tasks					
Modify cost of Resources					
Monitoring Function	**Never**	**Rarely**	**Occasional**	**Often**	**Very Often**
	1	**2**	**3**	**4**	**5**
Project Reports					
Completed tasks					
Percent Project Completed					
Effective Schedule					
Remaining Tasks					
Remaining days to complete					
Evaluating Function Tools	**Never**	**Rarely**	**Occasional**	**Often**	**Very Often**
	1	**2**	**3**	**4**	**5**
Identification of cost					
Identification of Schedule variation					
Tracking the use of Resources					

Reporting Function Tools	Never	Rarely	Occasional	Often	Very Often
	1	2	3	4	5
An Overview of the project					
Overview on work-in-progress					
Budget overruns					
Task and schedule slippage					

E. Impact on Project Management Information System in user

In your opinion, do you agree that the quality of information produced by the Project Management Information System in use influences the Project's success in the following activities? Please Tick

	Completely Disagree	Rarely Disagree	Occasionally Agree	Often Agree	Completely Agree
	1	2	3	4	5
Improvement of productivity at work					
Increase in the quality of Decisions					
Reduction of the time required for decision-Making					
Better monitoring of the project schedule					
Reduction of the time required to complete a task					
Improved control of activity costs					
Better management of Budgets					
Improved planning of Activities					
Better monitoring of Activities					
More efficient resource Allocation					

F. Impact of PMIS on Project Success

How would you rate PMIS's contribution to the general project success in the following areas? Please tick

	Very Low Contribution	Low Contribution	Moderate Contribution	High Contribution	V. High Contribution
	1	2	3	4	5
Meeting Deadlines					
Respecting budgets					
Meeting quality specifications					
Meeting customer's needs					
Gaining Profit					

G. Individual Readiness

In your opinion, how would you rate your readiness regarding the currently available PMIS technology/ new technology that will be availed? Please Tick

	Completely Disagree	Rarely Disagree	Occasionally Agree	Often Agree	Completely Agree
	1	2	3	4	5
I see myself as a champion/leader for PMIS technology in my organization					
I usually try hard to learn how to use new PMIS technology if availed					
I work with my team together to implement the present PMIS/ if new PMIS technology will be availed/					
I am satisfied with the currently available PMIS technology in my organization					
I find the PMIS technology generally complex					
I prefer to use PMIS technologies that I am confident will not change					
The effort I contribute to the use of PMIS technology matches the benefit I receive					

H. Organizational Readiness

In your opinion, how would you rate your organization's readiness regarding the currently available PMIS technology/ new technology, If it will be availed? I think the company…….

	Completely Disagree	Rarely Disagree	Occasionally Agree	Often Agree	Completely Agree
	1	2	3	4	5
Communicated what was expected of me related to PMIS technology					
Has a champion/leader for PMIS technology					
Effectively shares information with other construction organizations					
Has clear policies and procedures related to PMIS technology					
Shares descriptions of experiences related to the implementation of PMIS technology with other teams					
Effectively communicates information about upcoming PMIS technology changes					
Can manage several ongoing PMIS technology-based projects at the same time					
Has experienced too much change over the past year					
Has access to experts who understand both PMIS technology and the construction Industry					
Has the flexibility to reorganize resources to address changing PMIS needs					
Has a strategic plan that reflects PMIS technology in the value and goals					
Overall, I think PMIS technology in my organization generally performs at an adequate speed					
Overall, I think PMIS technology in my organization is flexible, allowing for growth and change					

Annex II

Structured Interview for Senior Managers

1. What are the PMIS system (software) Rama using currently?
2. Please describe the nature and types of projects handled by the organization.
3. Is there any pushing factors that the organization enables to use PMIS?
4. How does the practice of using a PMIS in RAMA construction / as an Industry as a whole look like?
5. Does Rama have an ICT policy?
6. Please give me a detail explanation on the challenges of using PMIS.
7. Please give me a detail explanation on the opportunities of using PMIS.
8. Are there any other issues concerning using PMIS that have not been covered in the interview and that you wish to bring to our attention?