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KUMASI, GHANA**

**The usage of Project Management Information Systems (PMIS) in the Ghanaian
Construction Industry**

BY

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MASTER OF SCIENCE

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DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another nor material which to a substantial extent has been accepted for the award of any other degree or diploma at the Kwame Nkrumah University of Science and Technology, Kumasi or any other educational institution, except where due acknowledgment is made in the thesis.

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ABSTRACT

One important component of project management is managing the information that is generated by different stakeholders to ensure that it is efficiently used for delivering the project. Managing this information often requires tools that fall in the framework of Project Management Information Systems (PMIS) and this study was instituted to evaluate the use of PMIS among Architectural-Engineering-Construction (AEC) firms in Ghana. The objectives included assessing the level of PMIS usage among the AEC professionals and identifying the challenges associated with PMIS adoption. The literature identified relevant information on the project objectives and was relied on to prepare a structured questionnaire which was presented to respondents selected purposely from AEC firms operating in the Greater Accra Region. The professional associations for the architects, engineers and contractors were accessed for the targeted respondents who were sampled using the Census method. Analysis of the data in relation to the literature showed that the AEC professionals showed great awareness PMIS and identified also the significant information management and information technology constraints that necessitated their use of PMIS. As well the study concluded that AEC professionals extensively used PMIS tools and even identified those used more frequently. These showed conclusively that the PMIS usage among AEC firms was extensive, and also concluded that the challenges faced by these firms included costs and training, differences in protocols used by different professionals on a project and finally the efficient collection and use of data. It was recommended that AEC professionals get adequate training on PMIS and firms invest in relevant tools to promote good information management.

Keywords: Project, Management, Information, System, adoption, construction, industry

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LIST OF ABBREVIATIONS

ABCECG – The Association of Building and Civil Engineering Contractors of Ghana

AEC – Architectural – Engineering - Construction

BIM – Building Information Management

IT – Information Technology

MS EXCEL – Microsoft Excel

MS ACCESS – Microsoft Access

MS WORD – Microsoft Word

PMBOK – Project Management Book of Knowledge

PMIS – Project Management Information System

STAAD – Structural Analysis and Design

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I thank the Almighty God for His grace in helping me write this, and I also want to thank my family, my supervisor, Dr. Michael Addy and all my lecturers for all the support given me throughout my study

DEDICATION

This work is dedicated to my uncle Architect Emmanuel Hayford and my wife Mrs. Ivy Hayford for their immense support

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Technology is altering the manner in which buildings and infrastructure are planned, assembled, and operated. This assists in advancing decision-making and performance across the building and infrastructure lifespan. Construction projects are characteristically on a scale too large for any one individual to carry out singularly, so from its very inception, humans have developed methods towards collaborating on such building undertakings (Autodesk, 2018). Construction, consequently, often includes a social context and aids a number of people, whose work ethic and social norms it symbolizes (Autodesk, 2018). These large-scale endeavours essentially requires collaboration between various participants, many of whom have varying cultures, thus producing social events around such collaboration exertions that are required to construct a facility (Ilyas et al, 2013).

Construction teams also are made up of different professionals with different backgrounds and operating in industries which have different standards for measuring work quality and performance. Professionals such as architects, engineering and building contractors all have different performance measures and quality standards, and in most cases with projects, it is difficult to streamline these standards (Goubau, 2018).

McKinsey (2014) carried out a research which shows that the construction industry worldwide will be worth about 50 billion dollars by the year 2030, and yet though there have been several technological advancements in the industry over the years, it is not expected that more than 1% of that will be spent on technological advancements, with less than 1% also spent on new software that have been developed for the industry.

Construction practices as they exist traditionally show a lot of inefficiencies, with quality challenges, time delays and cost overruns being recorded in almost every project. For large projects some researchers show that about 98% of such projects have cost overruns of over 30% while about 77% of such large project also experience time delays (McKinsey, 2015). Large projects take at least 20% longer to finish and are up to 80% over the budget (McKinsey, 2016). The industry's unhurried need to adapt to new technology has been steadily declining financial returns for contractors.

The PMBOK 6th edition defines a Project Management Information System (PMIS) as an information system consisting of tools and techniques used to gather, integrate, and disseminate the output of project management systems. The PMBOK 6th edition defines a Project Management Information System (PMIS) as 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 communication plan. It is used to support all aspects of the project from initiating through closing, and can include both manual and automated systems. The PMBOK 6th edition adds that PMIS have certain characteristics which make them useful for application in project management areas such as project integration, scope management, communications management, risk management, procurement management and stakeholder management (PMI Institute, 2017). Markgraf (2018) notes that Project Management Information Systems give more relevance to project information because they take critical project information and make it available to the project manager in a meaningful and usable way, so decisions can be made. PMIS also provides information that is accurate, relevant, current and complete.

1.2 PROBLEM STATEMENT

One of the greatest challenges of the construction industry is its failure to keep up with new technologies in the digital age, and many construction companies have been at the negative end of the situation where they adopt new technologies too slowly, and soon find foreign competitors coming to their home country and taking work from them (Roberts, 2018). The need to adopt relevant technologies, particularly in the digital spectrum is very important. PMIS fills a technology vacuum for Architects-Engineers-Contractors (AEC) and has been widely adopted in most Western economies. The benefits of PMIS cannot be overstated because it allows for real-time and intuitive framework for measuring project success by providing the necessary information for monitoring and controlling a project (Bonner, 2013).

Managing project information is challenging in itself because of the vast amounts of information that can be generated for any type of project, and in the instances where different teams of the Architectural, Engineering and Construction nature have to manage information flow among them to ensure the successful implementation of the project. For an AEC industry in Ghana which is at the forefront of providing the infrastructure needs for sustained development in Ghana, it is critical that project success rates be as high as possible. However, the construction industry in Ghana particularly is bedeviled with performance challenges related to cost management, quality management, resource management, timely delivery and so on (Laryea, 2010). Some of these challenges are because of how project information is managed across various project teams. Sometimes information from the client, and even to employees of the AEC firms from their top management can be challenging. Poor project information management is a major contributing factor to project failures because where the whole team is not abreast with current project information and how any changes affect the final project, then there is a problem (Bisk, 2018).

Accuracy of information generated during projects also is significant as the different teams working on the project will need to rely on it to make informed decisions (Ilyas et al., 2013). Without an appropriate information management system in place these inherent challenges can be exacerbated. Software applications have been developed by many companies to help with the management of project information, and adoption in Western economies has been very positive. Data on adoption and use of Project Management Information Systems in Ghana is very scant among AEC firms (Venter, 2004). It is therefore important to evaluate the state of PMIS appreciation and use in the Ghanaian construction industry and its bearing on AEC.

1.3 AIM OF THE STUDY

The broad aim of this study is to evaluate the current use of Project Management Information Systems (PMIS) in the Ghanaian construction industry.

1.4 OBJECTIVES OF THE STUDY

The objectives set out in line with the research questions include;

- I. To identify the level of PMIS usage among AEC professionals in Ghana,
- II. To identify the challenges associated with PMIS adoption and usage among AEC professionals in Accra, Ghana

1.5 RESEARCH QUESTIONS

The research questions developed to guide the research include;

- I. What is the level of PMIS usage among AEC professionals in Ghana?

II. What are the challenges associated with PMIS adoption and usage among AEC professionals in Accra, Ghana?

1.6 RESEARCH SCOPE

The architectural, engineering and contractors (AEC) industries in Ghana are three unique industries which often collaborate on projects from start to finish. These industries however have different standards which regulate their activities, and in some cases, these standards are hard to streamline. In other cases, as well the management of information related to the planning and execution of a project can prove to be challenging. However, the purpose of Project Management Information System (PMIS) is to develop a standard for streamlining all project information of the architects, engineers and contractors on a project. For the purposes of this study, the research will be limited to large scale commercial properties, since those mostly have a larger professional team. These projects will be selected from the Greater Accra region of Ghana, due to it being the capital city, and as well, having a large stock of commercial property which are both completed and ongoing. The study will assess the current level of PMIS adoption and use among AEC professionals, associated challenges and then make recommendations on PMIS for the professionals

1.7 RESEARCH SIGNIFICANCE

The findings for this study may have far reaching significance to the Ghanaian AEC firms, the professionals and academia. Specifically however, it may be significant for the following. For the construction industry in Ghana, PMIS will ensure that there is greater collaboration, because all project professionals and stakeholders will have access to real-time project information which will

guide their decisions and actions. Thus PMIS can be adopted more widely as a standard for ensuring adequate information flow in any project.

PMIS also will allow for better communication and operational efficiency on projects because it acts as a single point of reference. AEC professionals can all refer to it to ensure that all aspects of a project are in tandem, deducing cost overruns due to late completion and poor communication. AEC firms can ensure greater agility with their project planning and execution since having all information on a project readily available can ensure that professionals can jump between different roles and better manage risk. The AEC professional association can also base on the findings of the study to develop policies on PMIS adoption and use by members to affect the overall quality of works put out by their members. The findings of the study will also add to existing knowledge on PMIS in Ghana, and be the basis for future studies.

1.8 RESEARCH METHODOLOGY

The research methodology consists of the research design and strategy, data types used and collection methods, as well as the research population and data analysis methods. This study applied a quantitative research strategy which allowed for the collection of data from a large number of respondents and deriving conclusions from them. The study collected both primary data through research questionnaires presented to AEC professionals working on commercial projects in the Greater Accra region, and also secondary data from journals, articles, text books and other published works. The data collected was analyzed using descriptive statistics, mean score indexing and regression analysis.

1.9 ORGANIZATION OF THE STUDY

The study is divided into the following five unique chapters, beginning with chapter one, which includes the background, problem statement, aim and objectives, significance, scope and methodology of the study. Chapter two covers the literature review and contains previously published works related to the study, while chapter three includes the methodology of the study and contains the research design and strategy, population and sampling technique as well as the data collection and analysis techniques. Chapter four covers the analysis of data and discussion of the results and chapter five summarizes the findings, draw conclusions and make recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The literature review comprises of an examination and evaluation of the existing literature, which relates to the subject of the study. The literature review produces and summarizes the existing literature to identify the gaps in the existing knowledge and challenges to existing theories (Royal Literary Fund, 2018). The literature review will provide overview of key terms, historical contexts, and previous studies, and then outline further information in relation to the research objectives.

2.2 OVERVIEW OF PROJECT INFORMATION MANAGEMENT SYSTEM

The PMBOK 6th edition defines Project Management Information System (PMIS) as informational system, which involves tools and techniques used to collect, assimilate, and distribute the output of project management systems. The book further explains a Project Management Information System (PMIS) as a set of tools for the Project manager to capture, store and allocate information to stakeholders (internal and external) with the information they need according to the communication plan. However, it supports all aspects of the project from initiating through closing and includes both manual and automated systems.

Project Management Information Systems (PMIS) methodically craft, identify, collect, establish, share, adapt and often use information from projects. Simply put, PMIS determines the best strategies, per each project, for collecting all the relevant information that is generated from the project, identify the most efficient collection methods for the information and how best it can be organized so it is firstly easily accessible to all project stakeholders, and secondly, beneficial to the project delivery. The principal component of any PMIS is the information management method

that defines the information generated in a project as a critical component (Project Management Information Systems for Development Organizations, 2011).

PMIS is not so much about developing and managing the technology required for information control on a project but takes into consideration also the human behaviours that needs to be managed in relation to the technologies. It is humans who have to interact with the technologies and as such it is important to evaluate the information environment and how best humans can interact with it. The long term success of any organization is also dependent on how it manages critical information that is generated, and it relies on for its operations. However, organizations must be careful not to have a myopic view of the information and see it only as a product, but rather consider all dimensions of information. The current information age requires that organizations find the most efficient and effective way to tap into the vast potential of information to make their organizations successful (Project Management Information Systems for Development Organizations, 2011).

PMIS provides very versatile tools for project managers in their planning, implementation, monitoring and closeout of their projects, and it is significant because PMIS ensures that the project scope, baseline, financial estimates and schedule can be created easily (Southwest Research Institute, 2018). All through execution, the project team gathers information into one database; PMIS ensures that project managers are able to gather project information for comparison purposes, that is, actual work completed per stage against set targets. The tools then allow for this information to be put together in a structure that can be easily reported. A properly installed and functioning PMIS ensures that information is collected where necessary, stored and delivered to the right people when needed (Southwest Research Institute, 2018).

2.3 CHARACTERISTICS OF PMIS

The PMIS focuses on the categorization of the processes that an organization relies on to manage information; once planning and scheduling of a project has been completed, the PMIS tools for recording and storing information in a systemized manner is set up for the project, having a flexible and available connections, a project data system which will function beyond just a recording instrument, but ensures that organizations are able to operate in a transparent, and accountable manner, and also ensuring that all stakeholders on a project are up to date (Indiana Economic Development Corporation, 2016). A proper PMIS needs to encompass the following characteristics:

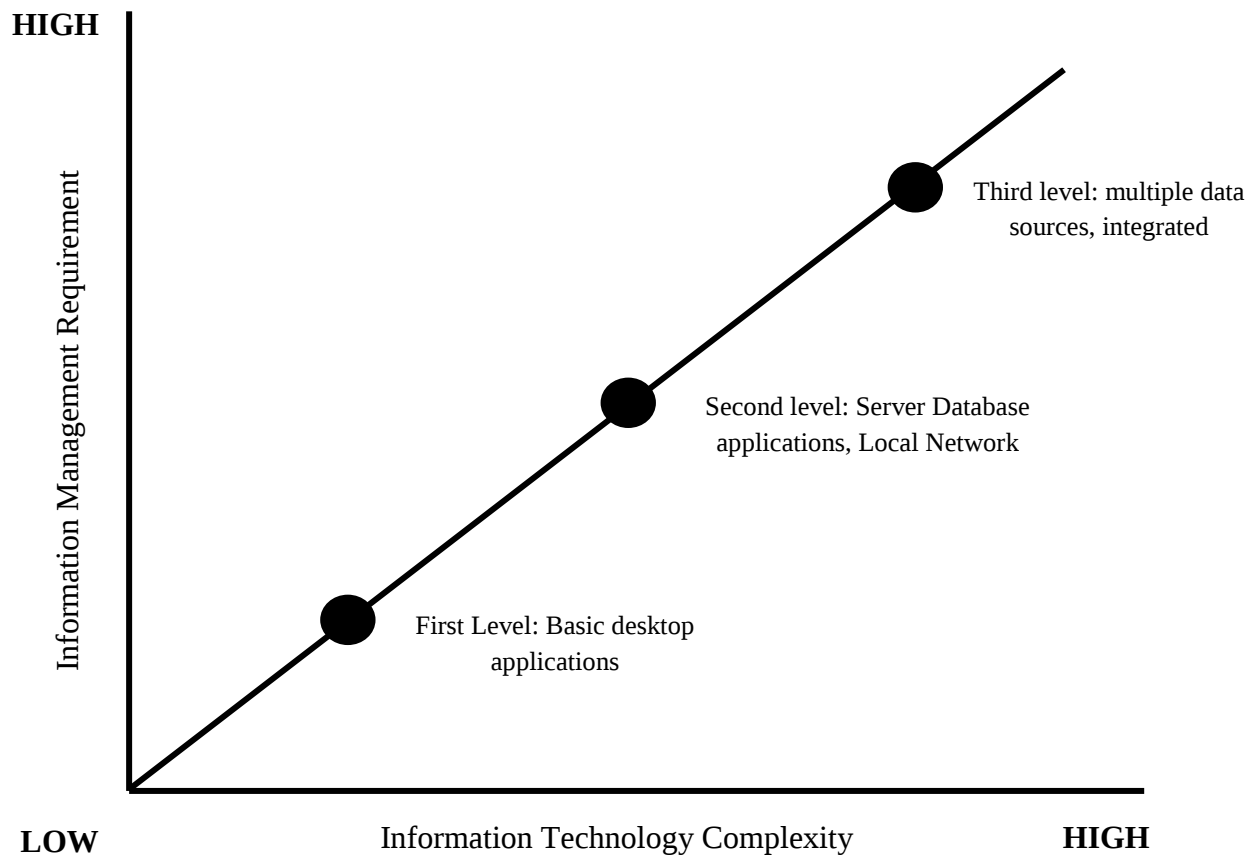
PMIS ensures that all information related to the project is collected and made available to project stakeholders and professions who can then identify any problems and deal with them in these initial stages before they become project constraints. PMIS collects information that can be relied on to identify the problems and initiate solutions. PMIS gathers, examines, stores and distributes the project information in a useful manner that can aid the decision making process for project professionals. Historical data collection is important in PMIS as it can be relied on to make future decisions. Management Information Systems (MIS) are different from PMIS in that while are rigid in nature and focus on strict reporting, PMIS is more fluid and its demand driven nature means that it is able to adapt to the flow of information from the project. Information flow in PMIS is at the core of its operation and it must abide by principles that relate to transparency, accountability and inclusion and participation

2.4 TECHNOLOGY REQUIREMENTS FOR PMIS

Technology requirements differ from project to project to meet the project management goals, and it stands to reason that a small project will have smaller technological requirements, as will a bigger project also have bigger requirements (Betts, 1995). Information control is very critical for any project, and efficient control can only be achieved when the project sets adequate standards for collecting and storing, as well as the dissemination of the information. Technology requirements vary from project to project, and complexity of the technology does not necessarily guarantee that it will be efficient. For instance, a small project which has limited technology requirements will not necessarily benefit from a complex set of tools which will not be fully used (Jung, 2008). Project managers must therefore ensure that they properly evaluate a project and determine its technological needs before installing one which may prove to be too expensive, or incompatible with the needs of the project.

Project information requirements are normally of three levels, with the first level being described as basic, often requiring just a computer and desktop software, the second level requiring multiple computers and a network connection to manage these computers, and finally the third level which is a more complex system managing several computers in several locations, and generating vast amounts of data.

Fig. 2.1 PMIS Levels of Technology



Source: Jung & Gibson, 1998

2.4.1 Level One Technology Requirement

This is the first level of the information needs requirement, and at this basic level the only requirement is one computer with the relevant desktop applications installed to manage the information flow and produce the necessary reports. Desktop applications such as Microsoft Office can handle these basic collecting and reporting functions. (Jung & Gibson, 1998).

Technology requirements at this level show that the information that is generated is relatively small, and often comes in physical form, where it is input into any of the Microsoft Office desktop

applications. A simple computer can handle all these tasks and produce the monthly reports that the project requires.

2.4.2 Level Two Technology Requirement

This level shows that there is significantly more information to be managed for the project, and the information may also come from different project locations and cannot be managed or accessed via one computer efficiently. More computers are needed to manage information at this level and they must be connected to a centralized server for proper management. Information is mostly stored in digital format, though some physical records are also kept. The localized server is accessible to different project teams, though arrangements can also be made to make it accessible from different locations (Jung & Gibson, 1998).

2.4.3 Level Three Technology Requirement

This is the highest level of technology requirement for a project, and at this level there is complex information that is generated in vast amounts by many different project teams from different geographical locations, and this information is not all stored in one location, but yet needs to be accessible to all project professionals (Jung & Gibson, 1998). An integrated system manages all the information that is generated and ensures that is accessible to all. This system can handle all forms of information generated and is dynamic enough to adapt to the changing needs of the project. Due to the large nature of the information generated from different sources there are often separate and dedicated networks that manage the information and they are all connected by the internet. Aside the Microsoft Office software suite other software such as AutoCAD, Primavera and ArchiCAD are used. Data protection mechanisms are also more stringent for such technology needs.

2.5 DETERMINING THE PMIS TO USE

In determining the PMIS requirements for any project, it is important that the project manager evaluate the information to be managed for a project and factors to make a decision. The list beneath can assist project managers identify information needed to state and generate the PIMS IT solution for it (Project Information Management Systems for Development Organizations, 2011). These determinants include structure of project governance, information access from different stakeholders, different methods for collecting and managing the information generated, frequency of reporting to stakeholders and volume of information collected. The remainder includes visuals required for reporting, access, security and controls for a project, especial reports required for project and detailed data analysis.

Next is to evaluate the IT resource capability of the project and this will involve availability of the necessary funds to manage the IT resources, project capacity for managing technology, emails, internet, communication requirements, computer usage on the project, staff IT knowledge and the project information technology support.

The necessary technology infrastructure can be put in place as soon as the needs of the project are fully evaluated, with the hardware and software components installed to be taken advantage of by the project stakeholders (Stewart & Mohamed, 2004).

The project methods adopted should take into account the development of a very detailed statement of work document that will describe the work a system expert or software designer to take in order to provide a solution that meets all requirements. This can be done by an external consulting team which has experience in installing such systems and will bid to win the contract. A request for proposals (RFP) can be relied on to secure an experienced consulting team to do this (Stewart & Mohamed, 2004). The RFP should contain the following; project scope, objectives and

environment, PMIS operational guide and the needs requirement for the project background, users of information, technical environment, number of connected computers and future additions, internet access, IT support and other technical information. The rest include project requirements such as budget, time for developing system, information management, security, access and maintenance. Other instructions such as date for proposal submission, format, experience level of consultant, other projects undertaken and decision date.

2.6 COMPONENTS OF PMIS

Detailed Information should be complete with adequate tractability to house the needs of the project and to fit in with time to basic principles that analyze the project development opens at all levels of management. Subject to the nature and material complexity of each project, the structure will comprise a basic central module that edifices the project's basic set of information (Aktura Technology, 2018). PMIS is often implemented in a modular and structured manner which allows it to be properly planned and grow along with the growing needs of the project. This sectional development as needs arise allows for the proper management of the project costs in relation to PMIS, and allows the users to also adapt to the project technology (Aktura Technology, 2018). The core modules of PMIS include the following:

2.6.1 Scope of Works

This defines the project objectives and expectations, as well as how the project information relates with the various modules. Modules include;

2.6.1.1 General Project Information: Information on the project includes the key objective of the project, code, client, project manager, estimate and total funds available to the project. Setting

up information at the beginning of the project requires little or no changes and provides high-level data to all stakeholders (Lydon, 2017).

2.6.1.2 The Project Scope: This gives a basic description of the project works to be undertaken, which is sometimes done using the work breakdown structure (WBS). This is a decomposition of project functions into smaller functions, and PMIS develops this into the project scope statement. The scope breaks down all the components of the project into rational and manageable structures that are linked to the project goals and objectives (Lydon, 2017).

2.6.2 Project Schedule

The work breakdown structure is also used to develop the project schedule, which outlines all project activities from start to finish. The quality of the project schedule is dependent on the accuracy of the WBS, and the project team must evaluate the schedule to ensure that all activities are stated. The initial development of the project schedule may not be challenging but once the project actually begins and the activities begin to vary, then management challenges of the schedule begin to creep in (Rodriguez, 2017). Schedule Development helps the project team to have a proper understanding of all the work that they must complete, it also develops understanding to limits, requirements and the structure of the activities. Schedule monitoring focuses mainly on determining the status of the project (Rodriguez, 2017).

2.6.3 Project Budget

The budget for a project is a very significant resource and it is important that the budget information is as accurate as possible, easy to track during the execution of the project and made available to whom it must be made available to. The system also generates regular reports regarding the project cost management. These reports can then be relied on by the management team to properly manage costs to prevent overruns (Scotto, 1994).

2.6.4 Project Team

This covers the information on all the professionals and stakeholders related to the project planning and execution. The information on the team identifies every single one of them, their roles and responsibilities on the project as well as the resources that are available to them to execute their work. The project team information will also track the progress of work carried out by each one of them and determine their efficiency levels (Brennan, 2009).

2.6.5 Project Beneficiaries

This is the information on the users of the information and must be added to the PMIS because it can also guide in the delivery of the project to meet their needs. The project managers must actively capture their information and benefits and report on progress of the works to meet the needs of the beneficiaries (Wieners, 2018).

2.6.6 Project Results

The final element is the result that emanates from the PMIS and it must tally with the objectives that were set out from the beginning of the project. The managers must be able to monitor the project information from start of the project all the way to the end to ensure that the results meet the project objectives (Erasmus, 2018).

2.7 INFORMATION STANDARDS FOR PMIS

Projects require a set of standards and principles which guide and make the process more efficient (Orfano, 2011). Below are some of the intricate standards and principles a project should follow to manage its information.

2.7.1 The value of the information

Planning, execution and evaluation of projects to determine effectiveness or otherwise all rely on reliable project information. Project information provides a basis for assessment of the project status with respect to planned expectation. The project information is very valuable in this regard where it is collected accurately, properly stored without compromise and interpreted accurately. It is used for decision making, evaluation, meeting legal standards, financial and other benefits to clients and stakeholders (Laxminarayan & Macaulry, 2014).

2.7.2 The purpose of the information

Project information is very essential to the efficient and effective completion of the project to meet the needs set out. It is important the purpose for installing the PMIS, as well as collecting, storing and distributing the information must be spelt out clearly (Sibal, 2011).

2.7.3 Respect for privacy

Privacy is very important when managing information and the PMIS system must ensure that there are necessary controls in place to ensure that whoever uses the system and requires privacy is granted such. Any information that needs to be accessed on a need-to-know bases must be treated as such (Solove, 2014).

2.7.4 Openness of information

Information should be put together directly from the individual or the original source of the information. The gathering and use of project information should be considered by transparency so that it is clear to the provider and the collector why the information is being collected. But most important, how it will be used and who will have access to it (Peters, 2014). Whenever feasible, the collection and use of project information is characterized by consent from the person about whom the information is collected (Peters, 2014).

2.7.5 Accountability

An accountable project is to defend and controlled the information entrusted to its care and is accountable to proper authority for the loss or misuse of that information. The project has to inform clients and project stakeholders of the manner in which project information is used and the information provided should be traceable back to the original data collected (Mulgan, 2000).

2.7.6 Confidentiality and security

A project requirement ensures that information is not exposed to unauthorized persons, processes or activities. The project is liable for the security of complex information from unauthorized disclosure to third parties; the treating of information as private and not for distribution beyond specifically identified individuals or organizations as defined by the project stakeholders. Receiver info must be treated with respect and only used within the objectives of the project (Barham, 2014).

2.7.7 Integrity of the information

The primary purpose for the collection and use of project information is to benefit the beneficiaries by improving the project interventions. Honesty offers verification that the original contents of info have not been changed or corrupted and that managers can be confident in the quality of the information to make decisions on the project. To make reasonable effort, a project is to ensure that all information is accurate and up-to-date and that procedures are in place to dispose of records once they are of no further use (Mills, 2018).

2.7.8 Timeliness

Information needs of the project must be met in as timely a way as possible, since delays can alter the impact that the project and its information management. Managers of the PMIS need to ensure that information that is supplied is timely manner so that they can be accessible to project stakeholders (Cooper, 1994).

2.7.9 Accuracy and completeness

Information that is put into any PMIS must be as accurate and complete as possible and be free from any manipulations. The extent to which the data is modified or tampered with can alter the effect that it will have when used in the project. That is why it is important to have adequate access controls to the data (Crema et al., 2016).

2.8 CHALLENGES WITH ADOPTION OF PMIS

Though PMIS have been identified above to have numerous benefits to any project implementation, it however does come with its own challenges to the project and the project team (Project Information Management Systems for Development Organizations, 2011).

2.8.1 Isolated systems

This is a common challenge for PMIS where it becomes very difficult for different systems which are operated by different project professionals, to be integrated and work as one unified system. As such the systems just operate in an isolated manner and do not serve the purpose for installing them.

2.8.2 Data Overload

In the quest to fully apply the benefits of the PMIS the situation arises where there is too much data generated by the system and not all of it may be actually usable. In that data overload it is often possible for the data to be ignored or overlooked.

2.8.3 High Expectations

Some project managers and stakeholders have too high an expectation on the PMIS and how it can impact the project, without conducting an adequate evaluation of their specific project IT needs and deciding on which system will best serve their needs. When that happens the managers may actually install a system which will work appropriately and efficiently on a different project where it is properly evaluated.

2.8.4 Little attention given to the PMIS

Some project managers may relegate the PMIS management and reporting to consultants or IT experts on the project who may not be able to apply the system to have a specific and direct impact on the project, simply because the project managers may also ignore reports.

2.8.5 Technology myopia

Prospects that technology will be the final solution have led to an incorrect focus that resulted in spending more time in handling the technology than managing the information.

2.8.6 Systems disconnected from the log frame

PMIS resources are not meant to operate in isolation but are to have a measurable impact on the project information management. Where the system is disconnected from the project execution, or it is not monitored to ensure that reports generated actually have the desired impact on the project then that disconnect can prove to be very challenging.

2.8.7 Unnecessary reports

In some cases reports are generated using the PMIS platforms without determining the use to which the reports will be put. In such instances the reports are just generated for the sake of just having to generate reports.

2.8.8 No standard PMIS process

Absent standard procedure has failed to the progress of many systems, with its specific processes, and all detached from each other. Without a standard system that manages information from different sources it leaves it disjointed and inefficient.

2.8.9 Duplication of efforts

Project teams may run their own systems and integrate it into the overall PMIS and share information. However this may sometimes lead to certain actions being repeated thereby impacting the resources and time for the project.

2.8.10 Training and maintenance cost

Training and sustaining the cost of systems can be significant when the system is on the level three, however there needs to be adequate cost planning that takes into account all these costs and makes adequate allocation for them.

2.8.11 Little or no experience with PMIS

Lacking experience leads to reduced systems or failures, with equally at a high cost to the organization. Systems developed with little quality need a high reliance on consultants to keep the system running.

2.8.12 Level of IT support

PMIS requires that there be adequate IT support available to manage it but in some cases some projects see the IT support as a cost that they do not want to bear or want to invest very little in, and therefore it leaves the project severely lacking in that regard.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The purpose of the research methodology is to detail the processes and procedures for conduction the study, and more specifically, it will detail the research strategy, research design, the research data and instrument, research population, sample size and the method for data analysis.

3.2 RESEARCH STRATEGY

Kothari (2004) suggested that, qualitative and quantitative researches are the recognized forms of research strategy. Kothari (2004) further explained that quantitative or qualitative strategy is adapted based on the object of the study, the research aim and objectives and the information available. Berg (2001) indicated that qualitative research emphasize on the ways of understanding social theories by stressing on the linkage between the study area and the researcher in question. Berg (2001) further opined that, qualitative research is subjectivity in nature because it seeks the views of people by observation, descriptions and making implied meanings into a concept. Quantitative data is a numerical investigation into world issues by testing theories or hypothesis to know the viability and the trueness of such theories. It is better to use quantitative data if the study wants to achieve objectivity, credible and real features of the world. Quantitative data are expressed with numbers and uses statistical tools for analysis (Burns and Grove, 2001). Based on the information gathered on the two strategies the research proceeded with the quantitative research strategy.

3.3 RESEARCH DESIGN

Yousaf (2018) defines the research design as a set of scientific procedures and approaches that is used by a researcher to draw the conclusions for a study. It provides the glue that holds the research together. Muaz (2013) added that it is a set of methods and procedures that are used to collect and analyze various measures of the variable specified in the research problem. Devaus (2006) outlined various research strategies, but they all came under three main strategies, quantitative research, qualitative research and a combination of the two, which is triangulation. As indicated in the research strategy, the quantitative research strategy was used, which allowed for the use of surveys for collecting the quantitative data. Research questionnaires were distributed to study respondents to collect data.

3.4 RESEARCH DATA

According to Bernard (2002), in any research the data is very important as the theoretical background is better understood with the gathering of appropriate data. When data is collected improperly you can never make up for it. There is the need to therefore select the best way of collecting your data and make sound judgement on who to collect the data from (Tongoco, 2007). Two sources of data were relied on primarily for this study, namely the primary and secondary data.

3.4.1 Primary data

The primary data is one of the most reliable and credible ways used to gather information for researches. The instrument implored under this section to gather first-hand information was mainly questionnaire as it provides information quickly and cheaply. The primary data was collected from

respondents in the Architectural, Engineering and Construction (AEC) firms operating in the Greater Accra region of Ghana.

3.4.2 Secondary data

Further information for the study was obtained from related secondary sources or published documents such as academic periodicals, textbooks, publications, magazines, research journals, past dissertations, articles and other relevant documents available in libraries and or from government departments. The internet resources were also used to obtain supplementary information relevant to the study.

3.5 RESEARCH INSTRUMENT

3.5.1 Questionnaire Development

To develop the questionnaire there must first be an understanding of what is required and the research population to be targeted for the study (Fray, 2002). The questionnaire designed included close-ended questions and scaled response questions. The Likert response scale employed, measure the strength or intensity of each respondent's opinion. Some of the advantages of the self-administered questionnaires include it been an efficient way to collect statistically quantifiable information and an efficient method as many respondents can be reached within a short space of time (Fray, 2002). The questionnaires are structured to align with the main objectives of this study.

3.5.2 Questionnaire Design and Distribution

The questionnaire was to guide the researcher in achieving the objectives of the study, and as such in its development, the first part dealt with the demographic data on the respondents. This demographic data is to ensure that the respondents are qualified to provide responses to the study. The second part dealt with the objectives of the study.

3.6 RESEARCH POPULATION

The research population is defined as a large collection of people or objects that remain the focus of a study. In most cases the research population is the expected beneficiary of the outcomes of the research because of the similar characteristics that they share. The population for this study was taken from Architectural, Engineering and Construction (AEC) firms operating in the Airport City Enclave and Tema within the Greater Accra. The list of Architectural firms in good standing operating in Accra was collected from the Ghana Institution of Architects (GIA). The latest list from 2016 showed 441 architects in good standing, with 39 identified to be operating within the elected areas. The researcher checked the addresses from the Ghana Institution of Architects to determine which to target. The Association of Building and Civil Engineering Contractors of Ghana (ABCECG) published its most recent list of members 2017, showing a membership of 1286, with 95 members working in the selected areas. Thus a total of 134 AEC firms formed the study population.

3.7 SAMPLE SIZE DETERMINATION

To determine the sample size for the study the census for small populations was considered. The approach is by using the entire population as the sample. The census eliminate sampling error provide data on the entire individual in the population. The target population was made up of the staff of various Architectural, Engineering and Construction firms in Accra. Thus a total of 134 AEC firms or professionals was issued with questionnaire and 100 response were received.

3.8 DATA ANALYSIS

The data for the study was collected using structured questionnaires with closed questions and Likert type scales. The first part of the questionnaire entailed the background data on the respondents was presented using descriptive statistics. Dodge (2003) defines the descriptive statistics as a form of summary statistics that uses quantitative methods to describe or summarize the features of the data collected. This study will apply the tally tables and graphs to present the demographic statistics. The second part of the questionnaire covered the various objectives of the study, and the questions were in Likert scale form. As such these were analyzed using mean score index.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 INTRODUCTION

Chapter four of study focuses on the analysis of the data collected using the research questionnaires and discussion of the results from the analysis. The analysis will be done with the objectives of the study in mind and will govern the structure of this chapter. The demographic data is presented using descriptive statistics and the data on the objectives of the study will be analyzed and presented using mean score analysis. A total of 134 questionnaires were handed out and 100 successfully collected showing a response rate of 74.6%.

4.2 DEMOGRAPHIC DATA ON RESPONDENTS

The purpose of the demographic data on respondents is to get the assurance that the respondents are qualified and experienced enough to provide relevant responses for the study. A total of 100 questionnaires were successfully distributed and collected from the respondents and the data is presented using tally tables.

Table 4.1 Demographic data of respondents

FACTOR	FREQUENCY	PERCENTAGE
Type of AEC firm respondents work with		
Architectural firm	16	16%
Engineering firm	23	23%
Construction firm	51	51%
Job designation of respondent		
Architect	16	16%
Engineer	12	12%
Building contractor	8	8%
Quantity Surveyor	39	39%
Project Manager	25	25%
Length of time working with company		
Less than a year	0	0%
1 – 3 years	19	19%
4 – 6 years	53	53%
7 – 10 years	11	5%
Above 10 years	17	17%
Number of years working in industry overall		
1 – 5 years	10	10%
6 – 10 years	38	38%
11 – 15 years	9	9%
16 – 20 years	18	18%
Over 20 years	25	25%
Number of projects worked on at Works Department		

1 – 10 projects	6	6%
11 – 20 projects	12	12%
21 – 30 projects	55	55%
31 – 40 projects	16	16%
More than 40 projects	11	11%
Awareness of Project Management Information System		
YES	100	100%
NO	0	0%
Are PMIS beneficial to project information flow		
YES	100	100%
NO	0	0%
NO IDEA	0	0%

Source: Field Survey 2018

Table 4.1 above gives a summary of the significant demographic characteristics of the respondents for the study. These were targeted from AEC firms with the hope that they would be adequately qualified and experienced to provide relevant responses. The first part of the demographic data determined from the respondents whether they actually work with any AEC firms and it can be seen from the table that all respondents indicated working with one form or the other, with 16% at the architectural firms, 23% in engineering firms and finally the largest percentage, 51% in building construction firms. However, to get a clearer depiction of what jobs the respondents are actually involved in with their various companies, and generally, their job designations are consistent with those of AEC firms. Quantity surveyors form the largest percentage of respondents in this study, with 39%, followed by project managers 25%. The two primarily form the largest percentage of the respondents because they can work across all three types of firms. Getting into

greater specifics however, there are also 16% architects, 12% engineers and 8% building contractors represented. In all this forms a fair representation of job designations at AEC firms.

With the type of company and job descriptions completed the next step is to determine the level of experience of the respondents to the study. The level of experience gives a good indication how much knowledge that the respondents have gathered in their line of work to be able to provide critical data to form conclusions for the study. Thus, the respondents experience level will be determined in this case by their length of time working in their various companies and then the amount of time working in their various industries. The two factors are important because they will determine how much specific knowledge and experience the respondents have gotten with their individual companies and overall within their industries. The table shows that all respondents had worked with their companies more than a year, with 81% showing that they had worked with the companies at least 4 year. That shows a significant percentage with relevant experience. 90% of the respondents also showed that they had worked in their respective industries for over five years, and thus also giving a strong indication of the level of experience of the respondents. In terms of the number of projects that each respondents has been involved in, the data also shows significant levels of experience from respondents, with 94% indicating that they have worked on more than ten different projects.

With the respondents' experience levels determined the next step is to determine their knowledge of PMIS, which is the core of the study. From the data gathered from the respondents 100% of them are aware of PMIS, and also appreciate its benefit to information flow during project execution.

It is thus clear from the data collected on the demographics that the respondents are indeed knowledgeable and experienced with respect to the project core objectives and thus can be relied upon to provide responses on the remainder of the questions.

4.3 IDENTIFY THE LEVEL OF PMIS USAGE AMONG AEC PROFESSIONALS IN GHANA

With the demographic data presented above this next section of the analysis focuses on the first objective of the study, which is to identify the level of PMIS usage among AEC professionals in Ghana. Measuring the level of usage will require several stages of respondents identifying various tools and principles related to PMIS and then a determination of their level of understanding and usage of the various PMIS tools. Overall, the objective will determine from the respondents the information management needs that necessitate the use of PMIS, the information technology constraints which also necessitate PMIS use, PMIS tools identifiable to the respondents and finally the frequency of use of these tools. This extensive evaluation will give a fair understanding of the level of PMIS usage among these AEC professionals.

Table 4.2 below gives the summary of the responses related to the information management needs among the AEC professionals which necessitate the use of PMIS. Different information management factors were identified in the literature and presented to the study respondents who were to select as many as related to their personal use needs as possible.

Table 4.2 Information management needs that necessitate the use of PMIS

FACTOR	FREQUENCY	PERCENTAGE
Requirement from the project governance structure	73/100	73%
Requirement of information from different project stakeholders	100/100	100%
Significant requirement to collect and organize information	100/100	100%
Frequency of collecting and reporting project information to stakeholders	93/100	93%
Types of visual reporting requirements for a project	68/100	68%
Security and control measures	77/100	77%
Special reports requirement	77/100	77%
Complex data analysis	93/100	93%

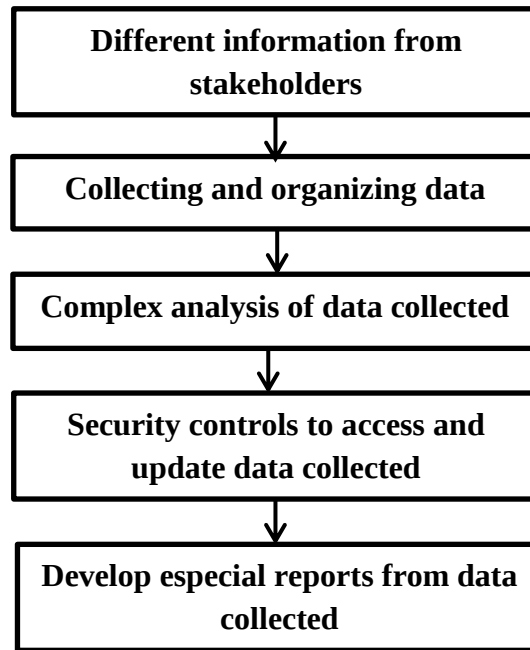
Source: *Field Survey 2018*

Table 4.2 above summarizes the data provided by the respondents on the information management needs of their projects which necessitate their use of PMIS. As already noted in the demographic data, all respondents indicated that they were aware of PMIS and saw it as necessary for information management. Each respondent was therefore given the opportunity to select as many information management needs as possible to determine the level and specificity of those needs that necessitated PMIS.

Table 4.2 shows that two of the needs were selected by all respondents, and these included the requirement of information from different project stakeholders and significant requirement to collect and organize information. According to the Project Information Management Systems for Development Organizations (2011) the success of any project is dependent to a large extent on the evaluation of the information to be managed, its sources and the complexity of the information.

Adequate evaluate of these will help to determine the level of PMIS to be used for each project. As identified by the AEC professionals, two of the most significant needs for them include the information that generated by the different stakeholders on the project such as the client, design team, procurement team and construction team, as well as how to collect and organize this information. Next, 93% of the respondents selected the need for complex analysis of data collected, which is the next logical step after the data is collected. Complex data can often be related to the nature of the project, its size and also the number of stakeholders who will be involved (Stewart & Mohamed, 2004). The frequency of collecting and reporting information to stakeholders can also influence the need for PMIS usage, with 93% of the respondents also selecting that factor. The purpose of PMIS is to eliminate the challenges associated with collecting and distributing information across to different stakeholders on a project in an efficient and effective manner, and certainly, frequency of collecting and reporting falls within the significant needs. 77% of the respondents next selected the types of access, security and controls to manage, modify and update project information for projects and the need to develop especial reports in defined formats as significant for requiring PMIS on a project. These selections certainly align with the natural progression of information management for a project as defined by Project Information Management Systems for Development Organizations (2011). Respondent's selection process goes from below.

Fig. 4.2 Hierarchy of PMIS needs decision process



With the information management needs assessment completed it is clear that the AEC professionals have an understanding of the information management challenges that PMIS are to solve. This initial assessment gives a clear, though basic picture of the level of understanding of PMIS among the AEC professionals. The next step is to identify from the respondents what their information technology constraints are which also influence their decision for PMIS. Table 4.3 gives a summary of the responses.

Table 4.3 The significant information technology constraints, which necessitate the need for PMIS

FACTOR	FREQUENCY	PERCENTAGE
Availability of IT resources committed to project information management	100/100	100%
Current capacity of project technology to manage information	85/100	85%
The need for IT communication resources	100/100	100%
Percentage requirement of IT resources	74/100	74%
Knowledge of IT	100/100	100%
The Information Technology resources required to support project	85/100	85%

Source: Field Survey 2018

Table 4.3 above summarize the information technology constraints identified by the respondents which necessitate the need for PMIS. The information management needs have been identified above and it is also important to understand from an information technology perspective what motivates the need for PMIS in project management. As with the information management needs, the most selected factors will be ranked highest to the least selected in an hierarchical manner.

From table 4.3 it can be seen that 100% of respondents selected three information technology constraints as most significant for needs PMIS, and these include the availability of IT resources committed to project information management, the need for communication, email, internet and other online systems and level of computer literacy of the project staff. These are significant information technology constraints that may exist for any project of any size and as such will warrant the need for PMIS. In this era of information technological advancements, almost all companies operate with some level of IT resources, such as computers and internet access. When

the project gets larger more resources will be required, and there needs to be collaboration with different consultants, as well as the project allowing the professionals to work offsite. Most projects now require significant commitment of IT resources for data management and reporting to clients, for site meetings, and transfer of information. However, it is not only important to have the IT resources but there needs to be adequate knowledge of how to use the resources among the AEC professionals. However, as noted by McKinsey Global Institute (2015) technology adoption among the professionals in the construction industry is very low, as such may limit the level of understanding of how to use these IT resources, particularly the PMIS. This will thus prove very challenging for AEC firms which have significant information to manage for any project. The need for communication with other stakeholders on the project through mobile applications and other internet resources such as email and instant messages, video conferencing and cloud data management services increases also the need for PMIS, as noted by the respondents (Jung, 2008). The determination of which to include in the project information management system, particularly for ensuring historical records of communications among stakeholders, drives the needs for a comprehensive system. Current capacity of project technology to manage information also can drive the need for PMIS, as identified by 85% of the respondents, and as well, the IT support requiring for execution of the project, also selected by 85% of respondents (Jung & Gibson, 1998). The two key information technology constraints are also significant to the decision on adopting PMIS because AEC firms need to evaluate their current IT resources and determine whether it has enough capacity to manage project information from all stakeholders, and also keep everyone updated on a need-to-know basis. IT support is also significant for any major project because the truth is that technology does not run flawlessly, and where hitches arise and the stakeholders are not duly knowledgeable of how to install resources or fix them, then IT support will be needed.

Functions such as installing a small network, internet connection installation and troubleshooting as well as a myriad of IT issues need to be handled by IT support, and this also influences the need for PMIS on a project.

The next step in determining the level of PMIS use among the AEC professionals is to determine from them the level of PMIS that they use on their projects currently. The study identified three levels of PMIS, namely the level one, level two and level three. This information from the respondents will also add to the measure of the level of PMIS usage among the AEC professionals. Table 4.4 below gives a fair summary of the responses provided on that subject matter.

Table 4.4 Significant PMIS level you use for your projects

FACTOR	FREQUENCY	PERCENTAGE
Level One – Basic components	5	5%
Level Two – Networked components	9	9%
Level Three – Integrated components	86	86%

Source: Field Survey 2018

Table 4.4 above shows a summary of the different levels of PMIS that the respondents indicate are used on their various projects. The three levels were identified by Jung and Gibson (1998) and they go from simple IT resource setups to a more complicated system that is able to connect different stakeholders on the project whether on-site or off-site. Level one was identified in the literature as a basic set up of one or two computers with basic computer desktop applications for evaluating a small amount of information and reporting on it, and is often appropriate for a small project. 5% of the respondents identified this as the level of PMIS that they use on their projects. This system is often used by a smaller firm working on a singular project with few external stakeholders. The next level identified is two, which is a more complex and integrated system

dealing with a greater volume of information often from different sources. This system either integrates all, or almost all the project information in one location that is accessible to all stakeholders (Jung & Gibson, 1998). 9% of the respondents also identified this as the system they use on their projects, and is quite common for an AEC firm which has different computers and software connected to one centralized server (Markgraf, 2018). Finally, the level three of technology requirement in PMIS relates to very large project information and other type of project data related to budgets, human resource and external data. In such a system, which is quite common for project teams working on a large project, the internet forms a core of the channel for information exchange, and many different desktop and even mobile applications are used, It is therefore understandable that 86% of the respondents identify this as their main level of IT requirement they have for their projects. In the modern world a project does not necessarily need to be classified in the context of large for this level to be used because smaller projects also now apply this level for the sake of efficiency and speed (Markgraf, 2018).

The above data therefore shows that a significant percentage of AEC professionals actually rely on a detailed PMIS system on a regular basis for information management and exchange for efficiency in project delivery. The extensive knowledge identified among the respondents on PMIS and the information and technology constraints that motivate their use of the systems shows a higher level of use. However, it is also possible that most use these technologies on a regular basis without necessarily identifying them under the PMIS protocols.

The next stage is to identify the PMIS tools that the respondents use on their projects for information management across stakeholders. Since a larger percentage of the respondents have identified that they use the highest level of PMIS technology requirement it is possible to expect

that a greater percentage of them will apply the tools identified on a regular basis. Table 4.5 gives a summary of the responses below.

Table 4.5 The significant PMIS tools as are applicable to your firm.

FACTOR	FREQUENCY	PERCENTAGE
Real-Time Dashboards	32/100	32%
Microsoft Project (Gantt Charts, Scheduling Chart, Costing)	74/100	74%
Microsoft Office (Reports)	100/100	100%
Project Task Lists	100/100	100%
Project Time Sheets	93/100	93%
Project Collaboration Tool, BIM(AutoCAD, ArchiCad, Autodesk Navisworks, STAAD Pro , Bently structural Modeler	78/100	78%
Project Resource Management Tool	81/100	81%
Mobile Technology and Apps	100/100	100%
Online File Storage and Cloud file sharing	42/100	42%
Project Templates	82/100	82%
Project Integration Tools	61/100	61%

Source: Field Survey 2018

Table 4.5 above gives the ranking of the PMIS tools identified by the study respondents as are applicable to their projects that they are involved in. As was indicated above with regards to the level of technology requirement of the respondents, it was found that a greater percentage (86%) worked at the level three, and the data presented above shows that indeed the respondents identify certain specific tools as relate to the various levels of PMIS technology requirement.

The table shows that on the whole, 100% of respondents identified Microsoft Office Suite, Project Task lists and Mobile Technology Apps as the most used tools in PMIS for them. Microsoft Office presently is the most popular desktop processing application with its many different sub-applications such as Word, Excel and Access which present numerous data collection and analysis options for projects. Project Task Lists are now standard for all project management functions and mobile technology apps have become very common with the proliferation of smartphones and internet access in Ghana now, allowing for work to be completed off-site and shared with all stakeholders. 93% of the respondents also selected project time sheets as useful PMIS tools since it allows for project managers and other project stakeholders to track how much time has been spent on a project. Other tools such as project templates and project resource management tools were also highly ranked, though from the data it can also be seen that online file sharing / cloud file sharing as well as real-time dashboards were the least used tools among the respondents. To get a greater depth of understanding of the level of use of these PMIS tools the respondents were presented with a 5-point Likert type scale to ranking how frequently or otherwise that they use these tools. Table 4.6 gives a summary of the responses.

Table 4.6 Mean score for level of PMIS usage by respondents' firms

	N	Mean	Std. Deviation	Std. Error Mean	Rank
Microsoft Office (Reports)	100	4.21	.587	.059	1
Mobile Technology and Apps	100	4.04	.847	.085	2
Project Task Lists	100	3.94	.881	.088	3
Microsoft Project (Gantt Charts, Scheduling Chart, Costing)	100	3.89	.928	.093	4
Project Time Sheets	100	3.84	.935	.094	5
Project Templates	100	3.69	.992	.099	6
Project Collaboration Tool, BIM(AutoCAD , ArchiCad , Autodesk Navisworks , STAAD Pro ,Bently structural Modeler	100	3.62	1.006	.107	7
Project Integration Tools	100	3.04	1.038	1.04	8
Project Resource Management Tool	100	2.94	1.090	.109	9
Online File Storage and Cloud file sharing	100	2.74	1.035	.104	10
Real-Time Dashboards	100	2.56	1.052	.105	11

Source: *Field Survey 2018*

Table 4.6 above gives the analysis and ranking respectively of the responses on level of use of the PMIS tools identified in the study. Respondents were to rank them on a scale of 1 to 5, with 1 representing never (No use) and 5 representing frequent use. Since this is a 5-point scale the midpoint is 3.00 and as such only mean scores above this point will be considered relevant for the study.

The summary table 4.6 shows that of the eleven tools identified by the study only eight scored high enough mean values above the midpoint, and though this ranks them as insignificant in terms of this study, it however does not discount the fact that they are still very important tools, but just not regularly used among the respondents. The table also goes to confirm to a greater extent the data represented in figure 4.4 detailing the most significant tools, with Microsoft Office being ranked highest, followed by Mobile Technology and Apps, Project Task Lists, Microsoft Project and so on. Thus this summary gives a firmer conclusion that the PMIS tools are readily identifiable and heavily used among the AEC professionals.

4.4 IDENTIFY THE CHALLENGES ASSOCIATED WITH PMIS ADOPTION AND USAGE AMONG AEC PROFESSIONALS IN GHANA

As has been identified in the objective above, PMIS is readily identifiable to AEC professionals and heavily used for their projects. However, this objective now is to determine if there exist any challenges associated with PMIS adoption and usage among the AEC professionals. Though their level of usage is considerably significant, it is also important to determine to what extent their adoption and use of the PMIS tools is challenged. The literature identified various challenges which are traditionally associated with any PMIS platform and these were presented to the respondents to rank on a scale to show how strongly they agreed or disagreed with the challenges to PMIS adoption and usage among AEC firms. Table 4.7 gives summaries of the responses.

Table 4.7 Mean score of challenges associated with PMIS adoption and usage

	N	Mean	Std. Deviation	Std. Error Mean	Rank
Training and maintenance costs for PMIS are high	100	4.09	.479	.048	1
Lack of a standard PMIS protocol makes choice difficult	100	4.03	.582	.058	2
High expectation placed on data collected which sometimes never gets shared across all project teams	100	3.94	.851	.085	3
Technology myopia	100	3.78	.861	.086	4
Isolated systems run by teams working with different information that is difficult to consolidate	100	3.69	.856	.086	5
Little IT support on a project makes a PMIS less useful	100	3.65	.866	.087	6
Focus on collecting and storing data does not afford ample time to analyze the data	100	3.47	.928	.093	7
There is duplication of information across different teams which renders a PMIS ineffective	100	3.41	.979	.098	
Little experience of AEC teams managing PMIS	100	2.74	1.038	.104	
Disconnect between the information reporting and what the system was set up to achieve	100	2.86	1.023	.102	9
Information reporting not entirely connected to decision making	100	2.77	1.029	.103	10

Source: Field Survey 2018

Table 4.7 gives an analysis and summary of the challenges associate with the adoption and use of the PMIS tools by AEC professionals in Ghana. The respondents ranked them on a scale 1 to 5,

with 1 representing strong disagreement and 5 representing strong agreement with the challenges. As already indicated also, with this being a 5 point Likert scale, the midpoint is 3.00 and as such only challenges with mean scores above 3.00 will be considered relevant for the study.

The greatest challenge associated with PMIS adoption is the cost of training and maintenance for these tools, as identified by Project Information Management Systems for Development Organizations (2011). A desktop processing software such as Microsoft Office for Business costs \$298.99 for a single license for one computer (Microsoft, 2018), and this translates to about GHC1400 (\$1 – GHC4.72: Bank of Ghana, September 2018). This cost may seem astronomical just for a single license purchase, not before the cost of the computer or laptop on which the software will be used. Some users however resort to free software which may have lesser functions or pirated versions of the full software. Other software such as for project management, cost planning and others also come with similar costs and may be a deterrent for some AEC professionals which may not be working in large companies. The lack of a standard PMIS protocol makes the choices difficult because there are different levels, different software and tools which can be introduced into the PMIS framework for any project. Where there is a large project with different teams, such as architects, quantity surveyors, engineers, building contractors and so on represented, and all using different software for their work, it is sometimes difficult to harmonize and share data if some stakeholders do not have the appropriate tools to access the data. This can pose a significant challenge as all stakeholders will need to first get the relevant software, often at a cost before proceeding to access the data.

Respondents also noted that sometimes when there is an extensive PMIS framework in place there is so much expectation placed on it with regards to information gathering and sharing across different stakeholders on a project that it sometimes becomes impossible for all relevant data to be

shared across all platforms. This can also bring to fore the challenge of technology myopia, in which case not all team members are abreast with the knowledge and skill needed to use some of the tools, which can slow down how much information can be easily collected and shared (Project Information Management Systems for Development Organizations, 2011). Respondents next ranked that different teams working with different information that is difficult to consolidate can also complicate the PMIS adoption and usage process for AEC professionals. This has already been identified above, as with teams working with different software or tools which may not be used by others. For example, an architectural firm using AutoCAD software to develop drawings and needs to quickly send drawings for estimates to be done, but the estimator not having AutoCAD can complicate the process.

Finally, the respondents also noted that sometimes there is so much focus on collecting data for the PMIS framework that there is little time to analyze the data properly. There may be so much focus on dumping data on the centralized network that there is little actual analysis, and as well, some data may be duplicated across different teams, which thus makes sharing and review also problematic (Project Information Management Systems for Development Organizations, 2011).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter provides a summary of the findings made in the chapters above, draws conclusions from them and finally make recommendations. All these will be done in accordance with the objectives set out at the beginning of the study, which include:

- I. To identify the level of PMIS usage among AEC professionals in Ghana,
- II. To identify the challenges associated with PMIS adoption and usage among AEC professionals in Ghana

5.2 SUMMARY OF FINDINGS

The following findings were made based on the literature collected and the analysis of the responses from the study respondents. The findings are categorized according to the objectives set out at the beginning of the study.

5.2.1 Identify the level of PMIS usage among AEC professionals in Ghana

The process of identifying the level of PMIS usage among the AEC firms was divided into five different steps, with the first step requiring the respondents to identify the information management requirements that necessitate their use of PMIS, and the second step requiring them also to identify the information technology constraints which also necessitate the need for PMIS. The third step was to identify the PMIS technology requirements level of each respondents for their projects, and the fourth step requiring the respondents to identify the PMIS tools that they regularly use, and the fifth step also requiring them to indicate the extent to which they used these tools. These five steps were deemed to be significant enough to determine the level of PMIS use.

Based on an analysis of the responses on the information management constraints presented to respondents from the literature it was found that most significant of them were different information from stakeholders, collecting and organizing data, complex analysis of data collected, security controls to access and update data collected and develop especial reports from data collected.

The study next found that for the second step, the significant information technology constraints which necessitate PMIS use among AEC firms include availability of IT resources committed to project information management, the need for communication, email, internet and other online systems, level of computer literacy of the project staff, the IT support requiring for execution of the project and current capacity of project technology to manage information

The study found that a greater percentage of AEC professionals actually require PMIS protocols of the highest level, Three, for their projects, and this is because they either work on significantly large projects or for the sake of efficiency they have to adopt the tools. With regards to the specific PMIS tools which the AEC firms use the most, it was also found that the most significant included Microsoft Office (Reports), Mobile Technology and Apps, Project Task Lists and Microsoft Project (Gantt Charts, Scheduling Chart, Costing). The rest include Project Time Sheets, Project Templates, Project Collaboration Tool, BIM(AutoCAD , ArchiCad, Autodesk Navisworks , STAAD Pro, Bentley structural Modeler and Project Integration Tools

5.2.2 To identify the challenges associated with PMIS adoption and usage among AEC professionals in Ghana

In order to identify the challenges that the AEC firms also face in adopting and using these tools the literature identified many different challenges associated with PMIS and presented them to the study respondents who were to rank them on the extent to which they agreed or disagreed with the

challenges. Based on the analysis of the rankings it was also found that the most significant challenges faced by the AEC professionals included training and maintenance costs for PMIS are high, lack of a standard PMIS protocol makes choice difficult, high expectation placed on data collected which sometimes never gets shared across all project teams and technology myopia leads to more time managing the technology than the information itself. The rest include Isolated systems run by teams working with different information that is difficult to consolidate, little support on a project makes a PMIS less useful, focus on collecting and storing data does not afford ample time to analyze the data and there is duplication of information across different teams which renders a PMIS ineffective

5.3 CONCLUSION

Though the task of determining the level of use of PMIS by AEC firms in Ghana requires some subjective analysis of opinions and experiences of the AEC professionals, the study was able to conclude that indeed there is significant use among them. The study noted that all respondents for this study did indeed have knowledge of PMIS and understand the benefit it offers to information management in project planning and execution. The study was also able to conclude that there is actually significant use of PMIS across the three levels by the respondents, from their identification of the significant information management and information technology constraints that necessitate their use of PMIS. The study was able to conclude on the significant PMIS tools and how frequently they were actually used by the respondents. Overall, it was conclusive that there is high understanding and use of PMIS among the AEC professionals. With regards to the challenges associated with PMIS adoption and use as well, the study was able to conclude that the significant challenges among the AEC professionals included costs and training for users, differences in

technologies and tools across different project teams and the actual collection and use of the information in order to be beneficial to all teams.

5.4 RECOMMENDATIONS

Based on the findings and conclusions drawn for the objectives of the study, it is determined that PMIS actually offer numerous challenges when effectively applied, and as such AEC professionals must educate themselves on the developing trends and tools which relate to their specific professions, in terms of PMIS. Also companies must include in their annual budgets the costs of installing and upgrading relevant PMIS tools to their operations because there will be returns when used efficiently and effectively. As well, project teams must determine from the project planning stages critical things such as how to harmonize their different PMIS platforms to ensure the appropriate flow of information to all stakeholders.

5.5 DIRECTION FOR FUTURE RESEARCH

This study was able to draw conclusions on PMIS usage among AEC firms in the Ghanaian construction industry, but future research can also focus on Building Information Model (BIM) adoption and use industry-wide. The study can determine the extent to which BIM is able to ensure greater efficiency and effectiveness in workflow as against working in 2D.

5.6 LIMITATIONS TO THE STUDY

The limitations which were encountered, and had a significant impact on the study included the sample size which only targeted the firms registered with and in good standing with the professional bodies in Accra alone. The conclusions could be significantly different if a larger percentage of respondents were targeted. As well, cost constraints limited the researcher's ability

to target respondents in other parts of the country, and time constraints also limited the extent to which the objectives could be fully explored.

REFERENCES

- Aktura Technology (2018) Project Management Information Systems: Geographical project management system for Australia's largest infrastructure roll-out [Online] Available from www.akturatech.com/project/project-management-information-system/ Accessed on 10/07/18
- Autodesk. (2018). What Is BIM | Building Information Modeling | Autodesk. Retrieved April 24, 2018, from <https://www.autodesk.com/solutions/bim>
- Barham, T. (2014) Practical ways of protecting business confidential information, [Online] Available from www.pglaw.co.uk/practical-ways-protecting-confidential-information/ Accessed on 10/07/18
- Berg, B. (2001). Qualitative Research Methods for Social Science. Boston: Allyn and Bacon.
- Bernard, H.R. (2002) Research Methods in Anthropology: Qualitative and Quantitative Methods. 3rd ed. California: Alta Mira Press, Walnut Creek
- Betts, M., (1995), Technology Planning Frameworks to Guide National IT Policy in Construction, Automation in Construction, 3(4), pp. 251-266.
- Bisk Education (2018) Top ten project management challenges: Dealing with issues in communication, resources, risk and more; Villanova University
- Bonner, T. (2013) The Project Management Information System (PMIS) Described. Retrieved from: <http://www.brighthubpm.com/project-planning/44058-the-project-management-information-system-pmis-described/>
- Brennan, M. (2009) Marshall-Brennan Constitutional Project Team: Overview [Online] Available from www.mitchellhamline.edu/m,arshall-brennan/ Accessed on 10/07/18

- Burns, N. and Grove, S.K. (2001) *The Practice of Nursing Research: Conduct, Critique & Utilization*. 4th ed. Philadelphia, WB Saunders
- Cooper, R. (1994) Determinants of timeliness in product development. *Journal of Product Innovation Management*, 11(5), pp. 381 – 396
- Crema, A., Brivio, P. A., Stroppiana, T. and Frigero, K. (2016) Spatial data infrastructure integrating geospatial data. *International Journal of Geo-Information*, 5(5), 73
- Devaus, D. A. (2006) *Resign Design in Social Research*: London, SAGE, Trochim
- Erasmus (2018) Erasmus + Project Results [Online] Available from www.europa.eu/programmes/erasmus/ Accessed on 10/07/18
- Goubau, H. (2018) Adopting new technologies a major challenge for construction industry. [Online] Available from <https://www.strategic-risk-europe.com/adopting-new-technologies-a-major-challenge-for-construction-industry/1421339.article> [Accessed on 19/06/18]
- Ilyas, M. A. B., Hassan, M. K. and Ilyas, M. U. (2013) PMIS: Boon or Bane? Paper presented at PMI Global Congress 2013 – EMEA, Istanbul, Turkey, Newtown Square, PA: Project Management Institute.
- Institute, P. M. (2017). *PMBOKGuideAgilePG.pdf* (2017th ed.). Project Management Institute, Inc. 14 Campus Boulevard Newtown Square , Pennsylvania 19073-3299 USA. Retrieved from WWW.PMI.org
- Indiana Economic Development Corporation (2016) Project Management Information System [Online] Available from www.iedc.in.gov/resources/project-management-information-systems/ Accessed on 10/07/18

- Jung, Y. and Gibson, G.E. (1999), Planning for Computer Integrated Construction, Journal of Computing in Civil Engineering, 13(4), pp. 217-225.
- Kothari, C. R. (2004). Research methodology: Methods and techniques. New Age International.
- Laryea, S. (2010) Challenges and opportunities facing contractors in Ghana; Paper presented at the Procs West African Built Environment Research (WABER) Conference, Accra, Ghana, 215 – 226
- Laxminarayan, R. and Macaulry, M. K. (2014) The value of information: Methodological frontiers and new applications in environment, Business and Management, DRM Publishers; ISBN 978-94-007-4839-2
- Lydon, J. (2017) Why your construction PMIS solution should be unique [Online] Available from www.lydonsolutions.com/construction-pmis-solution/ Accessed on 10/07/18
- Markgraf, G. (2018) Project Management Information Systems [Online] Available from <https://chron.smallbusiness.com/project-management-information-systems/> [Accessed on 19/06/18]
- McKinsey Global Institute (2013) Infrastructure productivity: How to save \$1 trillion a year. [Online] Available from <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/infrastructure-productivity> [Accessed on 19/06/18]
- McKinsey Global Institute (2015) The construction productivity imperative. [Online] Available from <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/the-construction-productivity-imperative> [Accessed on 19/06/18]
- Mills, G. (2018) Ethics and Integrity: Overview [Online] Available from www.generalmills.com/en/responsibility/ethics-privacy/ Accessed on 10/07/18

- Muaz, J. M. (2013) Practical guidelines for conducting research. Summarizing good research practice in line with DCED Standards, Available from <https://ssrn.com/abstract=2591803/> Accessed on 20/03/18
- Mulgan, R. (2000) Processes of Accountability, Australian Journal of Public Administration, 56(1), pp. 25-36
- Orfano, S. W. (2011) PMIS – An integrated approach for the management and distribution of project information: A data modelling approach. Project Management Journal, 20(3), pp. 5 – 10
- Peters, S. (2014) On the role of openness of information: A historical reconstruction [Online] Available from www.openpraxis.com/ Accessed on 10/07/18
- Project Management Information Systems for Development Organizations (2011) A methodology to manage development projects for international assistance and humanitarian relief organizations. Published by: PM4DEV, Project Management for Development Organizations. ISBN: 978-0-557-28879-3
- Rodriguez, M. (2017) Towards a smart project management information system; International Journal of Project Management, Vol 16(4), pp. 249 – 265
- Scotto, M. (1994) Project Budgeting: The key to bringing business projects in on-time and on-budget. Project Management Journal, 25(1), pp. 35 – 42
- Sibal, K. (2011) Point of View: The purpose of information [Online] Available from www.geospatialworld.net/article/point-of-view/ Accessed on 10/07/18
- Solove, D. (2014) Ten reasons why privacy matters [Online] Available from www.teachprivacy.com/10-reason-why-privacy-matters/ Accessed on 10/07/18

- Southwest Research Institute (2018) Project Management Information Systems: Overview
[Online] Available from www.swri.com/industry/project-management-information-system/ Accessed on 10/07/18
- Stewart, R. A. and Mohamed, S. (2004), Evaluating Web-based Project Information Management in Construction: capturing the long-term value creation process", *Automation in Construction*, 13(4), pp. 469-473.
- Tongoco, D.C. (2007) Purposive Sampling as a Tool for Informant Selection, *Enthobotany Research & Applications*, 5, pp.147-158. Available at <http://hdl.handle.net/10125/227> [Accessed on 04/08/2018]
- Venter, F. (2004) Project Management in Ghana, Expectations, Realities and Barriers to Use.
[Online] Available from <https://dspace.nwu.ac.za/bitstream/handle/10394/6937/>
[04/08/2018]
- Wieners, Eva (2018) Project Beneficiaries: Overview [Online] Available from www.proposalsforngo.com/proposals/project-beneficiaries/ Accessed on 10/07/18

APPENDICES

Appendix 1

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND BUILT ENVIRONMENT

DEPARTMENT OF BUILDING TECHNOLOGY

RESEARCH QUESTIONNAIRE

TOPIC: THE USAGE OF PROJECT MANAGEMENT INFORMATION SYSTEMS (PMIS) IN THE GHANAIAN CONSTRUCTION INDUSTRY

Dear Sir, Madam,

I am a student of the Kwame Nkrumah University of Science and Technology (KNUST) IDL Campus in Accra and I am undertaking a research for my MSc. Project Management studies on the above topic. The expectation is that this study will help to create a greater understanding of PIM usage among AEC firms and the benefits associated with it.

I will like you to participate in this study by providing answers to the questionnaire. I understand and respect that you may have busy schedules but I will be most grateful if you take out time to fill this. All answers provided here will be treated with all confidence and remain confidential. If you wish to receive further information about the study please contact me using the details below.
Thank you

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SECTION A – DEMOGRAPHIC DATA

Please tick where appropriate

1. Which type of AEC firm do you work with?

A. Architectural firm []

B. Engineering firm []

C. Construction firm []

2. What is your job designation in the company?

- A. Architect []
- B. Engineer []
- C. Building contractor []
- D. Quantity Surveyor []
- E. Project Manager []
- F. Other.....

3. How long have you worked with the company?

- A. Less than a year []
- B. 1 – 3 years []
- C. 4 – 6 years []
- D. 7 – 10 years []
- E. Above 10 years []

4. How long have you worked in your industry overall?

- A. 1 – 5 years []
- B. 6 – 10 years []
- C. 11 – 15 years []
- D. 16 – 20 years []
- E. Above 20 years []

5. How many projects have you worked on in your industry?

- A. 1 – 0 []
- B. 11 – 20 []
- C. 21 – 30 []
- D. 31 – 40 []
- E. Above 40 []

Are you aware of Project Management Information Systems (PMIS)?

- A. YES []
- B. NO []

6. Have you used PMIS on any project you have worked on?

- A. YES []
- B. NO []

7. Do you consider PMIS to be beneficial to information flow in any project?

- A. YES []
- B. NO []

SECTION B - IDENTIFY THE LEVEL OF PMIS USAGE AMONG AEC PROFESSIONALS IN GHANA

This section of the questionnaire is to identify the level of PMIS usage among AEC professionals in Ghana. This will be divided into two parts, with the first part requiring respondents to identify

the components of PMIS and information requirements which necessitate PMIS. The second part will determine from the respondents how beneficial PMIS are to their projects.

8. Please identify the information management needs that necessitate the use of PMIS at your firm. Please ticks as many as relate to your firm.

1	
Requirement from the project governance structure	
Requirement of information from different project stakeholders	
Significant requirement to collect and organize information	
Frequency of collecting and reporting project information to stakeholders	
Types of visual reporting requirements for a project	
Types of access, security and controls to manage, modify and update project information	
The need to develop especial reports in defined formats	
The need for complex analysis of data collected	

9. Please identify the significant information technology constraints, which necessitate the need for PMIS. Please ticks as many as relate to your firm.

2	
Availability of IT resources committed to project information management	
Current capacity of project technology to manage information	
The need for communication, email, internet and other online systems	
The number of staff requiring computer use on a project	
Level of computer literacy of the project staff	
The IT support requiring for execution of the project	

10. Please identify the significant PMIS level you use for your projects

3	
Level One – Common software, Microsoft Office Suite	
Level Two – Server database applications, Local network	
Level Three – Integrated database applications, Internet	

11. Please identify the significant PMIS tools as are applicable to your firm.

4	
Real-Time Dashboards	
Microsoft Project (Gantt Charts, Scheduling Chart, Costing)	
Microsoft Office (Reports)	
Project Task Lists	
Project Time Sheets	
Project Collaboration Tool, BIM(AutoCAD , ArchiCad , Autodesk Navisworks , STAAD Pro ,Bently structural Modeler	
Project Resource Management Tool	
Mobile Technology and Apps	
Online File Storage and Cloud file sharing	
Project Templates	
Project Integration Tools	

12. Please rank on a scale of 1 – 5 the level of use of PMIS tools in your firms. Please use the scale 1 – Very Frequently, 2 – Frequently, 3 – Occasionally, 4 –Rarely, 5 – Never

5					
	1	2	3	4	5
	Very Frequently	Frequently	Occasionally	Rarely	Never
Real-Time Dashboards					
Microsoft Project (Gantt Charts, Scheduling Chart, Costing)					
Microsoft Office (Reports)					
Project Task Lists					
Project Time Sheets					
Project Collaboration Tool, BIM(AutoCAD , ArchiCad , Autodesk Navisworks , STAAD Pro ,Bently structural Modeler					
Project Resource Management Tool					
Mobile Technology and Apps					
Online File Storage and Cloud file sharing					
Project Templates					
Project Integration Tools					

SECTION C - IDENTIFY THE CHALLENGES ASSOCIATED WITH PMIS ADOPTION AND USAGE AMONG AEC PROFESSIONALS IN GHANA

This next section of the questionnaire is to identify the challenges that AEC firms associate with PMIS adoption and usage. The expectation is that this will help to develop recommendations that can mitigate or eliminate the challenges entirely.

13. Please rank on a scale of 1 – 5 how the following challenges are to limiting the adopting and use of PMIS by AEC firms. Please use the scale 1 – Strongly disagree, 2 – Disagree, 3 – Never agree or disagree, 4 – Agree, 5 – Strongly agree

	1	2	3	4	5
	Strongly disagree	Disagree	Never agree or disagree	Agree	Strongly agree
Isolated systems run by teams working with different information that is difficult to consolidate					
Focus on collecting and storing data does not afford ample time to analyze the data					
High expectation placed on data collected which sometimes never gets shared across all project teams					
Technology myopia leads to more time managing the technology than the information itself					
Disconnect between the information reporting and what the system was set up to achieve					
Information reporting not entirely connected to decision making					
Lack of a standard PMIS protocol makes choice difficult					

There is duplication of information across different teams which renders a PMIS ineffective					
Training and maintenance costs for PMIS are high					
Little experience of AEC teams managing PMIS					
Little IT support on a project makes a PMIS less useful					