ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE DEPARTMENT OF PROJECT MANAGEMENT

Challenges of Software Development Projects: In the Case of Information Network Security Agency (INSA)

BY: REDA WELDEBRHAN

A Research Project Submitted to Addis Ababa University School of Commerce in Partial Fulfillment of the Requirement for Master of Arts in Project Management (MAPM)

ADVISOR: ADANE ATARA (PHD)

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NAME AND SIGNATURE OF MEMBERS OF THE EXAMINING BOARD

_____	_____
ADVISOR	**SIGNATURE**
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EXAMINER	**SIGNATURE**
_____	_____
EXAMINER	**SIGNATURE**

August 2019

ADDIS ABABA, ETHIOPIA

STATEMENT OF DECLARATION

I, the undersigned, declare that this research project work titled "Challenges of Software Development Projects: In the Case of Information Network Security Agency" is my original work, and has not been presented for the award of Degree or Diploma Program in this or any other institution. All the sources of data used in the research have been acknowledged regarding originality.

_____ _____

Reda Weldebrhan Date

CERTIFICATE

This is to certify that this project work, **Challenges of Software Development Projects: In the Case of Information Network Security Agency (INSA)**" undertaken by Reda Weldebrhan Kahsay in Partial fulfillment of the award of Master's degree in Project Management at Addis Ababa University, School of Commerce, is an original work and not submitted earlier for any degree either at this University or any other University.

_____ _____

Adane Atara (PHD). Date

Project Work Advisor

ACKNOWLEDGMENT

First, I am very grateful to my advisor Dr. Adane Atara for his overall guidance, understanding, reviews of the work and constructive comments.

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ABSTRACT

There are various software development project processes and disciplines, based on software engineering's disciplinary approach. This research focuses on the challenges that occur during software development projects and why they occurred. There are so many challenges to produce a quality software product within a time frame and allocated budget. In the dynamic world challenges are inevitable. In a global market, opportunities are clubbed with challenges. Business sustainability is therefore depends on how effectively the businesses convert challenges into opportunities. Both qualitative and quantitative approaches were used to conduct the study and purposive sampling was adopted to gather data. The total sample size taken for the survey was 45 employees of INSA. Data obtained through questionnaire were analyzed using SPSS and Microsoft excel tools. Moreover, the data obtained using interviews was analyzed qualitatively. The questionnaire of the study was conducted using a five Likert scale, namely, strongly disagree, disagree, neutral, agree and strongly agree. The frequency distribution and the percentage of the answers to the questionnaires on the challenges of software development projects in the case of INSA using the 5-point Likert scale shows that 54.68% of the respondents agree on the occurrence of challenges during the software development process, 27.34% of the respondents disagree of the occurrence of the challenges during software development process. The remaining 17.98% of respondents were neutral to the challenges happening during the software development processes. The result shows as there were visible challenges during the software development processes.

Keywords*: Challenge, Software, Project, Project Plan, Requirement Analysis, Development, Test, Management, Methodology*

ABBREVATIONS and ACRONYMS

Ag	Agree
DB	Database
Nu	Neutral
PMBOK	Project Management Book of Knowledge
PMI	Project Management Institute
Q	Question
QA	Quality Assurance
ICT	Information Communication Technology
INSA	Information Network Security Agency
IT	Information Technology
MP	Project Manager
SA	Strongly Agree
SD	Strongly Disagree
SDLC	Software Development Life Cycle
SME	Subject Matter Expert
SPSS	Statistical package for social science
URP	Unified Resource Planning

Contents

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The term "software" did not come into use until 1958. It was coined by Princeton University professor John Tukey in an article in The American Mathematical Monthly in January of that year (Peterson, 2000). Software development has begun in the 1960s. Starting from that time, software has become an essential part of modern society. Software has become pervasive in day-to-day activities of organizations and the economy. With the help of software systems it is possible to prepare a report, build a bridge, control the space aircraft, build social networks in the internet, and it may also play a crucial role in overall economy of an organization or a country as a whole (Watson, 1990).

Software development projects have become key drivers in today's world (Wong, 2010) and its popularity is rapidly increasing globally due to the tremendous need and dependency for software across businesses (Asiegbu, 2011). According to (Aldammas, 2011), as cited in (Al-Mudimigh, 2001), software solutions bring great value to organizations and its potential cannot be over-emphasized or disputed. Research has shown that organizations have now realized the undeniable benefits of software solutions to increase the quality, accuracy and operational effectiveness while using software solutions as strategic drivers for fulfilling the vision of the organization (Wong, 2010). Businesses have become so dependent on software solutions to drive their processes; however the development of software in itself is not a perfect process (Chow, 2008).The software development and project management are still facing problems and issues (Akbar, 2011). This has led to a compelling reason for opening the "black box" to investigate the factors causing software project failure (Wong, 2010). Software development projects have a reputation that they often fail; they may late, over-budget, or not able to satisfy customers' needs (Cerpa, 2009).

Software development projects support every possible industry and business function. Therefore managing projects requires not only skills in information technology but also understanding of customers' area of business (Schwalbe, 2010). Managing complex software projects is a difficult

task because of constantly changing conditions, technology, resources, project requirements, and schedules (Murch, 2001).

INSA, a governmental organization, was established with the objective to build National Cyber Power capable of protecting the national interest, to provide technical intelligence so as to support decisions and actions of the government, to build data and computing capacity so as to ensure the transformation of the national high-tech and information security industry, and to ensure that information and computer based key infrastructures are secure. INSA develop and implement secured information management infrastructures and software systems when the complexity of the system to be developed becomes beyond the capability of the domestic IT organizations.

The main purpose of this study is to assess and identify the challenges occurred during software development projects for different organizations developed by INSA. Which is the challenge occurred starting from project initiation until its closure. This mainly covers the challenges occurred during the planning, requirement analysis, system design, system development, testing, deployment and maintenance phases of the software development life cycle.

1.2 Statement of the problem

Today's organizations are obligated to use an integrated information system in order to reduce costs, to increase quality and product variety and to shorten delivery time. Software systems provide complete integration of information flows not only with in departments of an organizational but also across the companies under the same management. Implemented software system is a beneficial process for companies as it affects nearly all of the processes in an organization. It provides a unified organizational view of the business that encompasses all functions and departments, and organizational database where all business transactions are entered, recorded, processed, monitored and reported.

Successfully designed and developed software systems provide benefits to client organizations companies such as cost reduction and quality improvements. In order to obtain these benefits, system development companies need to manage the development processes of the software systems. When software systems are not developed according to the requirement of the client organizations they will be useless and disastrous. Although software development projects have been carried out for

over 50 years, it seems that we have not yet learned enough to ensure that our software development projects are successful (Cerpa, 2009).

The growth and the acceptance of software systems have been rapid due to competitive advantages that automated software systems provide to organizations especially for large organizations with complex activities. Software systems attempt to integrate all information processes in a single central database system which allows information to be retrieved from many different organizational positions, and in principle they allow any organizational object to be made visible, that enables companies to gain a distinctive competitive advantage over its competitors.

Even though there are hundreds of software development companies in Ethiopia, they cannot be competitor with the software development organizations which found in the developed countries and their progress is not satisfactory. Hence, many software developments projects which have been undertaken by various companies are failed to be completed within time and cost due to different factors. As far as the researcher tried to assess many studies, there are no sufficient researches done here in Ethiopia in this area, even though lots of researches have been done in other research areas such as in agriculture and health.

As a report on a project success point out at the end of 2010 regarding software development projects at INSA showed, more than 90% of the software projects did not complete on schedule and showed cost overruns.

Hence, it is important to undergo such a research on the challenges of software development projects, factors which can lead to software development project failure. This study further tried to develop a conceptual framework to identify the challenges in the software development projects specifically in the case of information Network Security Agency though it can be applied in other Ethiopian software development organizations.

1.3 Research questions

Research Question 1: What are the software development project challenges?

Research Question 2: Why do software development project challenges occur?

1.4 Objectives of the study

The general as well as the specific objectives of the research can be organized as follows

1.4.1 General objective

The main objective of the study is to examine the challenges and how they occur during software development projects in the case of Information Network Security Agency (INSA).

1.4.2 Specific **objectives**

- To explore the software development project challenges
- To examine why software development project challenges occur
- To assess the methodologies that the organization uses during the software development process

1.5 Significance of the study

The result of the study would contribute meaningfully to software development projects and to the software development industry as whole by identifying the software development project challenges and identify the management techniques on how to produce quality software development projects.

The alignment across the professional requirement criteria, the project management mechanism and the project management structure has a higher chance of project development success. It is important in identifying the bottlenecks on the software development quality factors (Kwak, 2002).

To sum up, the findings of the results provide valuable insights for the developers, researchers and practitioners who are interested in software development project, how best they can utilize their limited resources and to pay adequate attention to those factors that are most likely to have an impact upon the development of quality software development project.

1.6 Scope and limitation of the study

The scope and the limitation of the study is organized as below.

1.6.1. Scope

The scope of this research is bound to conduct a single-case study to investigate the challenges of software development projects in the case of Information Network Security Agency (INSA), even though the results of the study can be extended and applied to other software development projects. The study includes all customer specific software development projects in Information Network security Agency (INSA).

The system development is analyzed & focused in its process starting from its project initiation through its development until the closure phase of the software development life cycle. Other challenges which affect the software development process are out of the scope of this project work. Moreover, the challenges come from the client organization that affect the success of overall project management like time & quality are not included in this project work.

1.6.2. Limitation

The research is a case study in INSA and the result may not show the result of all software development projects in other organizations. The financial as well as time constraints forced the researcher to limit the scope of the study. But, it can also be used as a comparison for similar project papers. Limited availability and access to documents related to the software development projects processes also limit the research.

1.7 Operational definition of key terms

- Business process is a logically related activity or group of activities that takes input, processes to provide output (Maylor, 2010).
- Business process integration is the assimilation of business processes together in a central system (Bochmann, 2009).
- Central Database the repository where any data of the organization is stored (Teleo, 2018)
- Data repository is a location to store data (Jackson, 2013).
- Information technology in the broadest sense refers to both the hardware and software used to store, retrieve, and manipulate information using computer systems and applications (Peterson, 2000).

- Lifecycle refers to the structure through which software development project process passes and is integrated within business processes (Ruparelia, 2010).
- Project: the word project is described in different ways by different sources, one definition is provided here: Project is defined as a temporary endeavor undertaken to create a unique product or service. Temporary means the project has a definite ending point and unique means that the product or service differs in some distinguishing way from all similar products or services (Wessinger, 2012).
- Requirement Analysis is the process of gathering and collecting needs from the client organization (Rouse, 2007).

1.8 Organization of the study

This study is divided into five chapters. Chapter one is generally about the introduction which consists of Background of the study, Statement of the problem, Research Questions, Objectives of the study, Significance of the study, Scope and Limitation of the study, Definitions of Basic Terms and Organization of the study. Chapter two is the literature review. Based on the reference gathered, this chapter states out about Project and Project management, software development project, Software Development Project processes, Software Development Project Management Methodologies as well as assessment of related works.

Chapter three is about research design and methodology. In this chapter, the research approach and strategy applied by the study are identified, and it discusses the methodologies that were used to gather the data required to support the development and analysis of the study. This chapter further explains how the data were collected and methods of data analysis. Chapter four focus on data presentation and interpretations primarily contains subtitles such as characteristics of respondents, data analysis and discussions on the findings of software development project challenges. The last chapter, chapter five, presents the conclusions drawn from the findings, and the implications of the findings for future research, practitioners, government and other support agencies it is comprises of subtitles such introduction to conclusion, summary of major findings and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Theoretical literature review

2.1.1 Project and project management

Project: Different authors have defined projects in different ways to put it into perspective. By summarizing these definitions, this research tried to define project as follows:

A project is a temporary endeavor undertaken to create a unique product or service. Temporary means that every project has a defined beginning and a definite end. Unique means that the product or service is different in some distinguishing from all similar products or services (PMI, 2013).

A project is a sequence of unique, complex, and connected activities that have one goal or purpose and that must be completed by a specific time, within budget, and according to specification (Wysocki, 2014).

A project is a unique product, service or result which highlights that no two projects are alike because of the variation in requirements, available resources, internal and external environmental conditions and achievement goals of the project stakeholders (Wessinger, 2012).

A project is a temporary venture that exists to produce a defined outcome. Each project will have agreed and unique objectives as well as its own project plan, budget, timescale, deliverables and tasks (AXELOS, 2015).

From these definitions and from the message they convey, we can clearly understand that projects are short term, have a well -defined scope and are unique with set of activities to achieve a specific goal and objective.

Project Management: Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (PMI, 2013).

Project Management is an organized common-sense approach that utilizes the appropriate client involvement in order to meet sponsor needs and deliver expected incremental business value (Wysocki, 2014).

Project management is about knowing exactly what your goals are, how you're going to achieve them, what resources you'll need, and how long it will take you to reach that specific goal (Academy, 2018).

From these definitions we can summarize that project management is the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters.

Challenge: Cambridge online dictionary defines Challenge as "a job, duty or situation that is difficult because you must use a lot of effort, determination, and skill in order to be successful".

2.**1.**2 Software development project

Software development refers to a set of computer science activities dedicated to the process of planning, designing, creating, deploying a software system. Software itself is the set of instructions or programs that tell a computer what to do. It is independent of hardware and makes computers programmable (IBM-Research, 2014).

According to IBM (2014), there are three basic types of software developments as described below:

System software: It is a software on a computer that is designed to control and work with computer hardware. The two main types of system software are the operating system and the software installed with the operating system, often called utility software. In some cases, the operating system and utility software depend on each other to function properly.

Some system software is used directly by users and other system software works in the background. System software can allow users to interact directly with hardware functionality, like the Device Manager and many of the utilities found in the Control Panel.

Programming software to give programmers tools such as text editors, compilers, linkers, debuggers and other tools to create development code.

Application software (applications or apps) to help users perform tasks. Office productivity suites, data management software, media players and security programs are examples. Applications also refers to web and mobile applications like those used to shop on Amazon.com, socialize with Facebook or post pictures to Telegram.

2.1.3 Software development processes

Software life cycle processes standard, which is an endeavor with defined start and finish dates undertaken to create a product or service in accordance with specified resources and requirements (ISO/IEC, 2010).

As stated in the PMI (2013) the nature of project management processes, in terms of the integration between the processes, their interactions, and the purposes they serve, project management processes are grouped into five categories known as Project Management Process Groups (or Process Groups). The five process groups that the project undergoes from its initiation until closing of the project.

As clearly depicted on PMI (2013), the five process groups are describes as follows:

- **Initiation**: the goal of the software development project are identified. The project manager is assigned to the project, the project charter is created, and feasibility study is conducted, terms of reference organized, and teams are appointed.
- **Planning**: in this phase the objectives and the course of action required to attain the objectives of the project are refined. The project team work to plan all of the needed requirements to deliver a successful project.
- **Execution**: after project planning, the project team goes about follow the project plan to create the deliverables of the project.
- **Monitoring and controlling**: as the project is being executed by the project team, the project manager monitors and controls overall activity of the project. Monitoring and controlling is also an ongoing process to ensure that the project addresses its targets for each project objectives
- **Closing**: after finalization of each project development phase and at the end of the entire software development process there happens a closer to ensure that all of the work has been completed as defined in the planning phase. At this phase there will also be ownership transfer from the project team to the project owner.

According to Massachusetts Institute of Technology (Jackson, 2013), the software development project process or the software development life cycle is described as summarized below:

Planning: The planning phase involves aspects of project and product management. This mainly includes:

- Resource allocation (both human and materials)
- Capacity planning
- Project scheduling
- Cost estimation
- Provisioning

The outputs of the planning phase include: project plans, schedules, cost estimations, and procurement requirements. Ideally, Project Managers and Development staff collaborate with Operations and Security teams to ensure all perspectives are represented.

Requirements: The business must communicate with IT teams to convey their requirements for new development and enhancement. The requirements phase gathers these requirements from business stakeholders and Subject Matter Experts.

Architects, Development teams, and Product Managers work with the SMEs to document the business processes that need to be automated through software. The output of this phase in a Waterfall project is usually a document that lists these requirements. Agile methods, by contrast, may produce a backlog of tasks to be performed.

Design and prototyping: Once the requirements are understood, software architects and developers can begin to design the software. The design process uses established patterns for application architecture and software development.

Software development: This phase produces the software under development. Depending on the methodology, this phase may be conducted in time-boxed "sprints," (Agile) or may proceed as a single block of effort (Waterfall.) Regardless of methodology, development teams should produce working software as quickly as possible.

Testing: It is a necessary to measure quality of the software product to be used. The testing phase mainly includes the components such as:

- Code quality
- Unit testing
- Integration testing
- Performance testing
- Security testing

The output of the testing phase is functional software, ready for deployment to a production environment.

Deployment: The tested software is deployed after it has been approved for release. The output of this phase is the release to production of working software.

Operations and maintenance: The operations and maintenance phase is the "end of the beginning". Software must be monitored constantly to ensure proper operation. Bugs and defects discovered in Production must be reported and responded to, which often feeds work back into the process. Bug fixes may not flow through the entire cycle, however, at least an abbreviated process is necessary to ensure that the fix does not introduce other problems.

While working on software development projects there are commonly happening challenges in requirement elicitation, project management methodology selection, project manager selection, cost estimation and scheduling of the software development project (Sahibuddin, 2009).

2.1.4 Software development project management methodologies

A software development methodology is a set of rules and guidelines that are used in the process of researching, planning, designing, developing, testing, setup and maintaining a software product (Liviu, Comparative study on software development methodologies, 2014).

According to the Database Systems Journal, (Liviu, Comparative study on software development methodologies, 2014), there are about 20 popular types software development methodologies.

However, the methodologies highly related to customer specific software development projects can be summarized as follows.

Waterfall: It is the first methodology generally acknowledged as being dedicated to software development.

The Waterfall methodology is linear-sequential process where every stage starts only after the previous has been completed. Each stage has its own deliverables. The Waterfall methodology is predictable and values rigorous software planning and architecture.

Prototyping: It is a methodology that evolved out of the need to better define specifications and it entails building a demo version of the software product that includes the critical functionality. Initial specifications are defined only to provide sufficient information to build a prototype. The prototype is used to refine pacifications as it acts as baseline for communication between project team and project owner.

Iterative and incremental: It is a methodology that relies on building the software application one step at the time in the form of an expanding model. Based on initial specification a basic model of the application is built. Unlike the prototype, the model is not going to be discarded, but is instead meant to be extended. After the model is tested and feedback is received from the project owner specifications are adjusted and the model is extended. The process is repeated until the model becomes a fully functional application that meets all the project owner's requirements.

Spiral: It focuses on identifying objectives and analyzing viable alternatives in the context well documented project constrains. The Spiral methodology has four major phase: planning, risk analysis, development and evaluation. Project fallows each phase multiple times in the above mentioned order until the software application is ready to be setup on the live environment. The Spiral methodology emphasizes risk analysis and always evaluates multiple alternatives before proceeding to implementing one.

Rapid application development: It is designed to give much faster development and higher-quality results than those achieved with the traditional methodologies. Rapid application development imposes less emphasis on planning tasks and more emphasis on development. Development cycles are time boxed and multiple cycles can be developed at the same time. The project owner's feedback

is received after each module is completed. The Rapid application development methodology is suitable for small, medium and large scale projects with the constraint that projects have to be broken down into modules.

Extreme programming: breaks the conventional software development process into smaller more manageable chunks. Rather than planning, analyzing, and designing for the entire project at once, extreme programming exploits the reduction in the cost of changing software to do all of these activities a little at a time, throughout the entire software development process. In extreme programming methodology requires that a represented of the project owner is always with the development team in order to have access to continuous and relevant feedback.

V-Model: It is a software development process which is an extension of the waterfall model. It emphasizes thorough testing by pairing each software development stage with a matching phase of testing. The project owner's feedback is received in the form of acceptance testing after the entire application is completed. The V-Model development methodology is suitable for small and medium scale projects.

Agile-Scrum: It is a methodology for incrementally building software in complex environments. Software requirements are formulated and prioritized by the product owner and are called stories. All the stories make up the Product Backlog. The Scrum methodology adopted a time box approach where development cycles known as sprints take no more than 4 weeks and end with a working version of the software. All the stories of a sprint make up the Sprint's Backlog. The development progress is assessed in daily meetings that are confined to 15 minutes and are known as Daily Scrum. Task assignment is not done by the project manager or by any other individual. Scrum development teams are self-organized and task assignment is a process where every team member is involved. The team efforts are kept on track by a Scrum Master.

The project owner's feedback is received at the end of each sprint. The Scrum methodology is suitable for small, medium and large scale projects.

Rational unified process: This methodology comes with several out-of-the-box roadmaps for different types of software projects and it provides guidance for all aspects of a software project. It does not require the project team to engage in any specific activity or produce any specific artefact. It provides guidelines that help the project manager tailor the process if none of the out-of-the-box

roadmaps suits the project or organization. The project owner's feedback is received as agreed at the start of the project as the methodology does not enforce a rule on project team as project owner collaboration.

It divides the development process into four distinct phases that each involve business modeling, analysis and design, implementation, testing, and deployment. The four phases are:

1. **Inception -** The idea for the project is stated. The development team determines if the project is worth pursuing and what resources will be needed.
2. **Elaboration** - The project's architecture and required resources are further evaluated. Developers consider possible applications of the software and costs associated with the development.
3. **Construction -** The project is developed and completed. The software is designed, written, and tested.
4. **Transition** - The software is released to the user. Final adjustments or updates are made based on feedback from end users.

The Rational unified process methodology is suitable for small, medium and large scale projects.

Test-driven development: It is a methodology developed around unit testing. Before writing any actual code the developers write automated test cases for new functionality. If the tests work then there is no need to write any code as the functionality already exists, it was just not know to the developer. This scenario is often encountered when dealing with legacy code. If tests do not compile then the developer will write the code and run the tests again. The process is repeated until all requirements are met.

Crystal Methods: It is a family of methodologies that developed around the theory that people, and not tools or process are the most important factor in any software project. Crystal Methods is a myriad of methodology elements and does not tackle every project in the same manner but instead uses custom tailored processes and tools depending on the project's profile and scale. Large or safety critical projects require more methodology elements than small non-critical projects. With Crystal Methods, organizations only develop and use as much methodology as their business needs demand. Crystal uses an iterative approach but does not enforce a release with every iteration.

Adaptive software development: It is a methodology that was built as a response to an economy that is increasingly changing and evolving. Adaptive software development is based on iterative development and is oriented on the project's mission. It is a time boxed model that values delivering features and accepts changes in all stages of the project. Adaptive software development responds accepts risks and handles them efficiently.

The project owner's feedback is received after each iteration is finished. The Adaptive software development methodology is suitable for small, medium and large scale projects.

2.2 Empirical literature review

As per (Siles, 2018), it is not uncommon to find a project that has delivered all its expected outputs but has failed significantly in reaching its objectives. From extensive observation and experimentation through working with development agencies for years, he has seen the following challenges caused by: poor project planning, inadequate management skills, lack of accountability, lack of stakeholder involvement, unrealistic plans, no measure to evaluate quality, poor and inconsistent project management discipline, duplication of efforts, poor risk management strategies and unmotivated project staff.

According to Rodolfo Siles (2018), development organizations can benefit from a standardized approach to deliver their projects not only on time and within budget but in the quality expectations of the stakeholders. Project management processes and techniques are used to coordinate resources to achieve predictable results. The value proposition for project management results by implementing a common set of project management processes, competencies and tools. The value of project management to development organization includes:

- Better expectation-setting through up-front estimating, planning, and project definition.
- Faster execution through the reuse of common processes and templates.
- Fewer project problems encountered when utilizing proactive project management processes.
- Better organizational decision making through more effective project communication.
- Higher donor/beneficiary satisfaction and less rework by delivering a higher quality outputs the first time.

Project management provides a proven methodology to accurately and efficiently complete projects of any size and complexity. The detailed planning provides a realistic plan that helps manage risks before they occur and reduce costly changes late in the project. Benefits occur only when organizations consistently apply standard methodologies and principles on all projects.

Other study made by Villanova University (2019), "project management challenges Within Corporate Projects", which focuses on the challenges of software development projects is stated as bellow.

Inadequate Skills for the Project: A project sometimes requires skills that the project's contributors do not possess. Project management training can help a project leader determine the needed competencies, assess the available workers and recommend training, outsourcing or hiring additional staff.

Lack of Accountability: A project manager's leadership qualities can shine when each member of the team takes responsibility for his or her role in achieving project success. Conversely, a lack of accountability can bring a project to a complete halt. Finger-pointing and avoiding blame are unproductive, but all-too-common features of flawed project management. Learning to direct teams toward a common goal is an important aspect of project management training.

Improper Risk Management: Learning to deal with and plan for risk is another important piece of project management training. Risk tolerance is typically a desirable project manager trait because projects rarely go exactly to plan. Gathering input, developing trust and knowing which parts of a project are most likely to veer off course are aspects of the project manager's job.

Ambiguous Contingency Plans: It's important for project managers to know what direction to take in pre-defined "what-if" scenarios. If contingencies are not identified, the entire project can become mired in an unexpected set of problems. Asking others to identify potential problem areas can lead to a smooth and successful project.

Poor Communication: Project managers provide direction at every step of the project, so each team leader knows what's expected

Impossible Deadlines: A successful project manager knows that repeatedly asking a team for the impossible can quickly result in declining morale and productivity. The odds of successfully completing a project under unreasonable deadlines are generally not feasible expectations.

Resource Deprivation: In order for a project to be run efficiently and effectively, management must provide sufficient resources. Project management training shows how to define needs and obtain approval up front, and helps project managers assign and prioritize resources throughout the duration of a project.

2.3. Conceptual framework

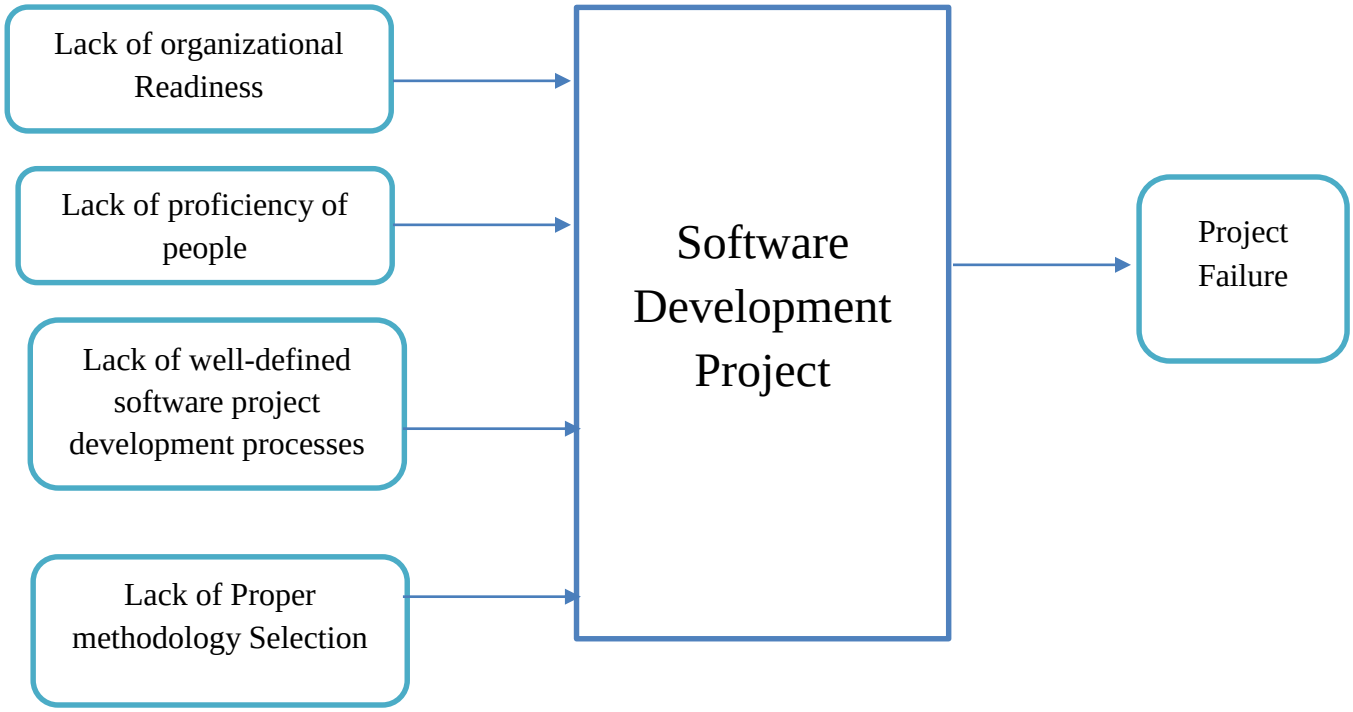
According to research findings of (Hamad, 2013)," IT Project Success/Failure Factors and Evaluating the Associated Risks", project development project challenges are grouped under organization, people, process and technical.

The organizational challenges are occurred due to: lack of executive sponsorship, Lack of management commitment, conventional organizational culture, and Political-based organizational culture.

The challenges occurred due to the people are due to: lack of technical know-how, lack of competent project management, lack of team work, groups or individuals resistance, wrong and bad customer relationship. The challenges in the software development processes are: project scope variation, incomplete requirements, poor project planning, lack of customer presence and customer role. And the challenges occurred due to technology selection is due to: lack of complete practice of the technology and in appropriation of technology and tools.

Based on the above literature review the below conceptual frame work is developed

Figure 1: conceptual frame work of software development project challenges



2.4 Related works:

There are many research works and literatures conducted about challenges of software development project conducted in perspectives of different countries and organizations.

(Demir, 2009) A surveys on failure factors and challenging issues in software projects. The author conducted the study to investigate the management challenges of software projects.

(Ruiz-Bertol, 2018) A research on Management Challenges in Software Projects: Improving Software Project Management and Representation in Multi-project Environments. The work presented here aims to provide specific solutions to problems that arise most commonly in complex software that includes real-time control and simulation, advanced commercial management systems, problems computing and solving systems, or decision-making and knowledge capturing software systems.

However, in Ethiopia there is only one slightly similar research project held by Missker (2018), which is a surveyed research about assessment of the Practice and Challenges of Information Technology Project Management.

The major themes defined in the research are coordinating, monitoring and controlling of E-Procurement Software Project of Ministry of Communication and Information Technology (MCIT).

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This section presents the research questions, describes the organizations where the case study was undertaken, and explains the research and data analysis methods used, sample and sampling technique, sources, tools and procedures of data collection and method of data analysis employed for the research project. An empirical study as a combination of questionnaire survey and interview were also applied in the research.

3.2 Research design

The research design was simply the framework or plan for the study that was used as a guide in collecting and analyzing the data as well it was a blueprint which describes what research approach to follow, the target population, sample size and method, and tools of data collection and analysis used to answer the research questions. According to (Saunders, 2009), mixed methods approach is important when both quantitative and qualitative data collection techniques and analysis procedures are used in a research design. Therefore the researcher employed mixed method approach with a high emphasis on the qualitative approach. Both qualitative and quantitative data were collected and analyzed.

3.3 Sample size and sampling techniques

As far as sampling technique is concerned the researcher used purposive sampling. The participants of the study were Information Network Security Agency (INSA) software development activity related departments and employees. The researcher deployed the knowledge, skills and judgments to determine the sample size of the participants from each teams of the software development division, namely, the business analysis team, the application design team, the application development team, quality assurance team and implementation teams, and project management teams of the project management division. The number of respondent varies from team to team based on the size of the team.

Based on (Tongco, 2012), members sampled are key informants on the topic under investigation because people who actively involving in division management were selected. The advantage of this sampling method is that the participants have knowledge about the topic and they can give reliable information which helped to reach at the intended objectives of the study. In addition the purposive sampling technique which was categorized under non-probability sampling gives time and cost advantages.

According to Saunders et al (2009), it is also appropriate for small inquiries and researches by individuals. Therefore based on the above technique, department heads, project managers and personnel's who participate in software development projects were included in the research.

Data were gathered from both employees and administrative staff through open and closed questions rated from 1 to 5 Likert scale. These Likert scales were commonly used in attitudinal measurements. This type of scale uses a five-point scale ranging from strongly disagree, disagree, neutral, agree, strongly agree to rate respondents agreement level on system quality and benefit.

Senior employees with higher work experience in the software development industry of each department of the agency were considered in the study. Moreover, higher number of participants were selected from departments with higher number of employees. A total of 45 respondents both in the questionnaire and in the interview were participated. That is 36 of the respondents were participated in the questionnaire and 9 participants were participated in the interview. Those nine participants of the interview were department heads of the customer specific software development departments and managers from project management division.

3.4 Source of data

The data sources which used for this study were both primary and secondary data sources. Primary data were collected from individuals under project management department of INSA that is from software requirement analysts, from software development architects, from code developers, from quality assurance team members and from the software product deployment/Implementation team who are closely engaged in software development projects.

Questionnaires and interviews were used to generate the primary data. Secondary data were collected from information provided by various documents of the organization.

The quantitative paradigm adopts an empirical view that seeks direct experience and objective reality when engaging in the software development process. This means that the measurement was conducted through measuring the effects of the intervention against quantitative indicators. Quantitative approaches often result in generalized conclusions that emerge from evaluations. On the other hand, the qualitative paradigm emphasizes the meaning and subjective experience of the intervention.

3.5 Data collection techniques and tools

As per the data collection tools and techniques, questionnaire were prepared having 5 likert scale close ended questions. Questionnaire was preferred because it is an efficient and economical way of gathering data from a large number of respondents anonymously which encourages respondents to provide genuine information. In addition it is relatively easy to analyze the data.

The questions were prepared based on the research questions required to achieve by the research. Then the questions were distributed and collected.

The interview questions were also held by the researcher face to face with the interviewee. Related documents were also collected.

The other point in relation to data collection is validity and reliability. Since quantitative and qualitative approach were employed, the validity was checked in relation to different literatures. The reliability of qualitative data can be checked by using different method. For this specific case triangulation was employed. Triangulation is using evidence from different sources to validate and confirm the same finding. For this study, triangulation is used to compare results of the interviews, from questionnaires and from observations of the reference documents.

According to (TOLEDO, 2016), using different data collection tools help to crosscheck information/responses reliability.

3.6 Method of data analysis

In order to analyze and interpret the collected data, Statistical Package for Social Sciences 24 (SPSS) and Microsoft excel computational techniques were used for the analysis purpose. The data collected through questionnaires were listed, grouped, and finally interpreted and analyzed quantitatively using the SPSS tool. Findings were tabulated and represented in descriptive figures

and tables. Job title, gender, age, educational level and work experience of respondents and major challenges of software development projects were analyzed using the SPSS tool.

The qualitative data which were collected through interview were coded and analyzed using open coding method. Then the result was verified by the respondent and presented.

3.7 Ethical issues

The ethical issues need to be considered in a scientific research were also considered in this study. The researcher ensures the quality and integrity of this project work. The respondents pursued consent for participation with full awareness of what it is. The study results depend on the data provided by the respondents and the qualitative data obtained from interview and document review and the process is realistic and bias free. In addition, the researcher asked for consent of the interviewees and pledged to keep the confidentiality of the information gathered to conduct this study.

CHAPTER FOUR

DATA PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter demonstrates the main findings and discussions from the questionnaire and interview questions regarding the software development project challenges in the case of information network security agency. The survey is composed of three basic sections as it is shown under the appendix component of the study. The first section is the category section which were designed to collect the basic personal information of the respondents of the survey. This first section of the study includes; job title, age, gender, educational level and experience. The second section is the questionnaire section. The questionnaire section is prepared to access the software development project challenges based five Likert scale questionnaires. The participants of this section were INSA employee who directly engaged in the software development activity. The third and the last section is the interview section. Like the second section, it was included in the survey so as to access the software development project challenges based on the prepared interview questions. Both middle and higher level management bodies were involved in the study.

This chapter covers the analysis, presentation, and interpretation of the findings resulting from the study. The analysis and interpretation of data is carried out in two phases. The first part, which is based on the results of the questionnaire, deals with a quantitative analysis of data. The second is based on the results of the interview which is based on open ended questions.

The result and discussion of finding is organized by using statistics, such as frequency, percentage, mean and standard deviation. The data obtained through interview and questioners were analyzed by using quantitative and qualitative method. The quantitative data gathered through questionnaire were analyzed by employing the computer software known as Statistical Package for Social Science (SPSS version 24) and MS-excel.

4.2 Characteristics of respondents

As I have tried to explain in chapter 3, the methodology part, the data collection methods that were used in this research were questionnaires and interviews. The questionnaire was distributed to software developers of the agency who were engaged in the software development process and the researcher interviewed team leaders, software development division and the project management division head of the organization. The number of questions distributed as a questionnaire were 38. The researcher was able to collect all the questionnaires filled properly. The qualification and experience of the participants of the questionnaire is presented in the table below (table 1) and graphically in figure1.

Table 1: Qualification and Experience of Participants

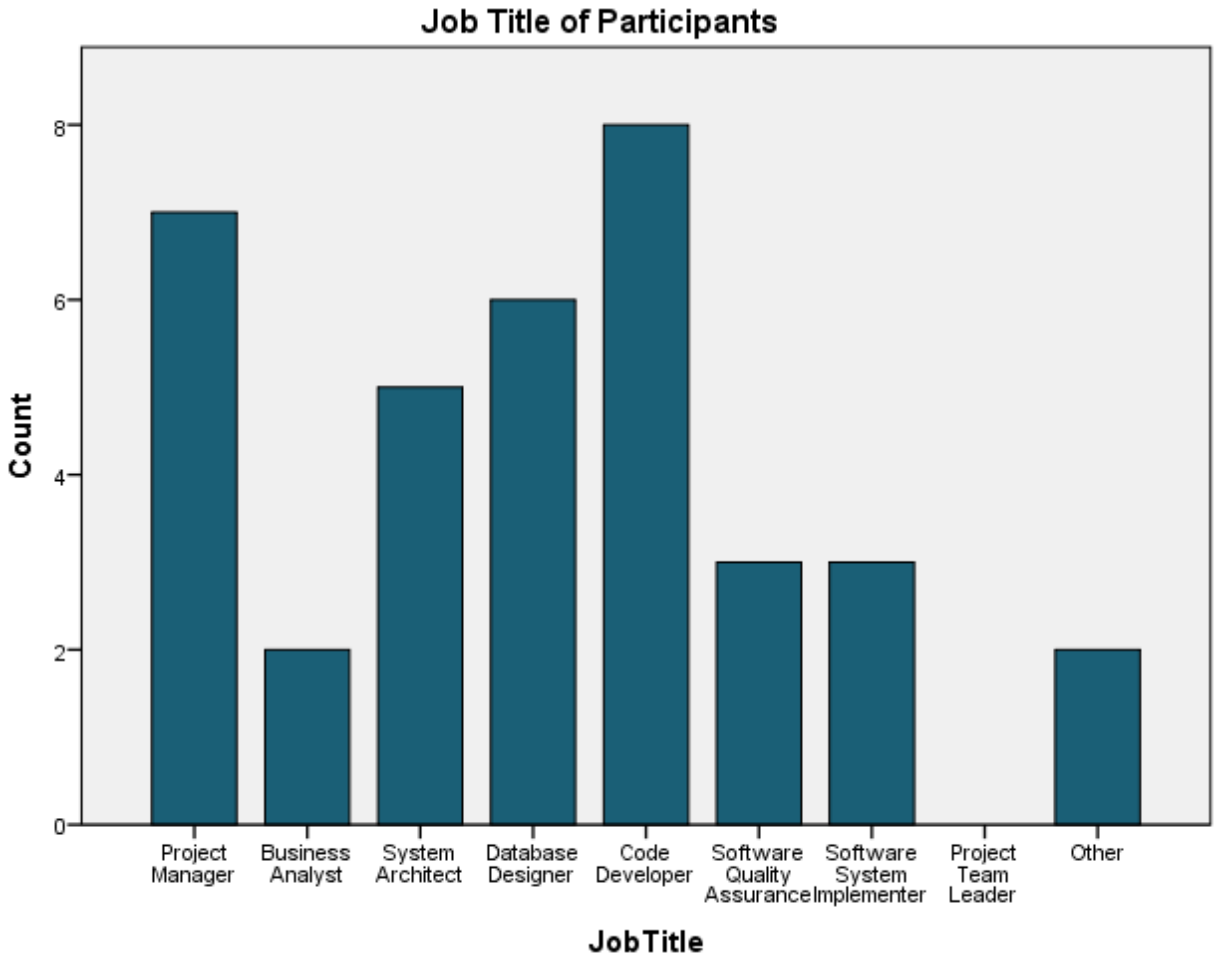
		Experience in years				Number of Participants	Participants in Percent
		1-5	6-10	11-15	16-20		
Job Title	Project Manager	5	0	2	0	7	19.44%
	Business Analyst	1	1	0	0	2	5.6%
	System Architect	0	5	0	0	5	13.9%
	Database Designer	5	1	0	0	6	16.7%
	Code Developer	5	3	0	0	8	22.2%
	Software Quality Assurance	0	3	0	0	3	8.33%
	Software System Implementer	1	2	0	0	3	8.33%
	Other	0	2	0	0	2	5.6%
Total		17	17	2	0	36	100%
Total In Percent		47.22 %	47.22 %	5.6%			

The above table shows that 47.22 % of the respondents have 1 up to 5 years of work experience in the software industry. Similarly the employees with 6 to 10 years of experience of the respondents comprises 47.22% present of study. The remaining 5.6% of the study covered by respondents with an experience of 11upto 15 years. This shows that most of the employees engaged in the software development were young who have less than 10 years work experience.

Among the participants the code developer and the project managers cover the higher number of participants which covers 22.2 % and 19.44% respectively.

Graphically the number of participants and their job title can be depicted as the following chart (figure 2).

Figure 2: Graphical Representation of the Job Title of the Participants



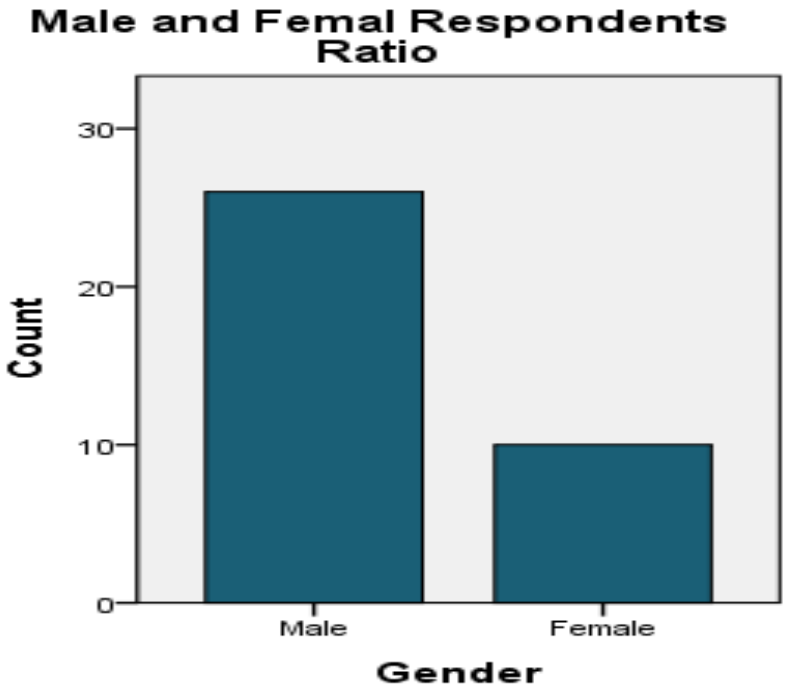
It is also important to watch the result of the survey focusing on the gender of the participants. The following table, table 2, shows the study result based on educational level and work experience in addition to the gender of the participants.

Table 2: Gender and Educational Distribution of the Participants

				Educational Level		Total Participants	Participants in Percent
				Degree	Masters		
Gender	Male	Experience	1-5	11	0	26	72.2%
			6-10	8	5		
			11-15	2	0		
	Female	Experience	1-5	4	2	10	27.8%
			6-10	3	1		
Total				**28**	**8**	**36**	**100%**

Graphically the male and female ratio of participants is also presented as the following figure.

Figure 3: Gender Representation Ratio



The above table, table 2, and the above figure, figure 3, shows the number of male and female participants. Both the table and the figure indicates from the questionnaire respondents 26 (72. 2%) are males and 10 (27.8%) are females. The number of males is slightly greater than the number of females. However, the difference in number does not affect the reliability of the study.

An organization, International Girls in ICT Day (Shek, 2019), which aims to encourage and empower girls and young women in the growing field of information and communication technology,enabling both girls and technology companies to reap the benefits of greater female participation in the ICT sector shows that the number of girls in technology companies is lower than the number of male workers.

The work experience distribution show that 11 (30.56%) male respondents and 6(16.67%) female respondents have working experiences of 1-5 years. 13(36.11%) males and 4(11.11%) female respondents were with working experiences of 6 up to 10 years.

Similarly 2 (5.56%) males have working experiences of more than 10 years. From the table we can understand that more than 50% of the respondents have experiences of 6 and above years. From this we can conclude that the respondents are well experienced in working with the technology for number of years which help them to understand the whole questions concerning the software development project processes and can provide relevant answers to the questions.

4.3 Data analysis

All the questions are attached in the appendix part. There are 38 questions as stated in chapter three and attached in the appendix. The likert scale solution of these questions is presented as the following table (table 3).

Table 3: Total Questionnaire 5 Likert Scale Responses

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Planning					
Incomplete feasibility study of the project	0.0%	27.8%	13.9%	50.0%	8.3%
Unrealistic project scope	11.1%	16.7%	19.4%	41.7%	11.1%
Unrealistic cost estimation	5.6%	5.6%	27.8%	55.6%	5.6%
Unrealistic time estimation	5.6%	11.1%	19.4%	38.9%	25.0%
Requirement Analysis					
Lack of client support	0.0%	13.9%	16.7%	61.1%	8.3%
Unclear requirement	0.0%	16.7%	5.6%	61.1%	16.7%
Lack of user awareness	0.0%	8.3%	13.9%	55.6%	22.2%
Unstable user requirement	0.0%	0.0%	8.3%	44.4%	47.2%
System Design					
Missed system features	0.0%	52.8%	11.1%	33.3%	2.8%
Improper application design	0.0%	25.0%	30.6%	38.9%	5.6%
Unprofessional database design	0.0%	58.3%	19.4%	13.9%	8.3%
Missed product output consideration	0.0%	33.3%	30.6%	36.1%	0.0%
Unclear business process	5.6%	13.9%	27.8%	41.7%	11.1%
System Development / Coding					
Lack of experience	0.0%	36.1%	16.7%	44.4%	2.8%
Limited senior staff support	0.0%	27.8%	19.4%	50.0%	2.8%
Undefined process performance benchmarks	0.0%	16.7%	22.2%	58.3%	2.8%
Testing					
Undefined testing policy	0.0%	30.6%	5.6%	47.2%	16.7%
Lack of test plan	2.8%	36.1%	27.8%	16.7%	16.7%

Lack of testing environment	5.6%	27.8%	33.3%	22.2%	11.1%
Absence of test cases	2.8%	36.1%	33.3%	13.9%	13.9%
Deployment					
Improper installation of products	8.3%	41.7%	27.8%	16.7%	5.6%
Lack of user readiness	0.0%	16.7%	19.4%	33.3%	30.6%
Insufficient production environment facilities	5.6%	22.2%	8.3%	47.2%	16.7%
Operation and Maintenance					
Insufficient training	0.0%	36.1%	16.7%	30.6%	16.7%
Poor user capability	0.0%	25.0%	13.9%	44.4%	16.7%
Additional features expectation	0.0%	13.9%	11.1%	52.8%	22.2%
General Manage					
Unexperienced project manager	13.9%	13.9%	27.8%	41.7%	2.8%
Insufficient project team allocation for each project development phases	5.6%	13.9%	2.8%	61.1%	16.7%
Undefined Roles and Responsibilities	0.0%	33.3%	0.0%	41.7%	25.0%
Poor change management handling	0.0%	16.7%	11.1%	41.7%	30.6%
Improper risk management	0.0%	25.0%	19.4%	36.1%	19.4%
Undefined communication channels	0.0%	30.6%	8.3%	38.9%	22.2%
Lack of stakeholders commitment	0.0%	19.4%	8.3%	47.2%	25.0%
Lack of Senior management support	11.1%	22.2%	16.7%	33.3%	16.7%
Unsuitable working environment	0.0%	25.0%	16.7%	38.9%	19.4%
Delay of document approval	0.0%	16.7%	25.0%	33.3%	25.0%
Methodology Selection					
Lack of suitable project management methodology	5.6%	41.7%	25.0%	25.0%	2.8%

Lack of experience to use selected project management methodology	5.6%	36.1%	22.2%	36.1%	0.0%

The questionnaire is grouped on the seven software development life cycle and two other categories, namely, general management and methodology selection categories. The questions were targeted to the software developers and the software development project management bodies of information network security agency.

The level of agreement or disagreement on the challenges of software development projects is organized under project planning, requirement analysis, system design, development, testing, deployment, operation and maintenance, management and methodology related questions.

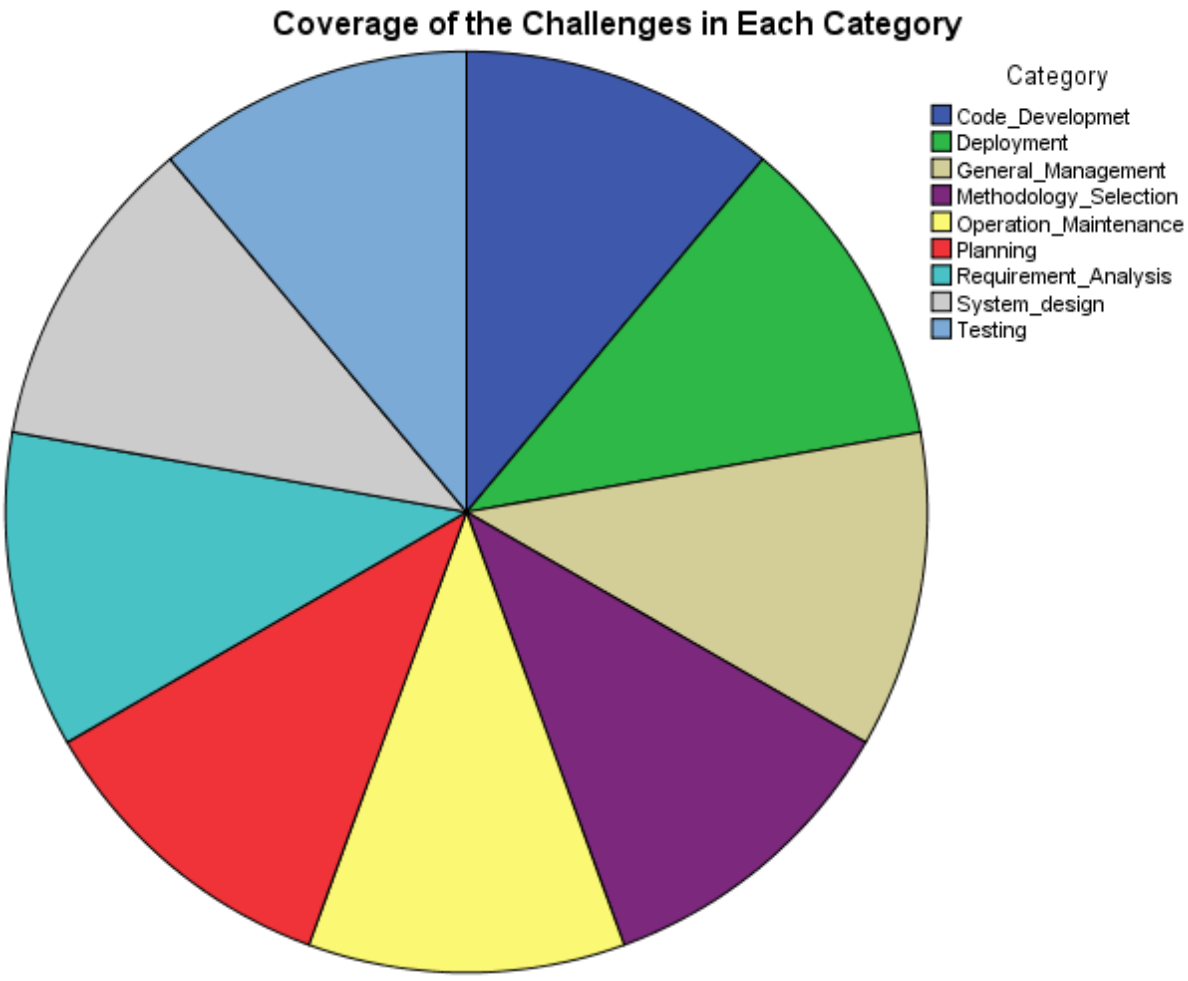
While discussing the challenges of software development projects it is necessary to clearly see the challenges that happened at every phase of the software development project. That is if we are able to identify the challenges occurred in each phase of the project, it will be easy to propose possible solution for each of the challenges of that phase. According to the study, the finding of each phase is depicted in the following table (table5).

Table 4: Challenges based on Category

Categories	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Planning Challenges	8	22	29	67	18
Requirement Analysis Challenges	0	14	16	80	34
System Design Challenges	2	66	43	59	10
Development/Coding Challenges	0	29	21	55	3
Testing Challenges	4	47	36	36	21
Deployment Challenges	5	29	20	35	19
Operation and Maintenance Challenges	0	27	15	46	20
General Management Challenges	11	78	49	149	73
Methodology Selection Challenges	4	28	17	22	1

As shown in the above table (Table 4), the software development project challenges were mainly occur due to the challenges in the general management and in the requirement analysis phase of the software development processes. On contrary, as indicated in table 4, methodology selection and deployment phases of the software development project phases were less challenging in case of information network security agency.

Figure 4: Coverage of challenges based on Category



The detail analysis of the challenges in each phase is discussed below.

Planning Challenges

As we can see in the table below (table 6) it presents the responses particularly given to the challenges in the planning phase. So that the result indicates 5.56% respondents completely disagree with the challenges in this phase. 15.28% of the respondents disagree with the challenges. Thus 20.84% of the respondents disagree with the challenges in the planning phase which is the sum of the strongly disagree and disagree responses. 20.14% of the respondents neither agree nor disagree that is they preferred to be abstain. 46.53% of the responses show that there is a challenge in the planning phase and 12.5% of the responses also show there was high challenges in the project planning phase. To sum up 59.03 % of the responses show there is a challenge in the planning phase. Which means the software developers agree as there is a challenge during planning phase of software development project.

Table 5: Planning Challenges

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Planning responses	0	10	5	18	3
	4	6	7	15	4
	2	2	10	20	2
	2	4	7	14	9
Total	8	22	29	67	18
In Percent	5.56%	15.28%	20.14%	46.53%	12.5%
Total Responses					144

Requirement Analysis Challenges

The goal of this section is to explore the requirement collecting techniques and factors that are used to elicit the requirement from client organizations. As discussed above customer specific projects are developed based on the requirements collected from the clients.

Questionnaires were prepared and asked to the software development team of INSA whether the organization faces challenges on the requirement analysis process. The survey result of the respondents is shown as the following table (table 7)

Table 6: Requirement Analysis Challenges

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Requirement Responses	0	5	6	22	3
	0	6	2	22	6
	0	3	5	20	8
	0	0	3	16	17
Total	0	14	16	80	34
In percent	0	9.7%	11.1%	55.62%	23.6%
Total Response					144

As the table above demonstrations 9.7% of the respondents disagree with the requirement challenge related questions. 11.1% are unsure regarding the occurrence of the challenges. On the other hand above 50% of the respondents which is 55.62% of the respondents agree as there are challenges in the requirement analysis phase of the software development. In addition 23.6% of the gathered responses under the requirement analysis strongly agree as there are challenges in the requirement gathering.

To generalize, 79.22% which is a higher percentage of the respondents indicate that there is a challenge in the requirement analysis phase of the software development projects.

System Design Challenges

The system design phase which mainly includes the application design and the database design is one of the software development project phase. The application as well as the database designs

performed based on the requirements gathered. According to INSA respondents the obtained result of the research is organized as the below table (table 8).

Table 7: System Design Challenges

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Design Responses System	0	19	4	12	1
	0	9	11	14	2
	0	21	7	5	3
	0	12	11	13	0
	2	5	10	15	4
Total	2	66	43	59	10
In Percent	1.11%	36.67%	23.89%	32.78%	5.56%
Total Responses	180				

The study result shows only 1.11% of the respondent strongly disagree with the system design challenge related questions. Out of the total 36.67% of the respondents disagree with the challenges of this phase related questions. 23.89% of the respondents neither agree nor disagree with the questions of the challenges. From the respondents 32.78% of the responses agree with the challenges happening and 5.56% of the respondents strongly agree with the possibility of the challenges. As the study shows the designing phase is not challenging. Less than 50% which is 38.34 agrees with the challenges on the system design phase of the software development life cycle. This is because system design is based on the requirement which is highly dependent on the quality of the requirement document.

Code Development Challenges

As I have understood from the survey, information Network security agency has developed many software development projects for many companies when seeking custom software to drive growth and solve their business challenges. It is known that the actual process of developing custom software can become a significant challenge in itself. It is highly important to understand the

roadblocks that can arise during software code development as well as potential ways to overcome these roadblocks.

The following table depicts the challenges occurred during code development of INSA software development projects.

Table 8: Development Challenges

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Development Responses	0	13	6	16	1
	0	10	7	18	1
	0	6	8	21	1
Total	0	29	21	55	3
In percent	0%	26.85%	19.44%	50.93%	2.78%
Total Respondents					108

The results obtained during the survey indicates that 26.85% of the respondent indicates that they disagree with obstacle during coding. Among the respondents 19.44% were neither agree nor disagree with the challenges. The majority of the respondents 50.93% of the responses agreed with the challenges during coding. And 2.78% of the respondents were also strongly agree with the possible challenges during the software code development phase of the software development life cycle, software development process.

Testing Challenges

This is the system quality investigation phase. The questionnaire of this phase is prepared with the aimed of understanding the quality assurance challenges in the software development of INSA. To accomplish, certain questions were asked to identify the possible challenges that are occurred during the software development process. The following table reveals obtained during the survey particularly in the testing phase.

Table 9: Testing Challenges

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Testing Responses	0	11	2	17	6
	1	13	10	6	6
	2	10	12	8	4
	1	13	12	5	5
Total	4	47	36	36	21
In Percent	2.78%	32.64%	25%	25%	14.58%
Total Participants					144

As indicated in the above table 2.78% of the respondents completely disagree with challenges in the testing phase of the software development project process. 32.64% of the respondents were not convenient with the possible obstacles of the phase. From the respondents 25% of them were abstain. Similar to the neutral respondents, 25% respondents agree as there is challenges in the testing phase. 14.58% of the respondents are highly agree with the possible challenges of testing phase of the software development project process. From the result obtained it is slightly difficult to conclude as there is high challenge in the testing phase of the software development process of INSA. This is almost similar number of respondent were in both agree and disagree sides. 35.42% were in the disagree side and 39.58% were in the agree side.

Deployment Challenges

The questionnaire of this phase is to access the challenges occurred during the movement of the software products from its development environment into the production area. According to the respondents of INSA software development project team members, the result of the questionnaire regarding to the challenges occurred during deployment phase is depicted as the following table (table 11).

Table 10: Deployment Challenges

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Deployment Responses	3	15	10	6	2
	0	6	7	12	11
	2	8	3	17	6
Total	5	29	20	35	19
In Percent	4.63%	26.85%	18.52%	32.41%	17.59%
Total Participant					108

From the survey 4.63% of the respondents were strongly disagree with the occurrence of the challenges. 26.85% of the respondents were also disagree with the challenges. 18.52% respondents of the survey were neither agree nor disagree with the challenges under deployment phase. The highest number of the respondents which is 32.41% of the respondents of the study approve the occurrence of the challenges. 17.59% respondents were also completely agree with the occurrence of the challenges. To sum up, 31.48% of the respondents disagree with the occurrence of the challenges and 50% of the respondents agree as there were challenges during the deployment phase of the software development process. Thus, there was a challenge in the deployment phase of the software development life cycle.

Operation and maintenance

The questionnaire of this phase is to investigate the challenges on planning for software product movement, executing the product, operating production software, monitoring system performance, making defect repairs and tuning a releases of the software system. Aiming on this the questionnaire were submitted to INSA software development members and the result were gathered. Accordingly the result of the survey is organized as the following table (table 12)

Table 11: Operation and maintenance

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Operation and maintenance Responses	0	13	6	11	6
	0	9	5	16	6
	0	5	4	19	8
Total	0	27	15	46	20
In Percent		25%	13.89%	42.59%	18.52%
Total Responses					108

As indicated in the above table 25% of the respondents disagree with the occurrence of the challenges. 13.89% of the respondents are neither agree nor disagree. The highest number of the respondents which is 42.59% of the respondents agreed on the occurrence of the challenges. Similarly 18.52% of the respondents strongly agreed on the occurrence of the challenges. So that the study result shows 61.11% of the respondents believe that there are a challenge in the deployment phase of the software development process of INSA.

Management Challenges

In this study phase management includes project manager selection, project team allocation, Roles and Responsibilities, change management and others as defined in the appendix part.

This part mainly covers questions which are not directly related with the software development phases are included. The survey result of the study is organized as the following table (table 13).

Table 12: Management Challenges

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Management Responses	5	5	10	15	1
	2	5	1	22	6
	0	12	0	15	9
	0	6	4	15	11
	0	9	7	13	7
	0	11	3	14	8
	0	7	3	17	9
	4	8	6	12	6
	0	9	6	14	7
	0	6	9	12	9
Total	11	78	49	149	73
In Percent	3.06%	21.67%	13.61%	69.17%	20.28%
Total Responses					360

As shown in the above table 3.06% of the respondents strongly disagree with the questions under this part. 21.67% of the respondents disagree with the challenges included in this category. However, a high number of the respondents which is 69.17% of them agreed with the occurrence of the challenges. In addition 20.28% of the respondents strongly approve that there are challenges. To sum up a huge number of respondents that covers 89.45% of the responses show that there is a challenge in the management process of the software development projects.

Methodology Selection challenges

The questionnaires of software development methodology selection are prepared to access the rules and guidelines that were used in the process of planning, designing, developing, testing, setup and maintaining of the software products during the development process. Accordingly the result of the survey is presented as the following table (table 13).

Table 13: Methodology Selection challenges

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Methodology Responses	2	15	9	9	1
	2	13	8	13	0
Total	4	28	17	22	1
In Percent	5.56%	38.89%	23.61%	30.56%	1.39%
Total Responses					72

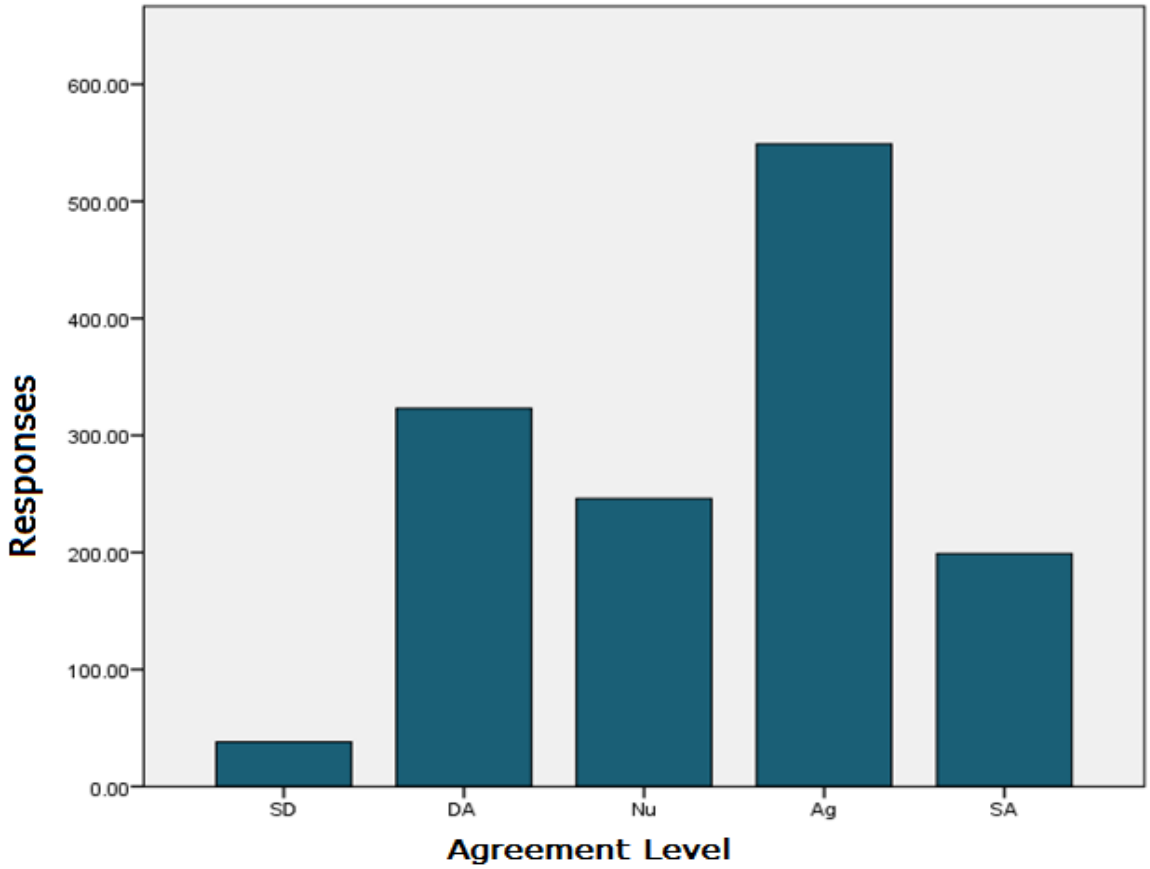
The obtained result shows that 5.56% strongly disagree. The highest number of the respondents which is 38.89% disagree with the challenges in methodology selection. 23.61% of the respondents neither agree nor disagree with the challenges of methodology selection. However, there were also high number of respondent which is 30.56% who believe as improper methodology selection was also a challenge. Although they are small in number there which is 1.39% of the respondent were strongly believe challenges occurred because of the methodology selection. To sum up most respondents that cover 44.45% believe as methodology selection was not a real challenge.

4.4 Discussions on the findings of Software Development Project Challenges

From the researcher's point of view, even though the manifestation and nature of the challenges vary from development project phase to other phase there is visible challenge in every phase of the development process.

The following figure (figure 5) indicates the overall result of the challenges given by the respondents of information network security agency of the whole software development project phases. As the figure indicates, the agreement level shows the highest result. That is most of the responses of the questionnaires given by the respondents indicates as there is a visible challenge during the software development projects as a whole.

Figure 5: Overall Agreement scale



From the above graph SD stands for strongly disagree, DA stands for disagree, Nu stands for neutral, Ag stand for agree and SA strongly agree.

As the researcher observes from both the questionnaire and the interview questions, the challenges in the planning phase were mainly because of the experience of the planners. Most of the employees engaged in planning were not professionals of the work ethics. Representatives of all the project stakeholders do not involve in the planning process and miss some resources necessary for the development process. The higher management also needs projects to be finalized in short period of time without considering the difficulty of the project tasks. This leads to a wrong cost and time estimations.

As the researcher understands from the survey, unprofessionalism of data collectors misses some basic business requirements and they collect the needs without thinking on how to change these requirements in to a software system. The data collection approach and methodology selection

was not in a way that enables to get full requirements because of the unfriendly and misbehaved approach of the data collectors. According to the study result almost in all projects there were a requirement mismatch.

Like in the requirement analysis there was problems in both database and application designs mainly due to missing system features in the design and incapacity of the professionals were also a challenge to prepare decomposed detail system designs.

One of the main phase that the research focused was the challenge in the code development phase. The challenges occurred during the code development phase was mainly due to incompetent professionals and the factors caused by limited support of senior experts. As the researcher understands, weak code documentation that describes the code structure was also a challenge in the code development phase. The lack of code documentation leads no to understand the code easily.

The limitations on the testing policy, lack of testing professionals and testing environment was also became a challenge to produce quality software development projects.

During the deployment phase, the commonly raised challenges were due to lack of configuration plan approved by both the software developing company (INSA) and the client organizations, and dissimilarity of the development environment and production environment of the product released were the main challenges.

These above described reasons indicates as there was a challenge in the software development process of INSA.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

As outlined in chapter one, the primary objective of this research is to access the software development project challenges, to examine why software development project challenges occur and finally to provide recommendations on how to cope with the software development project challenges. This chapter pursues to place the findings from chapter four in to the context of the aim and objectives, which represent the original motivation of the study.

5.2 Summary of major findings

The number of respondents in the survey was enough to the authors to make any sort of verdict using the data. There were a total of 44 questions composed of interview questions and completed questionnaires. Of these, 38 where Likert questionnaires and 6 (six) of the total questions were interview questions.

According the study result, the main challenges of software development projects at information Network Security Agency can be listed as follows

- During the requirement analysis the complete requirement were not collected
- The scope of the projects were not clearly defined and documented
- The cost estimation were not properly estimated by professionals
- The time estimated for the overall software project development were not accurate
- Many customers change their requirements at the middle of the development process
- Many systems designed with incomplete features
- Higher level professionals were not in a way that can help to the junior professionals
- There were no readily available test plan
- There were no readily available testing environment
- Enough training were not given both to the project team members of the phases and to the released product users
- The project managers were not professionally assigned

- There were confusion on the roles and responsibilities of the project team members
- There were no clear communication channel among the team members
- Even though there were project management methodologies, enough training were no given on how to use.

5.3 Recommendations

So as to solve the problems that hinder effective software development projects at information network security agency, the following recommendations are suggested in the view of the research finding.

1. The organization should give more time for project plan preparation. All stakeholders should be invited and approved the projects plan. In addition the project planning should consider the availability of the required resources and it should also be consulted with professionals with planning related competence. It is better to be more realistic and sufficient backup time should also be allocated.
2. The company should give sufficient time while gathering requirements. This is because in many of the projects there were high requirement changes and missing system features. Such cases became a reason to additional cost and time. The individual involved in requirement gathering should be equipped with customer handling knowledge and skill.
3. The organization should assign professionals architects/designers who can prepare standard system designs based on the requirements collected and elicited. Every small element of the requirement should be included in the design of software development projects.
4. Senior professionals should be in a position to assist the code developers. This is because many of the developers waste their time goggling solutions from the internet. In addition, due to lack of the senior staff support, systems developed with less quality. Software code documentation should also be taken as a culture of the organization. This is because the documentation will help for editing and makes easy to understand by other developers.
5. When the organization applied new technology, the researches highly advises to provide necessary training and upgrade skills so that the employees can perform their task without

difficulty. In addition, the developed software projects should be deployed at the customer site without affecting the day to day activities of the customer.

6. The organization should use an automated test cases and testing tools, and a testing environment different from the development environment should also be prepared. This is mainly because of many systems run successfully due to the plugins and add-ons found in the development environment but they fail when they moved to the production environment.
7. There should be a smooth and known communication channel between the stake holders so as to get and submit any required information. There should not be a gap of awareness between team members assigned the same role and responsibilities.
8. There should be a well-defined roles and responsibilities between the team members. Undefined roles and responsibilities tend to duplication of activities and causes missing of critical features of the system.
9. As the researcher observed, even if there are organized documents about development policies and user manual of software development methodologies, the developers are not aware of their existence. Hence, in order to easily access such documents, they should be available in the library and a training should be given to the project team members during initiation/startup of their project work.
10. At last but not least, the agency should prepare a platform to communicate with the client organizations. This will create a smooth information flow and enable to tackle the challenges at early stage

References

Academy, P. (2018, March 13). *Project Management Resources*. Retrieved from Project Management Resources: https://www.paymoapp.com

Akbar, R. a. (2011). *The Client as a Real Option in Successful Software*. Retrieved from IEEE: www.ieee.org

Asiegbu, B. a. (2011). Software cost drivers and cost estimation in Nigeria. *Interdicsiplinary journal of* .

AXELOS. (2015). *AXELOS GLOBAL*. Retrieved from AXELOS GLOBAL: https://www.axelos.com

Bochmann, G. v. (2009). *Requirements Elicitation Techniques.* Ottawa: University of Ottawa.

Brooks, F. J. (2010). *Essence and Accidents of Soft-ware Engineering.*

Cerpa, N. &. (2009). Why did your project fail. *Communications of the ACM*, 130-134.

Chow, T. a. (2008). A survey Study of critical success factors in agile software projects. *the Journal of systems and*.

Demir, K. A. (2009). A Survey on Challenges of Software Project Management. *Research Gate.* Naval Research Center.

IBM-Research. (2014, July 1). *IBM*. Retrieved from IBN: https://www.ibm.com

ISO/IEC. (2010). *Systems and Software Engineer-ing -System Life Cycle Processes.* Geneva: ISO/IEC.

Jackson, D. (2013). *Massachusetts Institute of Technology*. Retrieved from Massachusetts Institute of Technology: https://ocw.mit.edu

Kwak, Y. H. (2002). Critical Success Factors in International Development Project Management. *The George Washington University*.

Liviu, M. (2014). Comparative study on software development methodologies. *Database Systems Journal*, 2-2.

Liviu, M. (2014). Comparative study on software development methodologies. *Database Systems Journal*.

Maylor, H. (2010). PROJECT Management. In H. Maylor, *PROJECT Management.* London .

Missker, A. (2018). Assessment of the Practice and Challenges of Information Technology Project . *Addis Ababa University* , 7-45.

Murch, R. (2001). *Project management.* Upper Saddle River, New Jersey: Prentice Hall.

NaharG, N. (2010). *Managing Requirement Elicitation Issues Using Step-Wise Refinement Model.* Chennai: MOP Vaishnav College for Women.

Peterson. (2000). *Software's Origin.* IBM.

PMI. (2013). project management body of language. In *Projet Management* (pp. 10-15). Newtown: Project Management Institute.

Rouse, M. (2007). *Requirement Analysis* . Retrieved from Tech Target .

Ruiz-Bertol, F. J. (2018). Management Challenges in Software Projects: Improving Software Project. Researcg Gate.

Ruparelia, N. (2010). Software Development Life Cycle Models. *Research Gates* .

Sahibuddin, B. S. (2009). Requirements Engineering Problems and Practices in Software Companies. *Science Jornal*, 70 - 73.

Saunders, M. (2009). Research methods for business students (5th ed.). *Rotolito Lombarda: Pearson Education Limited.*

Schwalbe, K. (2010). *Information technology project management.* Boston: Cengage Learning.

Shek, S. (2019). *Girls in ICT*. Retrieved from Girls in ICT: https://www.itu.int/en

Siles, R. (2018). *project management for development organizations.*

Teleo. (2018). *Benefits of Centeral Repository* . Retrieved from Telio : telioinc.com

TOLEDO, M. (2016, Jully 25). Retrieved from Mettler toledo: https://www.mt.com

Tongco, M. D. (2012). Purposive Sampling as a Tool for Informant Selection. *ethnobotanyjourna*.

University, V. (2019). *The Challenges of Development Projects.*

Watson. (1990). *My Life at IBM and Beyond.* New York: Bantam Books.

Wessinger, K.-H. (2012). Identifying powerful project stakeholders using workflow. In K.-H. Wessinger, *Identifying powerful project stakeholders using workflow, .*

Wong, A. a. (2010). *critical failure factors in ERP implementation.*

Wysocki. (2014). Effective Project Management, Traditional, Agile, Extreme, 7th ED. In Wysocki, *Effective Project Management, Traditional, Agile, Extreme, 7.*

Annexes

Appendix I

ADDIA ABABA UNIVERSITY

SCHOOL OF COMMERCE DEPARTMENT OF PROJECT MANAGEMENT

Dear Participants,

I am Reda Weldebrhan a student of Addis Ababa University, School of Commerce project management department, conducting a research project for Master of Arts in project management (MAPM) on the **challenges of software development projects in case of Information Network Security Agency (INSA)**.

For successful accomplishment of the research paper I need your assistance. The survey will take about 20 minutes of your time. The information gathered is anonymous and will remain strictly confidential. It will be used only to advance knowledge and for the dissemination of the overall results at academic or professional forums. Only the researchers will have access to the data collected. Completing this questionnaire will be considered as your consent to participate in our research project and permission to use the data collected from this questionnaire in future research.

Thank you in advance for taking your precious time to fill out the questions.

Section I: Respondents Profile

1. What is your job title? Please tick (√) on the box followed your title.

Project Manager ☐ Business Analyst ☐ System Architect ☐

Project Team Leader ☐ Database Designer ☐ Software Code Developer ☐

Software Quality Assurance ☐ Software System Implementer ☐

Other ☐

2. How Many Years do you work at INSA? Please tick (√) on the box followed the years

1 – 5 years ☐ 6 – 10 years ☐ 11 – 15 years ☐ 16 – 20 years ☐

3. What is your gender?

Male ☐ Female ☐

4. What is your age? Please tick (√) on the box followed your age.

21 – 30 ☐ 31 – 40 ☐

41 – 50 ☐ Over 50 ☐

5. What is your Education Level? Please tick (√) on the box followed your educational level.

Diploma ☐ Bachelor degree ☐ Master ☐ PHD ☐

Appendix II

Section 2: Software development project challenges

Instructions: Refereeing to projects you participated, please answer the following questions. Indicate your level of agreement or disagreement with each of these statements or questions sing the given scale by placing tick **(√)** in the provided space. Please answer all the questions to enhance the objectivity of the research.

No	DESCRIPTION OF CHALLENGES	SCALE				
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	Planning					
1.	Incomplete feasibility study of the project					
2.	Unrealistic project scope					
3.	Unrealistic cost estimation					
4.	Unrealistic time estimation					
	Requirement Analysis					
5.	Lack of client support					
6.	Unclear requirement					
7.	Lack of user awareness					
8.	Unstable user requirement					

	System Design					
9.	Missed system features					
10.	Improper application design					
11.	Unprofessional database design					
12.	Missed product output consideration					
13.	Unclear business process					
	Development					
14.	Lack of experience					
15.	Limited senior staff support					
16.	Undefined process performance benchmarks					
	Testing					
17.	Undefined testing policy					
18.	Lack of test plan					
19.	Lack of testing environment					
20.	Absence of test cases					
	Deployment					

21.	Improper installation of products					
22.	Lack of user readiness					
23.	Insufficient production environment facilities					
	Operation and maintenance					
24.	Insufficient training					
25.	Poor user capability					
26.	Additional features expectation					
	Management					
27.	Unexperienced project manager					
28.	Insufficient project team allocation for each project development phases					
29.	Undefined Roles and Responsibilities					
30.	Poor change management handling					
31.	Improper risk management					
32.	Undefined communication channels					

33.	Lack of stakeholders commitment					
34.	Lack of Senior management support					
35.	Unsuitable working environment					
36.	Delay of document approval					
	Methodology Selection					
37.	Lack of suitable project management methodology					
38.	Lack of experience to use selected project management methodology					

Appendix III

Section 3: Interview Questions

Interview guide for Project Managers and Project Team Heads

Dear Interviewee,

First of all I would like to thank you for your willingness to respond my questions. My name is Reda Weldebrhan, I am a Masters of Art student in Project Management at Addis Ababa University School of Commerce. As part of my MA project work, I am studying **Challenges of Software Development Projects: In The case of Information Network Security Agency** for my study. This interview is made so as to have more in depth on the matter understudy. Thus, I kindly request you to answer all the questions assuring you that all responses will be used only as an input for this study.

1. What do you think are the main challenges occurred during collecting and eliciting software development project requirements?

2. What are the main challenges to prepare accurate software development project plan?

3. Could you elaborate the basic software development project design challenges?

4. What are the obstacles to develop software projects using standard software development code?

5. What are the basic challenges faced during software development quality assurance?

6. What are the basic challenges occurred during software system deployment and configuration?