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An Enterprise Resource Planning (ERP) Framework Design for Adama Hospital Medical College (AHMC)

By

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June, 2017

Adama, Ethiopia

Adama Science and Technology University
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An Enterprise Resource Planning (ERP) Framework Design for Adama Hospital Medical College (AHMC)

A Thesis Submitted to the School of Graduate Studies of Adama Science and Technology University for Partial Fulfillment of the Requirements for the Degree of Master of Science in Information System

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ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF COMPUTING

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Declaration

I hereby declare that the content of "An Enterprise Resource Planning (ERP) Framework Design for Adama Hospital Medical College (AHMC)" is my original work and has not previously been submitted as a partial requirement for a degree of master in any other university and all sources of materials used for the thesis have been acknowledged.

Mohammedaman Tukie _____ _____

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June, 2017

The thesis has been submitted for examination with my approval as university advisor.

Advisor: Mesfin Abebe (PhD) _____ _____

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Dedication

I would like to dedicate this thesis to my father late Tukie Guye, who taught and supported me in all my endeavors. I also dedicate this thesis to my many friends and staffs who have supported me throughout my study.

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Acknowledgment

In the course of this Thesis, I have received valuable assistance from various professionals and friends. These give me a great pleasure to express my heart-felt gratitude to those people who deserve my acknowledgment.

First and foremost, my deepest gratitude goes to my advisor Dr. Mesfin Abebe whose invaluable advice; critical comments and constructive suggestions were the major factors for the completion of this study. In addition to his unfailing and unreserved commitment and thorough comments, Dr. Mesfin has generously shared his precious materials throughout my writing of the thesis. I believe that this study would have been impossible without his unreserved dedication and encouragement.

My special thanks and limitless appreciation go to my mother Amina Subi and my father Tukie Guye for they put me in the world of education. Therefore, their persistent moral support and encouragement would be remaining engraved in my heart. My brothers and sisters also deserve special attention.

I am also indebted to many of my friends and relatives. Mr. Gobena Hasso, my best friend, deserve special thanks, along with his family, for his unreserved moral and technical support throughout my life in the world of education. My deepest thanks go to w/ro Asheraka Jebo and my daughters Efnan and Filebar for their moral and technical support to this stage. My heartfelt thanks also go to Kadir Filcha, my favorite friend while I was in high school, and who have also been with me, heartedly, throughout my life in the university.

Mr. Tariku Dabela and Ejigu Tefera, my friends, deserves special thanks for their assistance both, in providing me with their professional assistance with software guiding and technical editing this manuscript. Lastly, not the least by any means, I have no words to thank my former boss Amelework W., for her encouragement during undertaking this study.

Acronyms

AGHMC	Adama General Hospital And Medical College
AHMC	Adama Hospital Medical College
APS	Advanced Planning and Scheduling
CSF	Critical Success Factors
CRM	Customer Relationship Management
DSS	Decision Support Systems
EIS	Enterprise Information Systems
ERP	Enterprise Resource Planning
HIS	Health Information System
HR	Human Resource
ICT	Information Communication and Technology
IS	Information Systems
IT	Information Technology
MRP	Material Requirements Planning
OPD	Out Patient Department
SAAS	Software As A Service
SCM	Supply Chain Management
SFA	Sales Force Automation
SOA	Service Oriented Architecture
SQL	Structure Query Language
SCM	Supply Chain Management
SAP	System Application and Products
WHO	World Health Organization

Abstract

In today's competitive business environment, ERP systems are found to be essential for companies to get competitive and strategic advantages. ERP is software that integrates functional units across an organization into one computer system. Thus, each functional unit across of the hospital shares a common centralized database, which enables the flow of information in the hospital to be faster and, reliable.

According to this thesis, to develop ERP system for Adama Hospital Medical College (AHMC) the researcher studied the existing system on Patient Care Management Department, Accounting-Finance Department, Human Resource Department and Pharmacy Department. The methodology used in this research was the techniques used for analysis and design of Hospital ERP design in this paper was Odoo 10.0 open source ERP software, PostgreSQL 9.5, and. Microsoft Visio 2013 was the tool used for the analysis and design of this system.

Hence, the research describes ERP framework design for Adama Hospital Medical College and also used Odoo software to design the hospital functional units into a single database server. Finally, the researcher has designed a framework that is appropriate for the Hospital ERP system and integrated the hospital modules.

Keywords: Enterprise Resource Planning, ERP design system, odoo, open source ERP, ERP, Hospital, Data collection.

CHAPTER ONE

INTRODUCTION

This chapter presents an overview of research, discussion of the background of the research area, problems of the study, research questions, the objective, scope, limitations, and methodology of the study.

The advancement in communication technology and computers has revolutionized the field of Information Systems (IS) and Information Technology (IT). Over the time, many new terminologies emerged and some of them became magic words, popularly known as fads. Enterprise Resource Planning (ERP) Systems, a term used for highly integrated information systems in business organizations has become popular in the last decade. There are many challenges of business, which are the main driving reasons for adaption of ERP systems. In order to survive and grow in today's cut-throat competitive environment, an organization should take fast as well as the right decisions. If an organization fails to take quick decisions, it may lose its business to its competitors. Today, in this age of information, large voluminous information is available, which needs to be processed in an integrated manner so that organizations are able to take the right decision. If an organization fails to implement the process, it may cost them a fortune [1].

Thus, an organization must be equipped with some tool or a system, which integrates various functional areas across the entire organization and can provide information, support, thereby, enabling it to take operational as well as strategic decisions. Enterprise Resource Planning System is one of such computer-based integrated information system that supports an organization in its operations and enables it to take enterprise wide and strategic decisions. Owing to this, today, ERP system is considered to be of great importance and sometimes regarded as the backbone of an organization as well. Such a system, in an organization, assists the decision-makers by providing information and decision support at various stages of decision-making and thus greatly helps the organization to achieve its, goals, and strategies [1].

1.1. **Background of the Study**

This day, every aspect of business and service sectors heavily rely on information. Without information nothing can be moved and it is believed that information is the source for all activities in this world. A health care system is the organization of people, institutions, and resources to deliver health care services to meet the health needs of target populations [1]. In the case of ICT on health, Ethiopia has a poor health status in relation to other low-income countries, even within Sub-Saharan African countries [2]. Enterprise Resource Planning(ERP) is an industry term for the broad set of activities supported by multi-module application software that helps a manufacturer or other business in order to manage the important parts of its business, including product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, quality management, process management, data management, project management, financial accounting management, enterprise controlling, investment management, plant maintenance, sales and distribution and human resources management [3].

The most serious global health problems are in poorer countries, and good health information system is vital in tackling these problems. Effective ERP systems offer government and health department officials a clearer understanding of the effects of their policies on the health of their people [4].Health information systems in most developing countries like Ethiopia are miserably inadequate to provide the needed information support [5]. This then requires sound management that is based on information, which is crucial at each level of the health service management [6]. Correct and up-to-date information is critical, not only for the provision of high-quality clinical care, but also for continuing health care, maintaining health care at an optimal level, clinical and health service research, and planning and management of health systems [7].

Health information systems refer to any system that captures, stores, manages or transmits information related to the health of individuals or the activities of organizations that work within the health sector. Overall, a well-functioning HIS is an integrated effort to collect, process, report and use health information and knowledge to influence policy and decision making, program action, individual and public health outcomes, and research[8].

Health care sector is characteristic distinction between activities directed at keeping people healthy and activities directed at restoring health once a disease or injury occurs. Keeping people healthy is the domain of the public health care system and the activities associated with

behavioral health. Health care involves activities that work at the population level to keep people healthy: protecting the environment, making sure water supplies and restaurants and food are safe, and providing preventive health services, for example. ERP systems can also be an instrument for transforming functional organizations into process oriented ones. When properly integrated, ERP supports process-oriented businesses effectively [9].

Enterprise resource planning system is attempting to create not only an integrated product that manages the majority of operations in a company but also it is integrating the various processes that are essential to running a business, including: accounting, human resources, inventory and order management,, customer relationship management (CRM) to create single unified system rather than a group of separate, insular applications [10].

Thus, this Research would be focused on designing ERP system for Adama Hospital Medical College (AHMC). It is located in the Oromia Regional State, in Adama town 100km from Addis Ababa to the South East. It was established in 1946 by Italian missionaries. The hospital was named as Haile Mariam Memo memorial hospital little bit after establishment, but its name was changed to Adama Hospital in mean time and now it renamed as Adama Hospital Medical College by Oromia Regional State Health Bureau after it starts to teach accelerated Medicine, Emergency surgery and some Specialty in 2011.ARHMC is one of the hospital that serve large size of population from middle east and southern Oromia, Afar, Somali, Southern Nation, Nationalities and peoples(SNNP) and even some parts of Amhara region. Currently, the college hospital has catchment population of about 5 million serving as Referral Hospital for all nearby hospitals and the adjacent regions. It has capacity of 300 beds for inpatient with five disciplines (Surgery, Internal Medicine, Pediatrics, Gynecology/Obstetrics and ophthalmology) with four pharmacies (OPD, Ward, Emergency and ART pharmacy) and serves about 1000 patients per day at OPD during working hours and on average 52 patients per day after working time in private wing clinic. The hospital has about 465 workers of which 257 were health professionals and the remaining are administrative workers and teachers. The hospital is now working in collaboration with Adama General Hospital and Medical College (AGHMC) who is deliver health care and standard services with technological equipped and international professionals are serving this hospital.

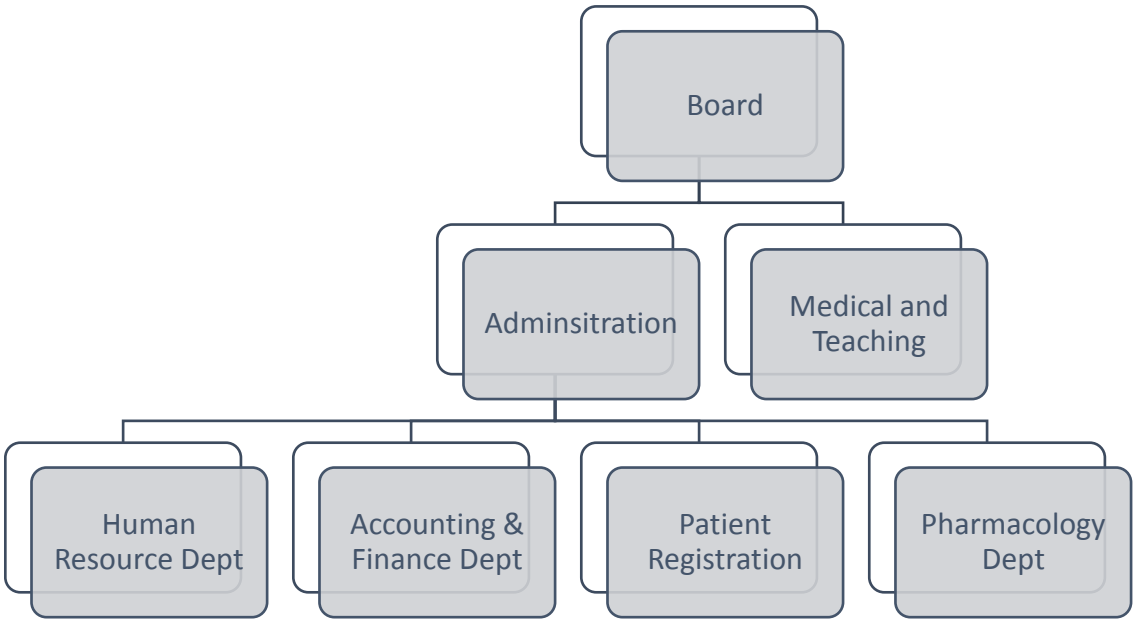

Figure 1: Organizational Structure of AHMC

Based on its mission, currently, Adama hospital provides public health care service and academic teaching service to fill the gap of the profession in the areas of the health services. The hospital organizational structure is the following categories which refer to levels of management categories within a hospital are:

Human Resource Department

The HR management department in the healthcare ERP helps in streamlining and delivering quality service in an effective manner. We specialize in providing right information at the right time to the right person thus enhancing the employee satisfaction. This maintain a complete employee database module including facilitates employee recruiting, hiring, training, payroll and benefits. Contact information, attendance, performance evaluation and promotion of the employs. Some of the benefits of the HR module are: Integrated, scalable HR applications and processes foster a healthy consistent culture, Reduced HR administrative costs, increased employee satisfaction, and enhanced workforce productivity, Single sign-on interface for all modules and self-service features [11].

Accounting and Finance Department

The accounting dept is responsible for recording and reporting the cash flow transactions of a company. It is an end-to-end financial management solution that deals with cash/bank, receipts/payments, journal vouchers and general ledger etc. The accounting feature provides core accounting and reporting capabilities with scalability to support the custom requirements from the clients. The solution integrates accounts payable and receivable applications in super specialty hospitals that have high-volume transaction environments. We have strong expertise in developing ERP systems that comprise a healthy set of applications to support all aspects of financial activities such as: ledger management, financial transactions reports/management, purchase management, sales management, account receivables, account payables, assets management, capital management, cash flow & funds flow management, supports numerous reports such as trail balance, balance sheet, list of accounts, ledger transactions report, departments/sub-division wise report etc. [11]

Patient Care Management Department

The patient registration dept is an integral part of the ERP system, which captures complete and vital patient information. It provides a tough patient administration functions to have better and efficient patient care process with features such as: *Providers* can provide appropriate care, make accurate and responsible care. Individuals shall be afforded impartial access to *treatment* that is available and the activities of nursing unit managers facilitate the provision of quality patient care. Here are some of its modules: practice management, appointment scheduling with physicians with an option to view free and booked slots for the hospital front desk, provision for rescheduling an appointment or cancelling based on the patient requests, telephonic appointments for unregistered patients, patient registration (Inpatient/Outpatient), medical alerts for emergency, patient scheduling (Patient / Doctor Wise), doctor's schedule summary and daily schedule list, patient visit history reports and appointments for radiology tests and operation. The patient registration dept provides an enterprise search feature for operational staff that helps them to search patient encounters by patient name and ID, location, admission date and time and appointment scheduling [11].

Pharmacological Department

Hospital Pharmacy Services are designed to meet the primary needs of all customers. Pharmacy services include dispensing of pharmaceuticals in accordance with country regulations, appropriate inventory maintenance functions, drug monitoring, patient drug assessment functions, appropriate record keeping, drug information, education services, and performance improvement functions. Community pharmacists supply medicines in accordance with a prescription or, when legally permitted, sell them without a prescription. In addition to ensuring an accurate supply of appropriate products, their professional activities also cover counseling of patients at the time of dispensing of prescription and non-prescription drugs, drug information to health professionals, patients and the general public, and participation in health-promotion programs [14].

1.2. Statement of the Problem

While hospital is serving different functional areas, its system deserves a great attention in the health sectors of developing countries like Ethiopia. It is one of health facilities that provide preventive, curative, and rehabilitative services to patients. A hospital comprises of a wide range of services and functional units. These include diagnostic and treatment functions, such as clinical laboratories, imaging, emergency rooms, and surgery; hospitality functions, such as food service and housekeeping; and the fundamental inpatient care or bed-related function. It also provides organizational function such as human resource, accounting and finance. Moreover, it continually looking solution and alternative to improve its services to patients and their health standards.

In the meantime, the study through interviews, reports, and observation indicate the following problems within the Adama Hospital Medical College. Thus, the services are provided within hospital are not effective and efficient as they use manual system and paper based system.

Some of the problems identified are data pertaining to patients are not complete; some patient records files are lost, the current system is time consuming service for customers, lack of security, lack of system prompt updating, functional units are nonintegrated one another. In general, they have problems with data quality and completeness of the patient records, illegible hand writing in records and prescriptions is also another problem.

Currently, as the hospital is using paper based patient information profile and scheduling problems with patients. The other problems in this hospital are duplication of records and medical errors, problems with accuracy of diagnosis and health treatments. Moreover, the

patients and the number of doctors' in the hospitals are not proportional. Besides these, different functional areas of the hospitals are disintegrated each other. The reports generated from each department are manual based. All these workflow among the functional areas led to delay decision making, customer dissatisfaction and data redundancy within the units, wastage of resources, and inefficient processes.

Therefore, to solve the above problems and improve the quality of health delivery and customer satisfaction in the hospital, designing ERP implementation for functional units are help to enhance more effective, efficient and more customer satisfaction with in hospital environment using open source ERP software.

To sum up, there are the following current gaps in the AHMC described here below.

- There is no integration of functional units of each working departments with one another and has no centralized database server to generate statistical reports.
- There are computer based archive to search and access patient history and no ERP system implementation in the hospital.

Research Questions

In order to achieve its objectives, the study attempts to explore and answer the following research questions:

1. What are the information requirements of Adama Hospital Medical Colleges to deliver efficient health services?
2. Which type of modeling would be the best to design an efficient ERP information system for Adama Hospital Medical Colleges?
3. What are the challenges of ERP implementation processes in the Adama Hospital Medical Colleges' functional units?

1.3. Objective of the Study

1.3.1. General Objective

The general objective of this research study is to design and develop a prototype Enterprise Resource Planning (ERP) implementation framework for Adama Hospital Medical College (AHMC).

1.3.2. Specific Objectives

The specific objectives of this research are the following:

- To review related literatures and frameworks on ERP implementation.
- To identify and analyze the information requirements of AHMC.
- To design an ERP Model for the Adama Hospital Medical College (AHMC).
- To implement a prototype ERP system for AHMC functional units.
- To evaluate the designed prototype ERP system.

1.4. Significance of the Study

The purpose of designing and implementation of the ERP system for the Adama Hospital Medical College have the following significances.

- The ERP system may have a better significance for health professionals by solving the problem in making appointment easily.
- As the hospital is to give quality service for patients, patients could be benefited from the system by getting quality service.
- Helps to have complete and quality patients' record and prevent their records from probability of loss.
- Duplication of records and other information would also be avoided.
- Have a benefit for the hospital in giving a better health care service, for adequate budgeting and planning for keeping adequate records.
- It provides diagnosis and service reporting purposes as a source of relevant information.
- It creates efficiencies including cost savings in managing the hospital systems.
- It integrates all functional areas of work that link each departments and units that create the work flow more effective, efficient and satisfaction of customer.

Generally, ERP software has been continuing to grow in the public and private health sectors. Thus, it is important that organizational top managers have information to make intelligent decisions. It is also important that organizational leaders understand the issues with which they could be faced when implementing ERP. This study implements using open source ERP software

that aims to minimize the cost of the hospital at large. Implementing this free ERP software in this hospital open the way to other hospitals and health center in the country.

1.5. Scope of the Study

The scope of this research is limited to study ERP framework and implement prototype ERP for Adama Hospital Medical College even though the results of the study can be extended and applied to other health sectors in the country.

The focus of the study is around the functional areas in the hospital main ERP departments which are fully implemented. These modules are listed as below.

- Finance and Accounting department
- Human Resource department
- Patient care management department
- Pharmacological department

1.6. Limitation of the Study

No one conduct research without some obstacles. The researcher of this paper also faced the following limitations which might reduce the quality of the under taken research. The most challenges the researcher faced were the following:

- Very limited availability and access to documents related to the ERP implementation in the case of health sectors.
- Limited literature and research on ERP in Ethiopian context for reference.
- Time constraint of some interviewees and survey respondents.
- Financial constraint to fully cover all functional units of Adama Hospital Medical College which require ERP services.

1.8. Organization of the Thesis

This research study paper is organized in seven chapters.

The first chapter deals with a general introduction about ERP systems implementation for AHMC; which includes background of the study, statement of the problem, purpose of the study,

objective of the study, research questions, scope and limitation of the study, and significance of the study. The second chapter contains review of literature about ERP, pros and cons, evolution of ERP critical success factors and related works. The third chapter continues with research methodology of the study including data collection tools, development tools, survey analysis, and data modeling. The fourth chapter is the designing and development of framework of ERP system. Fifth chapter the implementation framework using doo open source software. The sixth chapter is discusses about the evaluation of the system framework with the criteria set. Finally, the seventh chapter discusses about the conclusion and recommendation of the study. At the end of the research, there is a reference section followed by appendices.

CHAPTER TWO

REVIEW OF RELATED LITERATURES

2.1. Introduction

In this chapter the researcher also tries to review a number of literatures that have been conducted in the field so far to have deep understanding on the problem. Hence, related literature such as journal articles, books, proceeding papers, manuals, magazines, and some other sources that are retrieved from the internet have been accessed so as to understand its concepts, evolutions, pros and cons, selected open source vendors, and ERP benefits, success and failures that are important for developing enterprise resource planning system and for achieving the research objective in designing its system implementation for Adama Hospital Medical College and its challenges.

2.2. Overview of ERP Systems

According to [12], defined Enterprise Resource Planning (ERP) as 'a computer-based system designed to place companies' major activity areas: planning, production and customer service under an umbrella. ERP system is a "*software package of different modules such as fixed assets management, controlling, financial accounting, manufacturing, human resources, planning and development and so forth. Each module is business process specific*". Generally, companies choose one ready-made package available for their industry but it is also common to select the modules that best meet their needs As stated by [13], Enterprise Resource Planning (ERP) refers to large commercial software packages that promise a seamless integration of information flow throughout an organization by combining various sources of information into single software application and a single database. Application software package is a collection of software programs that have been developed for the purpose of being licensed to third-party organizations. While ERP originated from manufacturing and production planning systems used in the manufacturing industry, ERP expanded its scope in the 1990's to other "back-office" functions such as human resources, finance and production planning. Moreover, in recent years ERP has incorporated other business extensions such as supply chain management and customer relationship management to become more competitive [14].

The Enterprise Resource Planning (ERP) system is an enterprise information system designed to integrate and optimize the business processes and transactions in a corporation. The ERP is an industry-driven concepts and systems, and is universally accepted by the industry as a practical solution to achieve integrated enterprise information systems. A typical way of contributing to a field is by publishing archival journal papers for public benefits [15].

According to [16], ERP comprises of a commercial software package that promises the seamless integration of all the information flowing through the company- financial, accounting, human resources, supply chain and customer information is a method for the effective planning and controlling of all the resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service company. In 1990s, Gartner Group first employed the acronym ERP as an extension of material requirements planning (MRP).

Simply, ERP systems use a single database and control all related information about the business organization including production, funds, purchase, sale, inventory and manpower. The systems are used as a tool to accelerate and automate operations in order and sale process alongside integration with financial and production systems. Moreover, these systems considered as highways for Decision Support Systems (DSS). These systems are designed and installed in such a way that it could be used in many manufacturing and service industries. Vendors of these systems, however, in order to develop the market for their customers and attract new customers, provide products in terms of cost and revenue which in are economically justified for small and medium organizations. [17]

2.3. Components of ERP Systems

The basic components of ERP System are used to integrated computer based information system that comprises the following components.

These components are as follows.

1. People (Users and IT staff)

2. Hardware (servers, peripherals) and Software (Information Systems software, Operating systems and databases)

3. Database (organizational data from within and outside)

4. Model base

5. Processes (Business processes, procedures, and policies)

People: As ERP systems are user machine systems, people are one of the important components of ERP system. Thus, this component includes all the people, may be users, top management and IT personnel and so on.

Hardware and Software: This component represents the computers that include hardware like servers, desktops, peripherals; and software like enterprise resource systems software, operating systems and so on.

Database: This is the repository of an organizational data from within and outside the organization.

Model base: This is the group of various models like mathematical model, arithmetical model, statistical model, financial model, forecasting model, and descriptive model etc., which are essential to process the data into information.

Processes: Include business processes, procedures, and policies of an organization

2.4. Pros and Cons of ERP

While implementing ERP system in any organization the system may have some positive side and drawbacks. Enterprise resource planning software is designed mainly to eliminate the complexity involved in managing the resources pertaining to the company. Though the main motive of ERP software is to increase the productivity and customer satisfaction, it also has some in it. Let's discuss some of the advantages and disadvantages involved in the ERP systems.

2.4.1. Advantages of ERP Systems

Any hospital or health care which doesn't use ERP really finds it difficult to have proper communication with each other functional units. Even though many software applications are available to share the resources efficiently, ERP overtakes every other software with the fact that ERP are centralized service for any kind of information available related to the company.

The advantages of ERP systems are summarized as here below.

- Integrate financial data and information of different working environment.
- Standardize Human Resources information for simple tracking of employees time and benefits data.
- Standardize and speed up diagnosis operating processes
- Reduce inventory and lower costs
- Using ERP helps in making design engineering better. It helps in shaping the products and services better.
- Empower and enable employees, partners, customers and suppliers.
- Cross functional services which need communication between different business units are permitted by this system [19].

Benefits of ERP

The implementation of ERP system in the business or service organization has a numbers of benefits. Among those some of them are discussed as follows.

- Improved decision making capability
- Reduced data transfer time
- Reduced carrying cost of inventory, and reduced workforce and errors
- Processes effective and efficient
- Organizations do not need to reinvent processes
- Built-in process based on industry best practices
- Improved customer satisfaction
- No data inconsistency problem
- Lower costs and higher profitability
- Improved information accuracy

Table 1: ERP System Benefits in different dimensions

Dimensions	*Benefits*
Operational	• Productivity improvement • Cost reduction • Quality improvement • Customer satisfaction • Cycle time reduction
Managerial Improvement	• Better planning • Better decision making • Resource management • Performance management
Strategic Improvement	• Business growth and alliances • Business innovation • Business leadership • Product differentiation • Build external linkages
IT Infrastructure	• Build business flexibility • IT cost reduction • Increased IT capability
Organizational	• Build common vision • Empower employees • Changing work patterns • Facilitate business learning

2.4.2. Disadvantages of ERP Systems

In contrast, ERP systems have some shortcoming and limitations. These systems are usually complex. Regardless of their long-term benefits and reduced maintenance costs, initial one time implementation is too software expensive. And even though data accuracy and integration is achieved by ERP systems, it is hard to correct or modify data once it is maintained in the system as it affects many modules and processes. While ERP systems have more efficient methods, freedom and self-creativity practice with the system is insignificant. One of the common problems which ERP implemented companies now face are the inadequate funding required in providing training for using the ERP. Other than these, some of its disadvantages are discussed here:

- The customizations options available in the ERP software are limited.
- ERP systems are expensive.
- After implementation, migration of the system might become expensive.
- Sensitive information regarding a company can't be shared efficiently with ERP.

Moreover, here listed below are some of ERP systems constraints or challenges to implement.

Cost and Length of Implementation

The cost of implementing of ERP system is too expensive to purchase such software requires more amount of dollars. The implementation time is also too long period of time.

Business Process Re-Engineering and Customization

ERP systems are developed based on industry best practices. If these best-practice solutions in the ERP system do not match the business processes, then organizations are required to reengineer their business processes to fit these best practices. However, changing all processes may lead to a loss of competitive advantage. Strategic processes which give competitive advantage to a company should not be changed. In this case, the ERP system must be customized and configured properly to fit the business processes.

User Interface and Usage

ERP systems can be difficult to use. They are too restrictive and rigid (highly controlling) and do not allow much flexibility in implementation and usage. Moreover, users may have to go through many screens in order to maintain a single data set.

Interoperability and Interface

The system can suffer from the weakest-link problem. Inefficiency in one department or at one of the partners may affect other participants. So, the integrated links need high accuracy in other applications to work effectively.

Responsiveness

ERP systems have low response time to user actions and information requests. Due to the complexity and user interface screens, ERP systems usually take long time to respond to data entry and report generation processes.

2.5. Concepts of ERP and Its Definition

- **Enterprise Resource Planning (ERP):** ERP software is a cross-department, enterprise-wide package that provides an integrated set of functionality to user organizations.

- **Customer Relationship Management (CRM):** CRM Software addresses customer management functionality and is primarily used by customer-facing departments. It involves managing all aspects of a customer's relationship with an organization to increase customer loyalty and retention and an organization's profitability.

- **Supply Chain Management (SCM):** SCM software supports the complex supply chain management function and is commonly deployed by manufacturing and other organizations reliant on third-party goods and services. It involves the management of information flows between and among stages in supply chain to maximize total supply chain effectiveness and profitability.

- **System Application and Products (SAP):** - which creates a common centralized database for all the applications running in an organization.
- **Service Oriented Architecture (SOA):** - It defines how two computing entities, such as programs, interact in such a way as to enable one entity to perform a unit of work on behalf of another entity.
- **Structure Query Language (SQL):** - works with relational databases which all organize data into tables, rows, and columns which correspond to file, records and fields.

2.6. ERP Implementation

In the late 1990s, many companies rushed to implement ERP because of the year 2000 problem, which caused dramatic lack of experienced consultants and related experts, so that the quality and speed of ERP implementation in those years were slowed down for certain degree. Most of the Fortune 500 companies implemented ERP during the decade, thus the later market turned to small and medium enterprises [22].The aim of implementing ERP for a company can be various, despite cutting the running Costs, some companies just want to integrate its multi business units, or integrate redundant information systems or databases, and the year 2000 problems as aforementioned [23].An ERP implementation project costs a lot, it includes the fees for ERP package licensing Firstly, and fees for consulting and project team members, user training also costs, as well As the business losses caused by productivity reduction and orders losing [22].

Figure 2: ERP implementation in the work process

2.7. CSF in ERP Implementation

As ERP implementation is a quite high-risk activity, it is worthwhile to discuss the various critical factors that determine the success of the implementation [23]. Based on these critical success factors (CSF), a framework can be built to describe the CSFs and the relationships between them. Regarding "critical success factors", the definition or clarification of "success" is necessary here. Umble et al. [23]defined a successful ERP project as the various implementation effects that can cut over millions of dollars in the long run for the company such as more accurate marketing forecast, accelerated product efficiency, improved customer service. However, there is not a consensus and clarity of definition of "success" both in practice and in academic [25]. Based on this, [25] tried to give a solution of the definition of success: firstly it is vital to get success measurements from the perspective of the adopting organization's executive leadership; secondly, the success measure should be a set of success metrics addressing different dimensions (technical, financial, personnel) at different time points, instead of a single measurement of IS adoption success.

As to the selection of CSF categories, practically each ERP implementation CSF paper has their own sets of CSFs and thus has different CSF names depending on their different classify ways. There are two principles of selecting CSF names in this chapter: firstly it must be some features or actions that can be controlled and can be taken measures against during the implementation activities, secondly there are no CSF can be completely covered by another CSF in the list [26].

The following lists below are the basic *ERP Critical Success Factors*: [23].

- Clear understanding – strategic goals
- Cope with technical issues
- Data accuracy
- Extensive education & training
- Focused performance measures
- Great implementation team
- Organizational commitment to change
- Project management implementation
- Resolution of multi-site issues
- Top management commitment

Table 2: Top ten risk factors of ERP risk

Priority	***Name of Factors***
1	Lack of senior manager Commitment
2	Ineffective communication with users
3	Insufficient training of end-users
4	Failure of get user support
5	Lack of effective project management methodology
6	Attempts to build bridge to legacy applications
7	Conflicts between user departments
8	Composition of project team members
9	Failure to redesign business process
10	Misunderstanding of change requirements

2.8. Evolution of Enterprise Resource Planning (ERP)

ERP History began with early attempts at calculating machines in the 1940's. In the 1960s, Enterprise Resource Planning (ERP) is born in the early 1960s from a joint effort between J.I. Case, the manufacturer of tractors and other construction machinery, and partner IBM. Material Requirements Planning or MRP is the initial effort. This application software serves as the method for planning and scheduling materials for complex manufactured products [27].

Table 3: Evolution of ERP system

Time-line	***Stages***	***System***	***Platform/Scope***
1960s	1	Inventory Management & Control	Mainframe legacy systems using third generation software (Cobol, Fortran). Inventory and warehouse management.
1970s	2	Materials Requirements Planning (MRP)	Mainframe legacy systems using third generation software-(Cobol, Fortran).Raw materials to be supplied are calculated by computing the materials needed
1980s	3	Materials Requirements Planning (MRP-II)	Mainframe legacy systems using fourth generation database software and manufacturing applications.
1990s	4	Enterprise Resource Planning	Mainframe or client-server systems using fourth generation database, software and package software.
2000s	5	Extended ERP or ERP-II	Client-server systems using Web platform, open source with integration to fifth generation applications like SCM, CRM, and SFA. Also SAAS environment Available.
2010	6	Integrated ES	Integration of enterprise portals and CRM (Customer Relations Management) systems via Web services or EAI

2.9. Characteristics of ERP Systems

In particular, ERP systems have been assumed to have the following characteristics.

- ERP systems are packaged software designed for a client server environment, whether traditional or web-based.
- ERP systems integrate the majority of a business's processes.
- Centralized database system.
- System runs in real time, having also Internet based applications.
- ERP systems process a large majority of an organization's transactions
- ERP systems use an enterprise-wide database that typically stores each piece of data once.
- ERP systems allow access to the data in real time.
- support for multiple currencies and languages (critical for multinational companies);
- support for specific industries (e.g., SAP supports a wide range of industries, including oil and gas, health care, chemicals, and banking);
- ability to customize without programming (e.g., switch setting);
- Electronic Data Transfer Technology
- Flexible. Third party tool can be attached.
- Support remote functions and having powerful interface technology.

2.10. ERP System Life Cycle

Like other work process, ERP system has also its own life cycle process as viewed below with table 4.

Table 4: ERP system Life Cycle [24]

Life-cycle	***Issues***
Adoption decision	Adoption drivers
	Adoption evaluation
	Organizational characteristics
	Other adoption issues
Acquisition	Factors affecting selection
	Selection criteria
	In-house developed systems
	Other acquisition issues
Implementation	CSFs
	SME Characteristics
	Impact of consultant
	Risk management
	Other implementation issues
Use and maintenance	Benefits
	Use
	ERP impact
Evolution and retirement	ERP evolutions

2.11. Related Works

There are many literatures and research works conducted about ERP implementation all over the world and from different countries on different disciplines like educational, finance, health, business, and security issues. Most of these works are about the failure factors of ERP systems. According to Ghosh [44] was one of such studies which tried to see ERP failures. He has surveyed key issues in ERP system implementation.

In the case of Ethiopian context, there was very limited research and literature about ERP systems regardless of many ERP research works worldwide. The first attempt in considering the work of Tewodros [45] which just only argue about the concept and design of ERP framework and its implementation guideline at Gafat Engineering Company. This is just about ERP framework and it has no experiences of actual ERP implementation success and failures.

Similarly, Bhagwani [46] has tried to review critical success factors in relation to implementation methodologies based on only assessment of earlier research articles. Bhagwani [46] has suggested extending such researches to case studies. Esteves has a research work which is about defining and analyzing critical success factors [50].

The other ERP literature from Ethiopian perspective is that of Gomez and Abiot [47]. This study has argued about a successful ERP Implementation in another Ethiopian private limited engineering company. The ERP system cited by the author is Microsoft Dynamics which has less market share and it is not well known and deployed as SAP and Oracle. In addition, the authors have not mentioned the detail factors encountered as challenges. They have just mentioned that problems encountered are cultural, business and technical.

They have suggested for more studies and reports on ERP implementations related to Ethiopian context for better experience sharing. The last study on ERP system in Ethiopia is the work of Derese [48] which is a case study at Ethio-telecom on Oracle ERP. Derese's study was a frame work for successful ERP project. He has tried to list critical success factors along pre-implementation, implementation and post-implementation phases of Oracle ERP. This was a framework for high level implementation guide. He rather suggested to further study the contextual factors in other organizations and with other ERP systems relating them with ERP implementation methodologies. This study is in line with suggestions of many previous research works in the study area. As the type and management of critical success factors is different in context, a critical success factors approach is necessary [49].

This research work finds out the factors that determine the success of an Enterprise Resource Planning (ERP) system implementation with particular reference to Ethiopian Airlines. An Enterprise Resource Planning system is a corporate wide information system which is used to integrate the business processes and resources of a company. This research takes the case of SAP ERP system implementation project at Ethiopian Airlines. The result of this research found out twenty critical success factors for success of ERP systems. Factors such as project planning, top management support, project management and leadership, capability of consultants, change management and communication, organizational readiness and overall knowledge transfer are among the factors found to be critical for ERP system implementation in the Ethiopian context. As researcher, discussed in the his paper, ERP system was decided to be implemented at Ethiopian Airlines as part of its IT transformation project to upgrade and replace the existing back office support systems mainly the financial support system, human resource management system and the general purchasing and materials management support system.

2.12. Framework of ERP System

There were many ERP Design and implementation in many countries is varying with countries. In most developed countries the ERP implementations were successful with using SAP, Oracle, and other ERP vendors. This ERP software is very expensive and successful real world implementation. While in many developing countries are an ERP implementation attempts in the researcher above reviewed most of the design a framework sample and discuss the problems and recommend the solution for the problems. But they didn't use any open software to solve the problems instead of designing the framework and show some direction for the future researcher rather.

The researcher was using open ERP software and designs the framework that integrates the hospital functional areas into single database components. This ERP software is ODOO open source software. The software has many components modules that bring them in to a single integrated data one another. The other common gap in the literature is most of time the hospital functional units are separate each other. They have their own server that are not integrated each other. The other gap in this literature is that no service quality in the hospital and the delay of report generated in each department has no uniformity.

Table 5: ERP Framework and its implementation summary

S. No.	***Study Title***	***Author***	***Year***	***Type of the study***	***Vendor /frame work***	***Focus of the study***	***ERP Frame work***
1	Design of Enterprise Resource Planning (ERP)Framework and its implementation	Tewodros G.rufael	2007	Survey	Frame work	Quality evaluation	Yes
2	Critical Success Factors In Implementing SAP ERP Software	Anil Bhagwani	2009	Case study	SAP	Usability, Functionality, reliability,efficiency)	Yes
3	A Successful ERP Implementation in an Ethiopian Company: A case Study of ERP Implementation in Mesfin Industrial Engineering	Abiot Sinamo Boltena & Jorge Marx Gomez	2012	Case study	___	Business, technical, &cultural issues	Yes
4	Success Factors for Implementation of Enterprise Resource Planning System at Ethiopian Airlines	Sintayehu Demeke	2014	case study, online survey	SAP	20 CSF on service delivery	Yes
5	ERP Implementation Framework: The Case of Ethiopia	Alem Samuel, Mesfin B.,Mesfin K.		survey result an interview	___	CSF influence process in Ethiopia	Yes

CHAPTER THREE

RESEARCH METHODOLOGY

The research would be used the following research methodologies and techniques to achieve the general and specific objectives of the research. Research methodology is the set of, methods, processes, techniques, and tools deployed and used to conduct a research and reach to the final output of the study. The chapter deals with the research design, sampling procedure, techniques and tools are used to develop methodology that addresses research questions. The methods and techniques used for this research are explained in this way.

3.1. Literature Review

For successful completion of this research, the researcher has been reviewed more related literatures such as books, thesis, magazines, journals articles, newspapers, proceedings, manuals, report papers, conference papers, and other offline as well as online resources discussed thoroughly. Detailed and focused literature review is done to understand more about Enterprise Resource Planning concepts and ERP systems technical and business/service framework. More research works conducted on ERP implementation experiences in developing countries are reviewed as a benchmark. Moreover, the studies also identify and test various methods of ERP implementation.

3.2 Case Study

This research is a qualitative type that would be as exploratory study. This type of research tools is considered for the study as following reasons and justifications. First, this type of research aims to identify key issues and variables and it is suited to exploration of issues in depth. Exploratory case study is used to understand what happened within a case by looking beyond descriptive features and studying the respective context. As clearly stated in [37], case study method is the most widely used qualitative research method for researches in information systems. According to [38], case study is important especially in situations when the focus of the study is to answer why and how questions and when the researcher wants to cover contextual conditions relevant to the phenomenon understudy.

3.3. Case Selection and Sampling size

Sampling is necessary as it is difficult to conduct the research on all the population. Although large sample size is advisable, there is no clear cut answer for the correct sample size [69]. It may depend on the nature of population of interest, purpose of the study or the data to be gathered and analyzed [71].

Sampling is the process of selecting units or individuals from a people which can be included in the study, for instance, to answer interview questions or respond to survey questionnaires. There are different sampling techniques such as probability sampling, random sampling, convenience sampling and purposive sampling. For this research, purposive sampling techniques used as this is a qualitative case study. According to [63], case study almost always uses purposive sampling. The objective of a case study is not to find out how often something occurs in a population, instead what occurred and why it occurred. In case study, the sample units must have the potential and richness in information to be key informants for the study. As to [67], purposive sampling is virtually synonymous with qualitative research.

3.4. Data Collection Tools

3.4.1. Interview

Interviews are used as the main sources of primary data in this detail investigative study. Preliminary discussions were made with hospital managers and members. The purpose of the study was explained to them. Preparing interview questions and interviewees were identified based on their role in the ERP design for the hospital.

3.4.2. Questionnaire

Survey questionnaire is the other primary data source used for this research. The researcher organized some questionnaire and collected the information that helps to build the ERP system implementation in the hospital. Based on this, the questionnaire is used for this study mainly to supplement the interviews by adding some breadth and rank the level of success factors importance for ERP implementation.

3.4.3. Observation

The other sources of primary data in this study are observations. In conducting case studies, direct observation is a situation in which the investigator makes a site visit and collects data from

the study area the researcher has made observation on how the ERP system is being used and the users 'impression and usage of the system. This has given insights to what is necessary for ERP system implementation.

3.4. Research Design

To gain an understanding of the ERP implementation system for this study, the researcher used a qualitative exploratory approach within Odoo open source ERP system vendors. It is also for this study, data collection techniques such as analyze existing documents; preparing questionnaire and interview has conducted with concerned Adama Hospital Medical College Medical doctors, administrative staffs and customers. In addition both primary and secondary data collection methods would be employed to collect the required data that support this research to be successful.

3.5. **Development Tools**

There are several open source softwares and ERP systems were reviewed. These softwares are includes: ERP5,ERPnext, iDempiere, JFire, Kuali, Odoo, Phreedom, Postbooks, SQL-Ledger, Tryton and etc.

Among those open sources ERP, Odoo is found to be the most commonly used system. Hence, Odoo ERP system was used to implement the identified functional areas in the Adama Hospital Medical College. The one best fit for this research is Odoo software as compare to other commercial and open source ERP vendors this is more likely suitable for this system. So, Odoo ERP open source software is used as a model for the study. This Odoo and its phases are reviewed and explained briefly.

Why Odoo ERP software was Chosen?

- Odoo maintains a high level of security compared to others ERP vendors.
- Odoo database ensures maximum data throughput (i.e. accepting of data with ease).
- Odoo database data storage capacity very high.
- Odoo is supported by many operating system platform e.g. Linux, Mac, and windows.
- Odoo has several data management and administrative modules.

3.6. Open Source ERP System Software

There is a lot of ERP software in this real world. There are two basic categories of ERP software. The first category is commercial ERP vendors or software like the primary ERP vendors are referred to as BOPSE (BAAN, Oracle, PeopleSoft, SAP, and J.D. Edwards). Other ERP firms include Great Plains, Lawson, Platinum, QAD, and Ross and Solomon [31].

The second category is open source that are their source are open and free Source ERP Soft ware. Since the aim of this research focus on open source ERP, the below list are some of their short summary of them.

1. ***Phreedom***

Phreedom is ERP vendors or software that is an open source that serving for accounting modules. It supported by a platform of program written in the PHP scripting language with a My SQL database engine. The objective is to provide the small-business community with a multi-language end-to-end enterprise management tool to run in an internet environment. This is a fully functioning version of the software with all core modules installed and a few add-on modules.[33]

Phreedom is platform independent, browser independent, and can be translated into many languages. Features include, full double entry accounting, complete inventory management, project cost tracking, CRM, Shipping and payment interfaces to major services, manufacturing process control and more. [32]

2. ***WEBERP***

WebERP is an open source system for small and medium sized enterprise (SME) and it an entire web based accounting and business management system that involves only a web-browser and pdf reader to use. It has a wide range of aspects suitable for many businesses particularly distributed businesses in distribution, manufacturing and wholesales. It shared the Virtual Machine to save others the time of creating their own server to test on WEBERP which is a system using MySQL and PHP. [33]

3. ***Odoo***

Odoo previously known as OPENER is suite for open source enterprise management applications. Targeting companies of all sizes, the application suite includes: billing, accounting, human resource, manufacturing, purchasing, inventory, warehouse management, and project management.[33]

4. Ino ERP

InoERPis an open source ERP system PHP based ERP application. The objective of inoERP is to provide a dynamic pull based system where the demand/supply changes frequently and traditional planning systems (such as MRP or Kanban) are incompetent to provide a good inventory turn. Is platform technology is JavaScript, PHP, MySQL/Oracle 12c

5. KUALI

Kuali is open source ERP software for higher education instructions. Kuali modules include student, human resource, research administration, financial, and library. Is origin country is USA. [33] There are also many others of free and open source ERP softwares such as Adaxa suite, Adempiere, Dolibarr, Epesi, ERP5, Compiere, openbravo, SQL-Ledger, Tryton, and LedgerMSB.

3.7. Data Modeling for the Hospital Information

There is a numbers of Information system modeling.

Data flow diagram: used for a graphical representation of the "flow" of data through an information system, modeling its *process* aspects and also it used for a graphical representation of the logical flow of the data and it contains four graphical symbols for source, data flow, process and storage.

ER diagram: used for design of the database diagram of the system. Entity-Relationship model is used in the conceptual design of a database (+ conceptual level, conceptual schema)
UML Modeling: UML is a notation that resulted from the unification of OMT (Object Modeling Technique); UML has also been influenced by other object-oriented notations. UML has been designed for a broad range of applications.

The functional model, represented in UML with use case diagrams, describes the functionality of the system from the user's point of view. The object model, represented in UML with class diagrams, describes the structure of a system in terms of objects, attributes, associations, and operations. As compared to other IS model it is the best representation of hospital functional areas. Its main strength seems to be in its support for the development business process. This seems to be of limited interest to Soft FMEA where networks are concerned, but might it be more valuable when considering software based components. If our interest is confined to a system's logical architecture and behavior we might only use the state and interaction diagrams, where there are plenty of alternatives. UML's usefulness seems therefore to depend on whether it fits in well with an existing development process. [61]

3.7.1. UML Diagrams

UML diagrams are the ultimate output of the entire discussion. All the elements, relationships are used to make a complete UML diagram and the diagram represents a system. The visual effect of the UML diagram is the most important part of the entire process. All the other elements are used to make it complete.UML includes the following nine diagrams, the details of which are described in the subsequent chapters. Class diagram, Object diagram, Use case diagram, Sequence diagram, Collaboration diagram, Activity diagram, State chart diagram, Deployment diagram, and Component diagram. Seeing that the data modeling relate directly to a process the system has to perform or information it needs to contain the hospital modules in one integrated window.

The data modeling systems facilitate the delivery of services at several levels. They support the activities of planning, management and the performance of processes besides enabling the recording of information. Healthcare Information Systems refers to a set of systems for the entire healthcare services encompassing patient care as well as services for the early detection of disease, prevention of health problems and promotion of wellness, at any location. The main subject discussed in this article is the Hospital Information which deals with the care of patients suffering from an illness. An information requirement system that assists the activities of a hospital takes into consideration like the financial/accounting services, the human resource management service, the functions of a health cares' patient/customer service delivery quality, the drugs delivery and inventory system.

The information system complements the other components of the very difficult organizational structure and operations of a hospital. It acts as an integrator of all these components by enabling the collection, storage and sharing of information. The scope, content and structure of the Hospital Information System serve a lot of different functions. It contains a set of sub-systems and applications (modules) that utilizes information-communications technology and computerization optimally to facilitate the delivery of services of the hospital.

Table 6: Actors Name Description

Actor name	***Description***
Administrator	Administrator refers to the person who administers the system of the hospital.
Data clerk/Patient Registrar	Data clerk refers to a person who gives service in the registration department or enters the patient personal information and address to the system.
Triage officer	Triage officer refers to a professional who screens patients status
Physician/HO/nurses	Physician/HO/nurses refers to professionals who diagnosis and treated patients and enters the diagnosis and treatment data's to the system.
Laboratory technician	The technician refers to professional who perform the diagnostic services and enters laboratory information to the system.
Pharmacist	The druggist refers to professional who give services towards medication/drug and enters drug information to the system
Cashier	An accountant who collect any financial transaction flow in the hospital

3.7.1.1. Use Case Diagram

Use case diagrams are a set of use cases, actors, and their relationships. They represent the use case view of a system. A use case represents a particular functionality of a system. Hence, use case diagram is used to describe the relationships among the functionalities and their internal/external controllers. These controllers are known as actors.

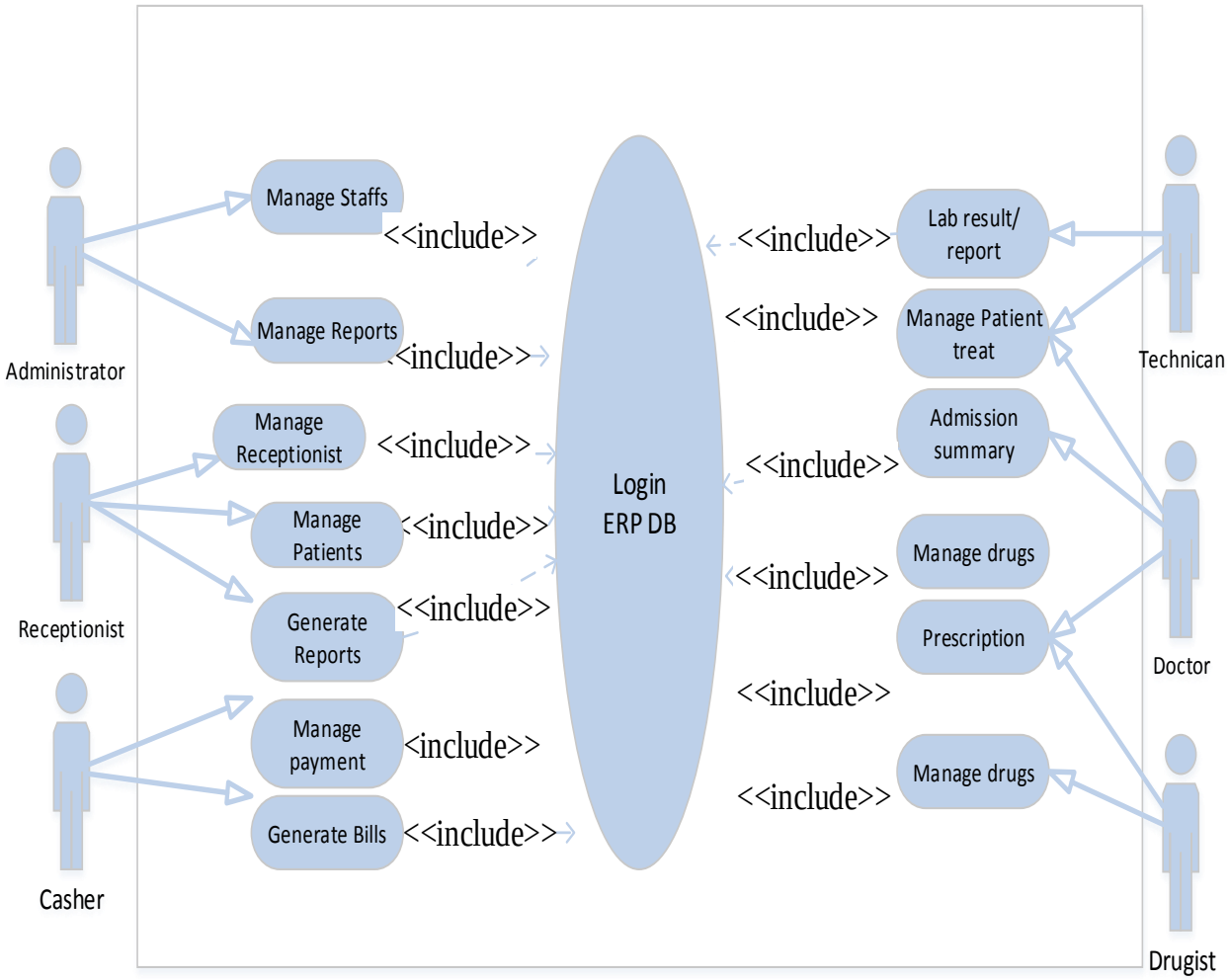

Figure 3: AHMC ERP Systems in Use Case Diagram

Description of Use case Diagram

Table 7: Description of Use case Login

Use case name	Login
Participating Actors	Administrator, reception, Doctor, Technician, pharmacist and cashier
Description	It is initiated when the actors of the system wants to login to the system.
Pre-condition	The actor must have an account
Flow of events:	• actor browse the systems page • System displays login window • actor fills user name and password • System authenticate the actor • System displays the entire page of the actor
Post condition	Actors logon to their pages

Table 8: Appointment Use Case Description

Use case name	Appointment
Participating Actors	Reception, Doctor
Description	It is initiated when the Receptionist wants to appointment to a patient.
Pre-condition	Date, Time Doctor ID
Flow of events:	• Receptionist clicks appointment link • System displays appointment page • Receptionist clicks the add button and fills data • System validate the data and store in database • Receptionist clicks modify button to update appointment • System displays update appointment form • Doctor click appointment link • Doctor view list of appointed patient • Use case ends
Post condition	Appointed Doctor

3.7.1.2. Class Diagram

A class diagram is used to describe the types of objects in a hospital system and their relationships. Class diagrams model class structure and contents using design elements such as classes, packages and objects. It describes three different perspectives when designing a system, conceptual, specification, and implementation. It also represents the static view of an application.

Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application. Class diagram describes the attributes and operations of a class and also the constraints imposed on the system. The class diagrams are widely used in the modeling of object oriented systems because they are the only UML diagrams, which can be mapped directly with object-oriented languages. Class diagram shows a collection of classes, interfaces, associations, collaborations, and constraints. It is also known as a structural diagram.

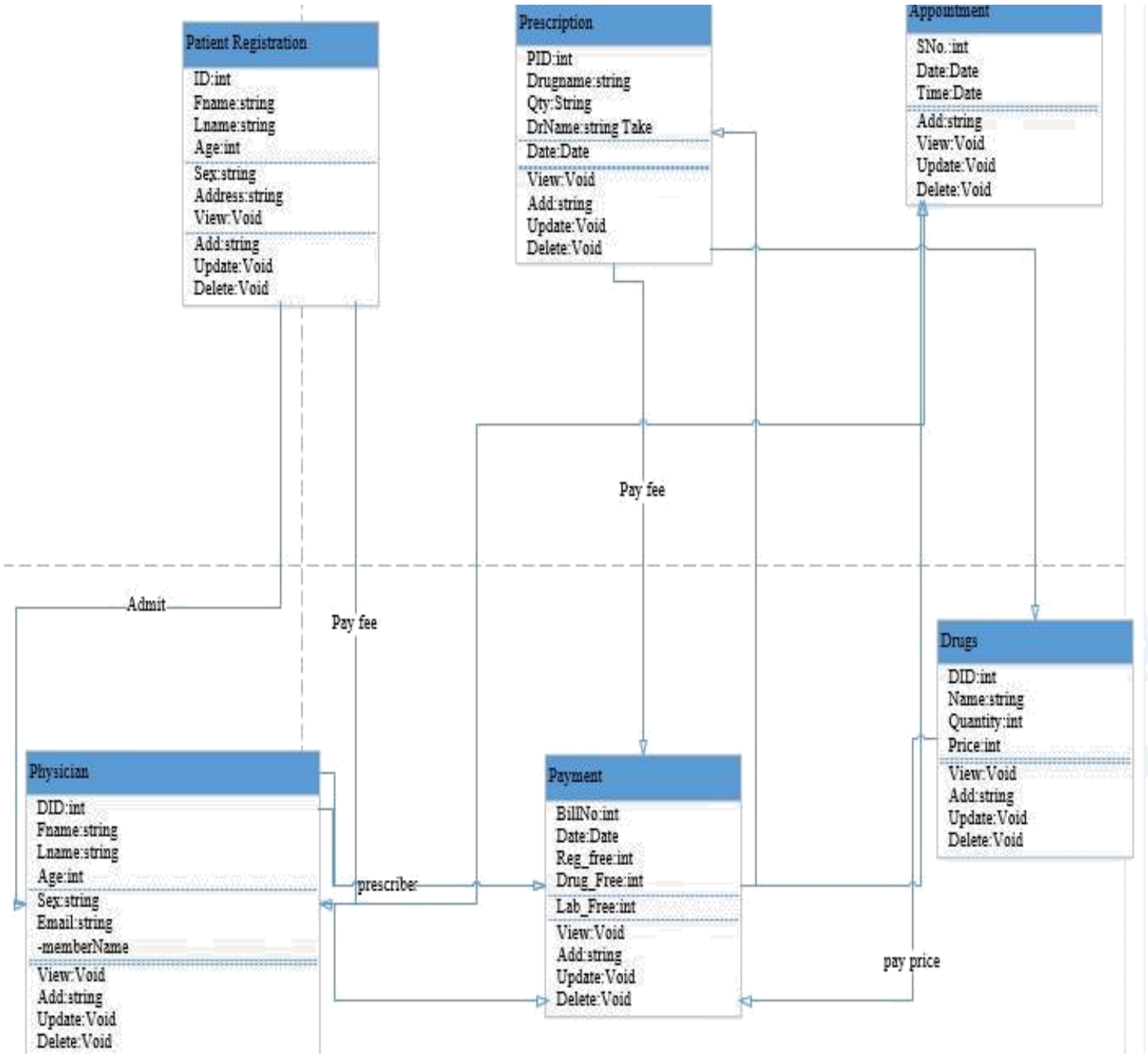

Figure 4: AHMC ERP Systems in Class Diagram

3.7.1.3. Sequence Diagrams

Sequence diagrams are used to formalize the behavior of the system and to visualize the communication among objects. They are useful for identifying additional objects that Participating in the use cases. We call objects involved in a use case participating objects. A sequence diagram represents the interactions that take place among these objects.

Description for manage Administrator sequence diagram

The administrator request for login by entering the username and password to submits the form. The system validates the username and password of the user in Database
In database search the user name and the password, Retrieve the status of the user, If the user is authorized the administrator logon on to admin page, To register staff the administrator should click the manage staff link, The system displays the staff page, administrator should click the register button to register staffs, The administrator should fill all necessary data in the form, The system validate the fields, It will be stored on the database, Lastly the administrator click logout button, And finally the system logout the administrator from admin page.

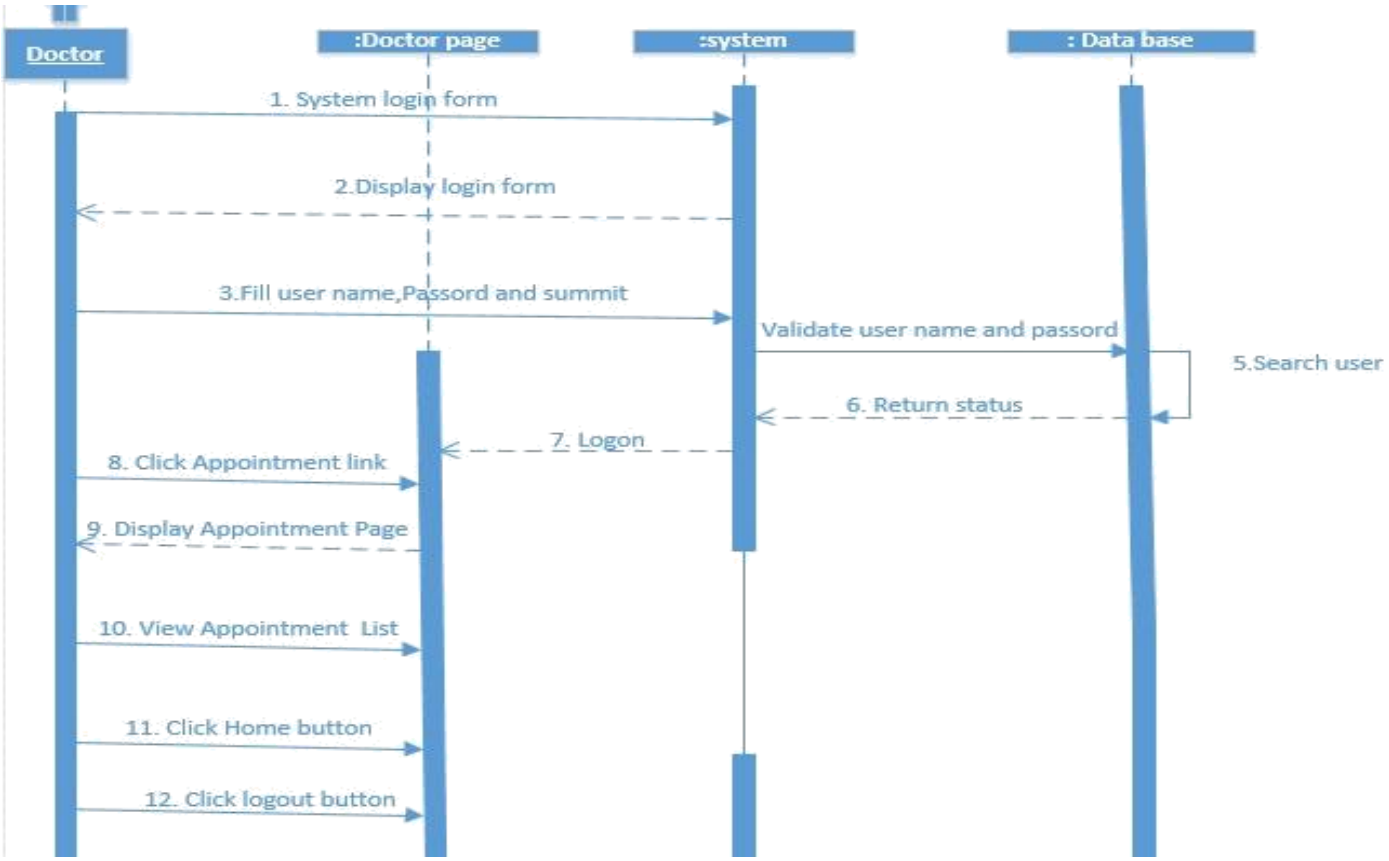

Figure 5: Sequence Diagram for Doctor

CHAPTER FOUR

FRAMEWORK DEVELOPMENT

4.1. ERP Framework Design for AHMC

Adama Hospitals currently use a manual based system for the management and maintenance of critical information. The current system requires numerous paper forms, with data stores on different database of spread throughout the hospital functional units. Often information (on forms) is incomplete, a lot of data redundancy, delay service for customers and it does not follow management standards. Forms are often lost in transit between functional units. Multiple copies of the same information exist in the hospital and may lead to inconsistencies in data in various data stores. A significant part of the operation of any hospital involves the acquisition, management and timely retrieval of great volumes of information. This information typically involves; patient personal information and medical history, staff information, room and ward scheduling, staff scheduling, operating theater scheduling and various facilities waiting lists. All of this information must be managed in an efficient and cost wise fashion so that an institution's resources may be effectively utilized ERP system was automated the management of the hospital making it more efficient and error free. It aims at standardizing data, consolidating data ensuring data integrity and reducing inconsistencies. From this Hospital requirement point of view and from the survey conducted in the hospital, the significant critical success factors and failure of the ERP design in the hospital identified. According to the interview and questionnaire data gathered and analyzed made. In the follows picture compared the current system of the hospital and the designed ERP framework for AHMC to be designed was shown as follows with factual events. There are a variety of costs incurred in ERP framework have also been identified and their relationship with benefits is analyzed. All of these revealed that certain features need to be improved and/or enhanced, while there are certain other activities which need to be controlled to provide an efficient ERP framework Design shown as below.

4.2. Current System versus Designed System

The current AHMC existing system of functional areas is highly dependent on the tradition services. The hospitals' the patient information was collected through manual based system using simple pen and paper forms.

These data on printed forms are, then entered into the hospital information system by an administrative assistant. When a patient arrives at the departments, for example at outpatient department, initially a nurse/physician fills about the patient history information onto the outpatient department form, and diagnoses the problem according to the diagnosis; the patient get treatment and the treatment and diagnosis information are register on the patient card file. The overall business process description of the departments is presented as follows.

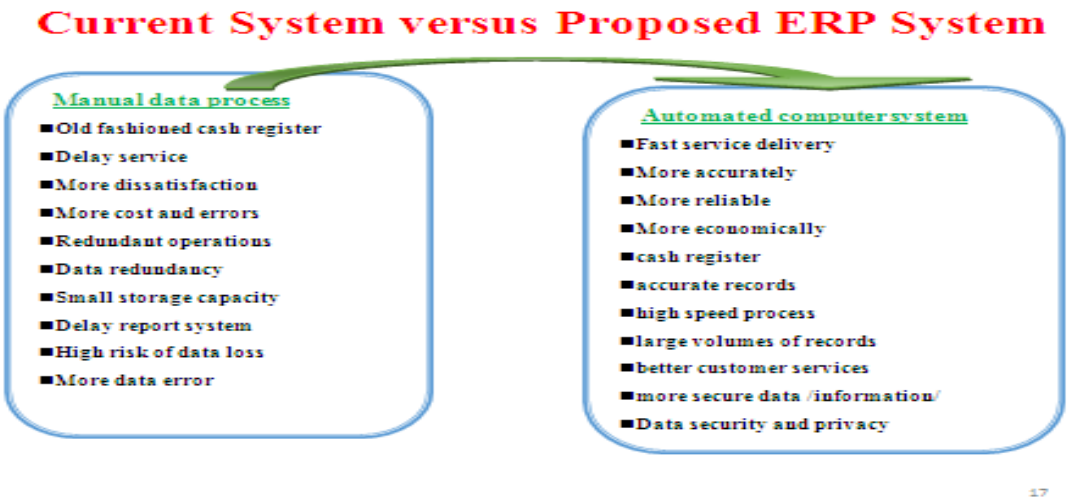

Figure 6: Manual based versus ERP system based hospital system

4.3. Framework of ERP Systems

In the preceding ERP Framework indicate that how each hospital modules are associated with the central database of ERP system and how users are interacted with database server. It also show that how the staff could be communicated with users or customers in the hospital. How the front office and back office of ERP system can integrate one another. The Suppliers were the staffs of the hospital including human resource, physicians, accountants and other working departments. The customers were the end users of the hospitals especially the patients.

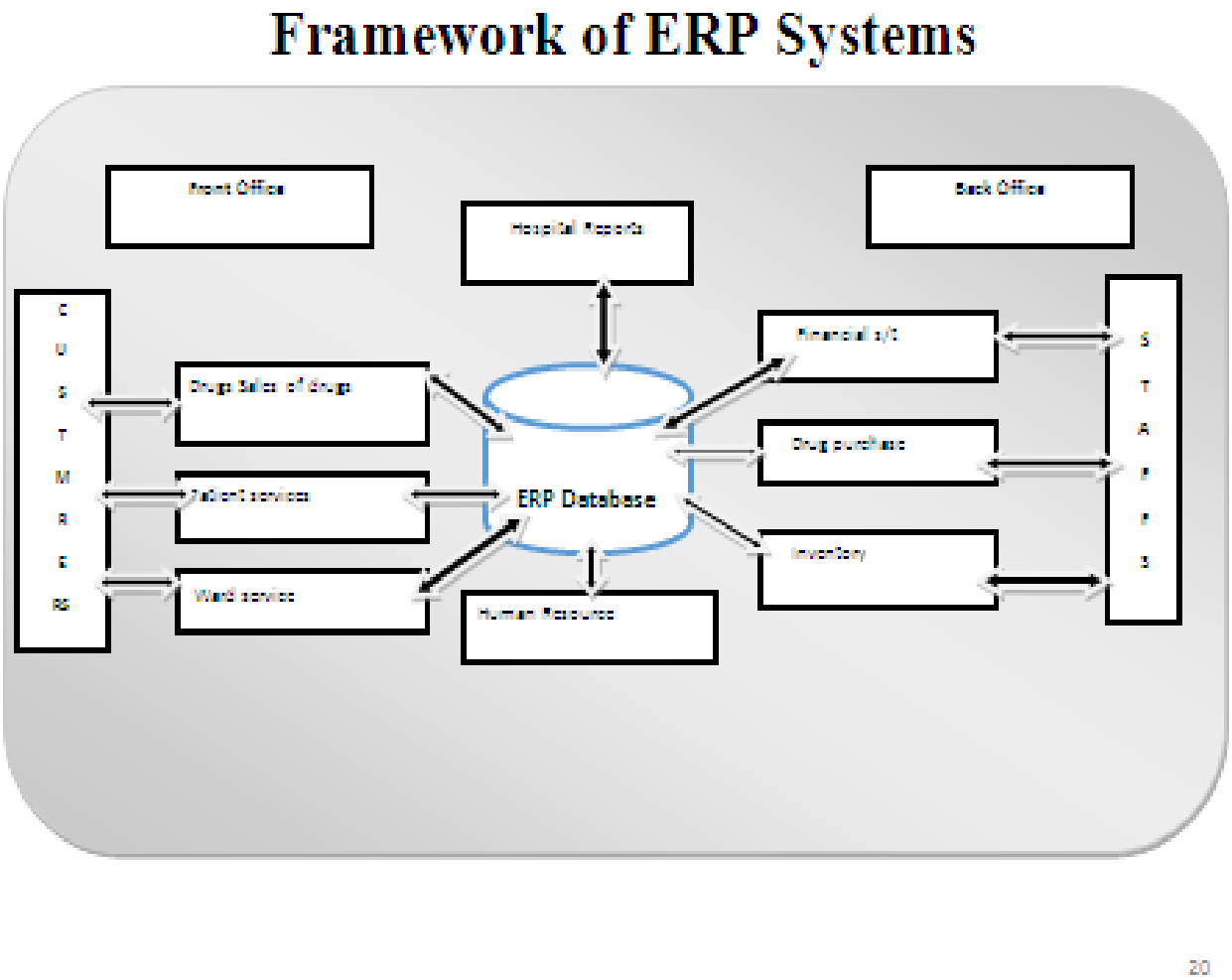

Figure 7: Framework of ERP systems

4.4. AHMC ERP System in Modular Based System

While the current system of the hospital is the paper-based that has some problems with existing working environment. So that the researcher designed the ERP implementation using open source software. This software composes of many departments that bring them into one window. For this study the four basic departments are taken as a model for designing a framework structure of the AHMC. This suggested system integrates accounting-finance department, CRM (patient care management department), Human resource (employee department) and Inventory (Pharmacy department). There is a centralized database to store all departments database as a server using posrgreSQL9.5 database.

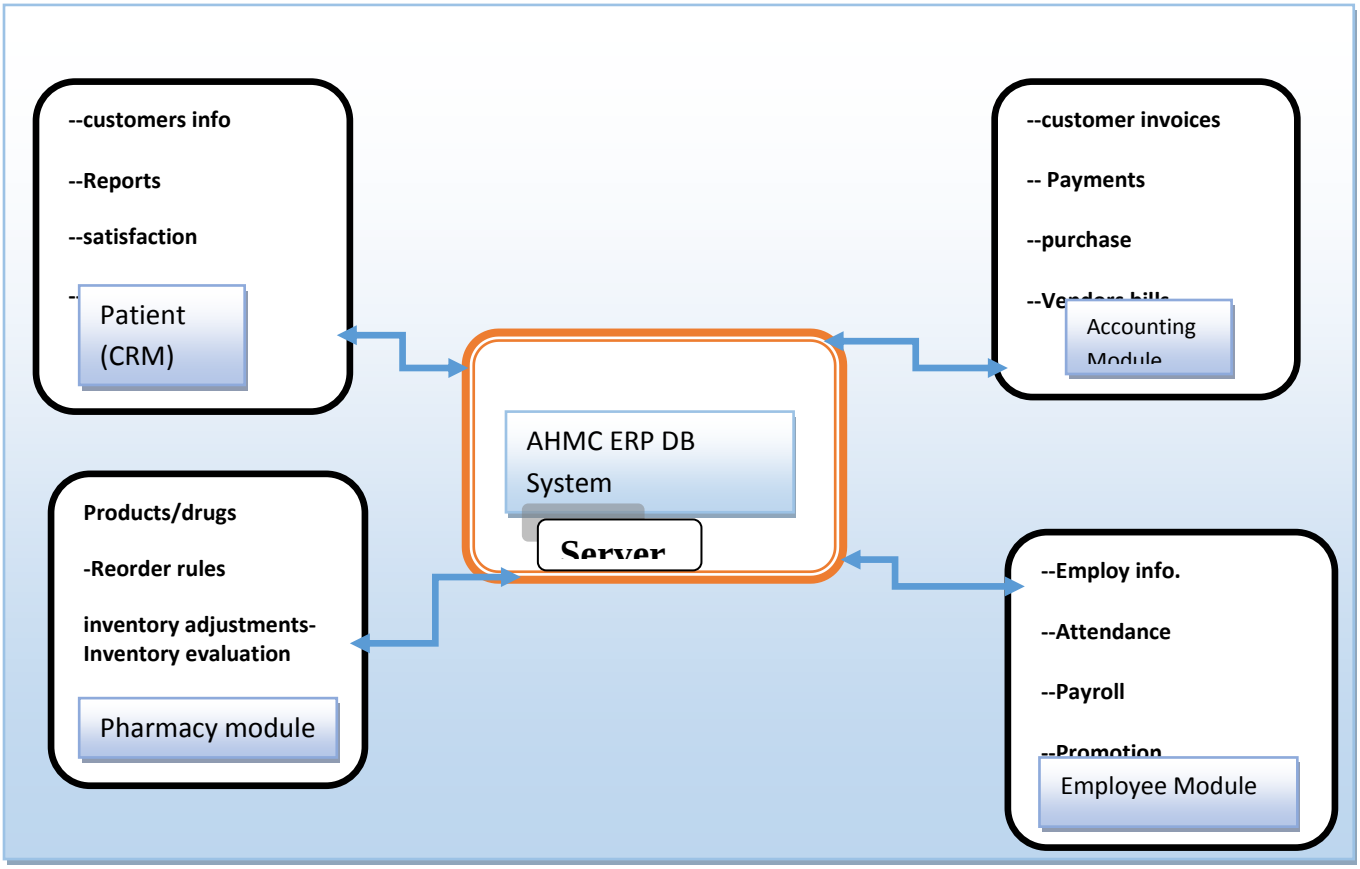

Figure 8: Integrated AHMC ERP Designed Modules

CHAPTER FIVE

IMPLEMENTATIONOF THE FRAMEWORK

5.1. The Odoo Software Component

The Odoo software component of the ERP model is the component that is most visible to the users and is therefore seen as the ERP product. It consists of several generic modules, some of which are listed below:

1. *Odoo Inventory Module or Pharmacy module:* The inventory management system the main component of the ERP System. This part is used to facilitate the inventory system of the Pharmacy medicine flow. Items are recorded in proper manner their respective categories. Adding a new drugs, editing and deleting of an existing drugs, receiving and issuing of drugs is possible and enable fast and reliable system of recording the assets of the hospital.

2.*Odoo Employee or Human Resources (HR Module):* it is a HR administration automates personnel management processes, including: recruitment, master data management, payroll accounting, travel expense, time management, application processing, personnel development, manpower planning, HR information system and etc.

3.*Odoo Accounting/Finance Module:* is the oversight of materials, information and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer.

4.*Odoo Customer Relationship Management (CRM) or Patient Care Management:* CRM is hospital customer especially patients are the main user of this system that manages customer relationships in an organized and efficient manner.

5.2. ERP Implementation at AHMC

In order to implement ERP system in the hospital there are some basic critical success factors that highly affect the system implementation. This basic and fundamental factor would be analyzed through questionnaire and interview with hospital key personnel of the hospital. It was decided to be implemented the system as part of its IT transformation with its functional units as plan to replace and upgrade the existing back office support systems. Especially in the accounting-financial support system, human resource management, patient registration care, and

Pharmacy modules system and other modules like the general purchasing, logistic services, and materials management support system. Basically, the goal of the ERP system implementation was to accomplish three main purposes.

- To have best practice industry standard back office system
- To have real time integrated working environment this can integrate all the operational support systems of the hospital.
- To have one central database warehouse system to get the right business intelligence (BI) and dashboard tool instead of having many decentralized database servers.

Since the main objective this research was a huge investment on the IT based system implementation that was a need for consulting organization to implement the ERP system. ICT department was also established in the company to decide on business and budget issues for this major research. Decision of ERP as back office system was part of the IT strategy. Odoo, an ERP vendor company, was selected to deliver the ERP system product. ERP system implementation is not just an IT plan. It is mainly a business process project. For this reason, vendor consultants and implementers were also considered for better implementation of the project. To this end, Odoo open software was selected as implementer partner for the ERP system in the AHMC.

5.2. Odoo Module Installation and Configuration

Odoo is one of the open source ERP software that the researcher selected to deploy for the hospital functional units. It supported many modular applications for different companies. Odoo, formerly called "Open ERP", is one of the top open source ERP applications available and a perfect ERP software solution for small to mid-sized manufacturers, distributors, retail, and services businesses. It also supported with window, ubuntu, and Linux.

How Odoo download and Install steps

- Download new version odoo10.0 community.
- Install odoo with postgreSQL9.5
- Register online with company law
- Create account with password
- Enter with default local host user (openpg)and password(openpgpwd)
- Localhost:8069
- Create your own username and password
- Install apps module you want for your project
- Create customers as individual or company with their information like name, address, phone number, photos, and other information you want.

In this study the researcher focused on four modules that were installed and their information created according to their demand. The modules installed were CRM (Patient Care Management Modules with their information), Inventory (the pharmacy modules with their in formations), Employees (HRM modules with their information), and Accounting and Finance Modules with the information it required. The details of the prototype were shown below with each modular based system with pictures.

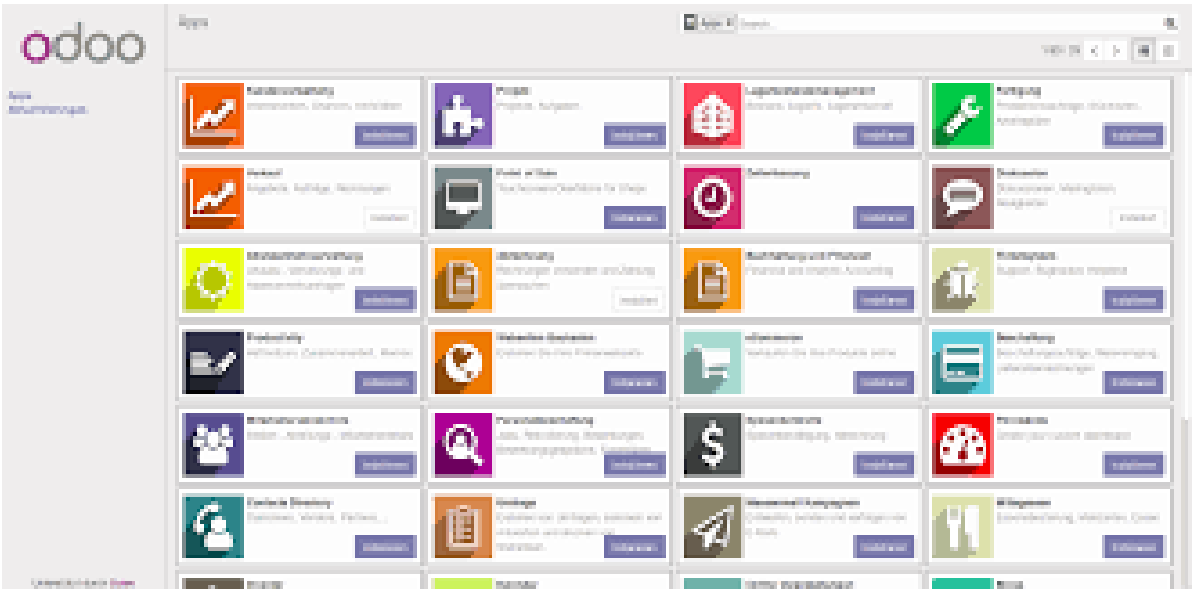

Figure 9: Odoo Open ERP System Modules Display

5.2.1. Patient Care Registration Module

The Patient care registration module consists of applications designed to enable service delivery managers and care providers to manage an individual or groups of patients as clients or customers in an efficient, responsive, flexible and customer-friendly manner with optimal use of resources. The registration and appointment scheduling module is an efficient patient management system that eases capturing of pertinent information of the patients. The patient administration functionalities of the hospital can be automated to provide proficient patient care. The scheduling of patient and physician appointments can be done from this module. Scheduling, rescheduling and manipulating of appointments can be done easily from our patient registration module.

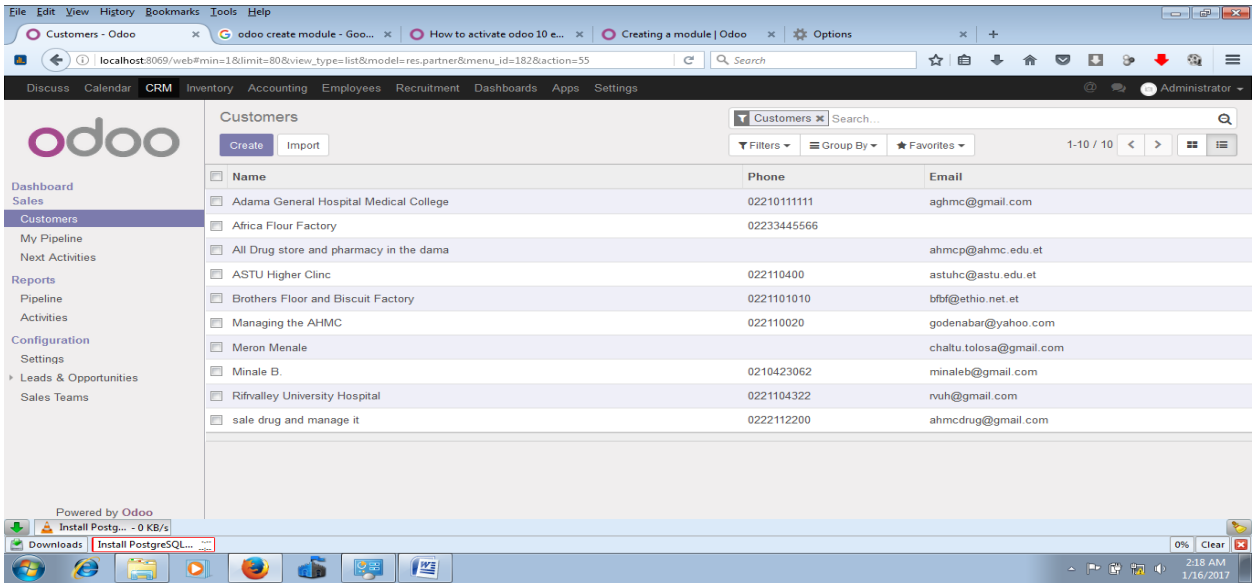

Figure 10: Odoo AHMC ERP System Design for Patient Modules DB

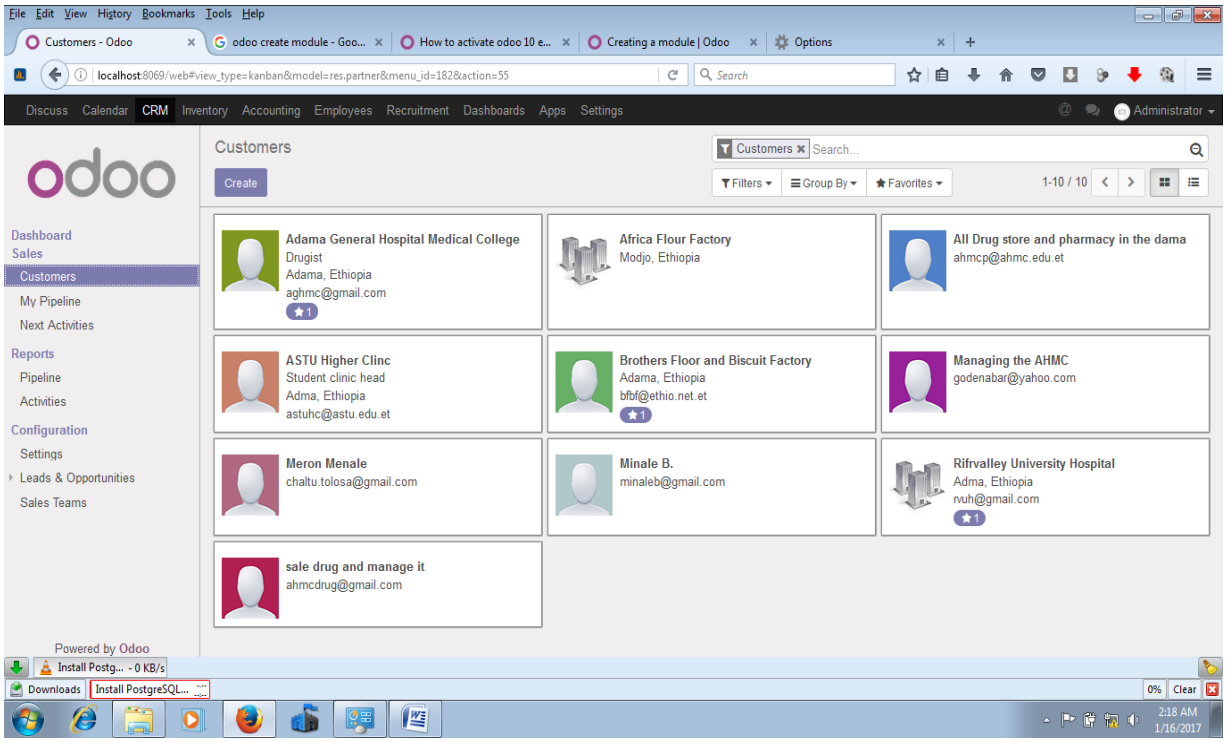

Figure 11: Odoo AHMC ERP System Design for Patient Modules display

5.2.2. ERP Pharmacy Module

ERP Pharmacy Module is an application designed to ease the work of a pharmacy function. It was developed to transform how stores are managed and to integrate aspects of pharmaceutical operations. Pharmaceutical ERP (Enterprise Resource Planning) software system is the most effective way to identify and track every single raw material from receipt through processing, packaging and shipping, to the exact customer location. If that is the case then what prevents from many enterprises keeping away from implementing this effective tool.

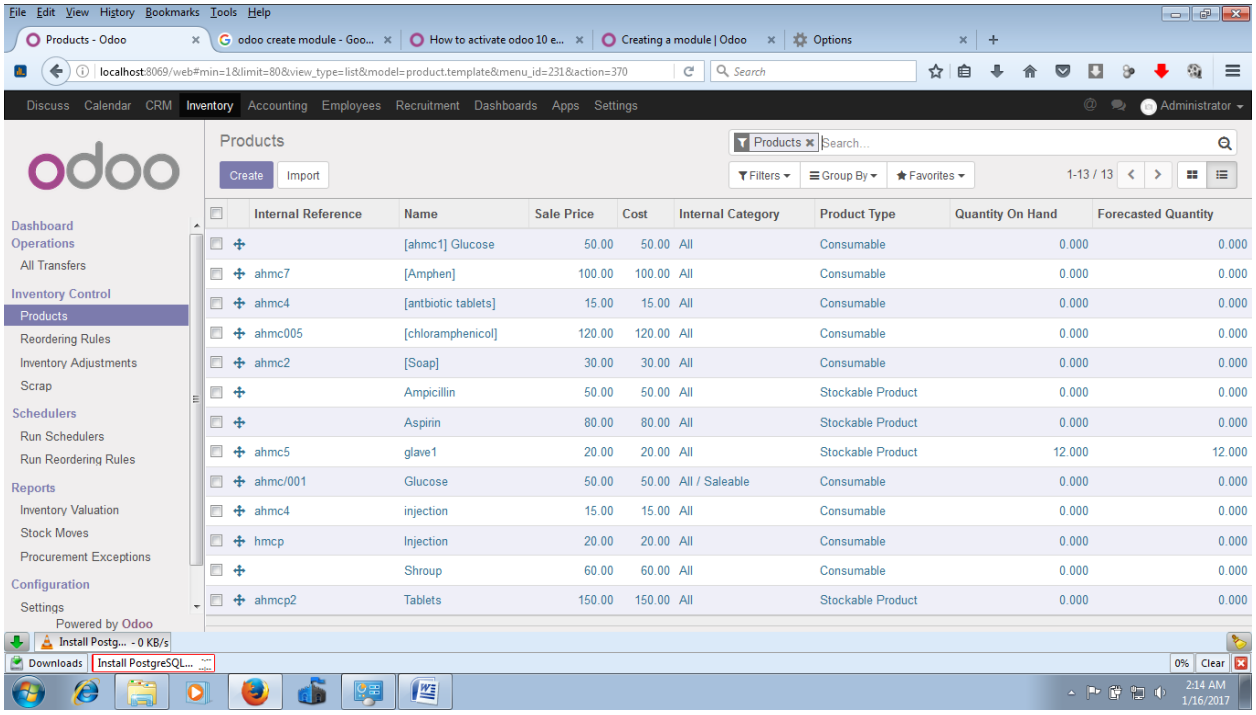

Figure 12: Odoo AHMC ERP System Design for Pharmacy Modules DB

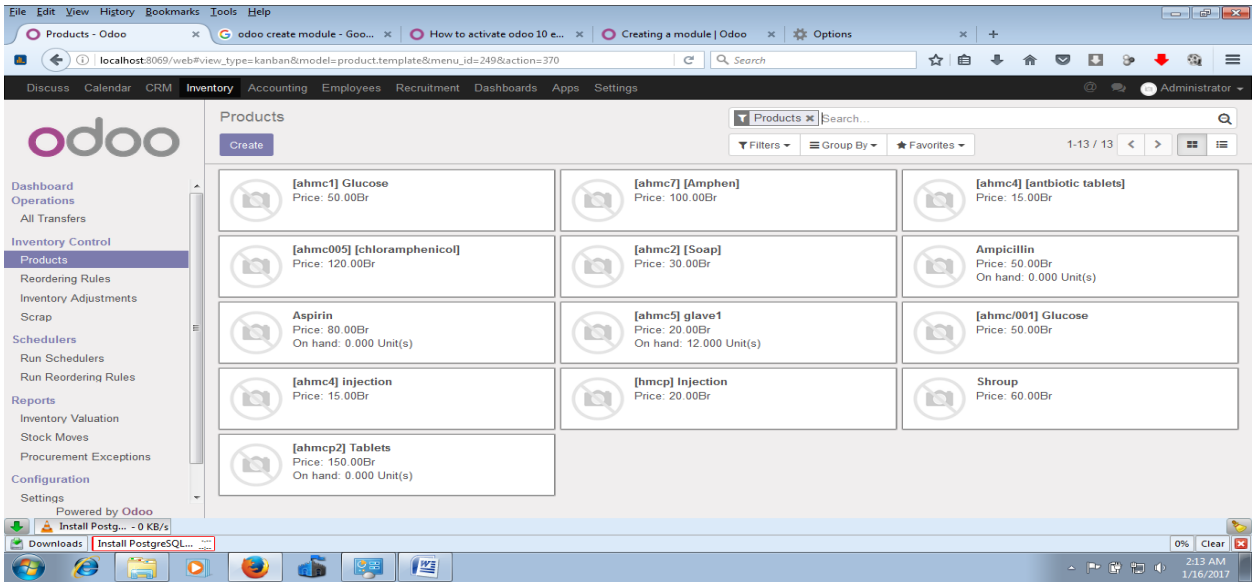

Figure 13: Odoo AHMC ERP System Design for Pharmacy Modules display

5.2.3. Human Resource (HR) Module

Human Resource module in resource ERP streamlines the management of human resources and human capitals. HR module in resource routinely maintains a complete employee database

including contact information, salary details, attendance, performance evaluation, training, recruitment, payroll and promotion of all employees.

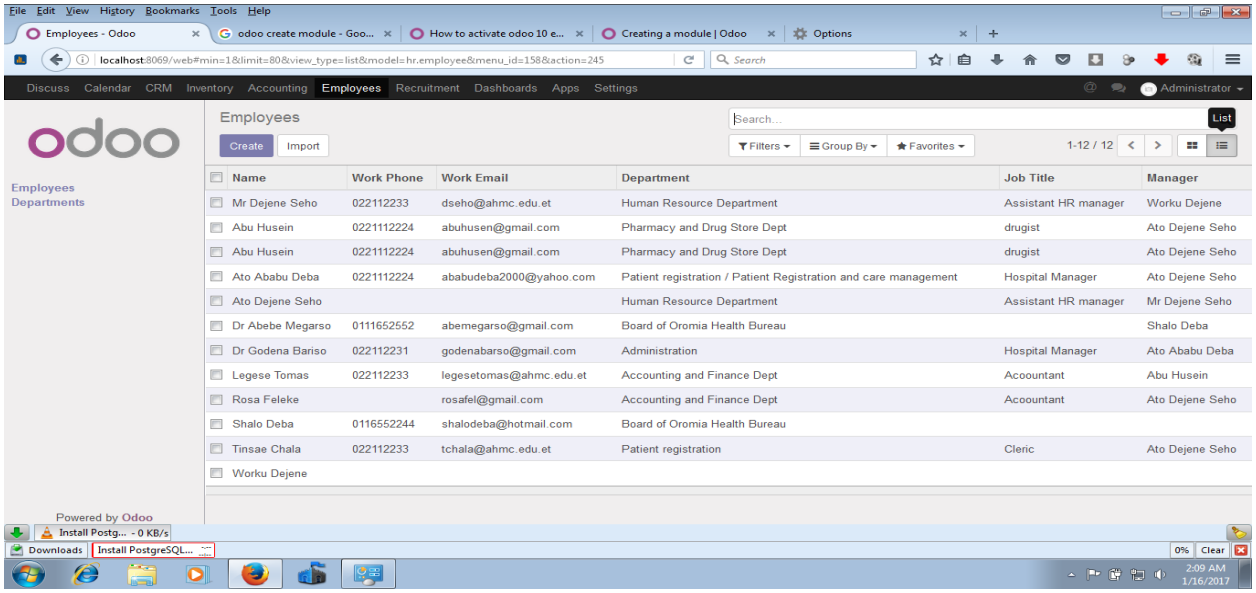

Figure 14: Odoo AHMC ERP System Design for HR Modules DB

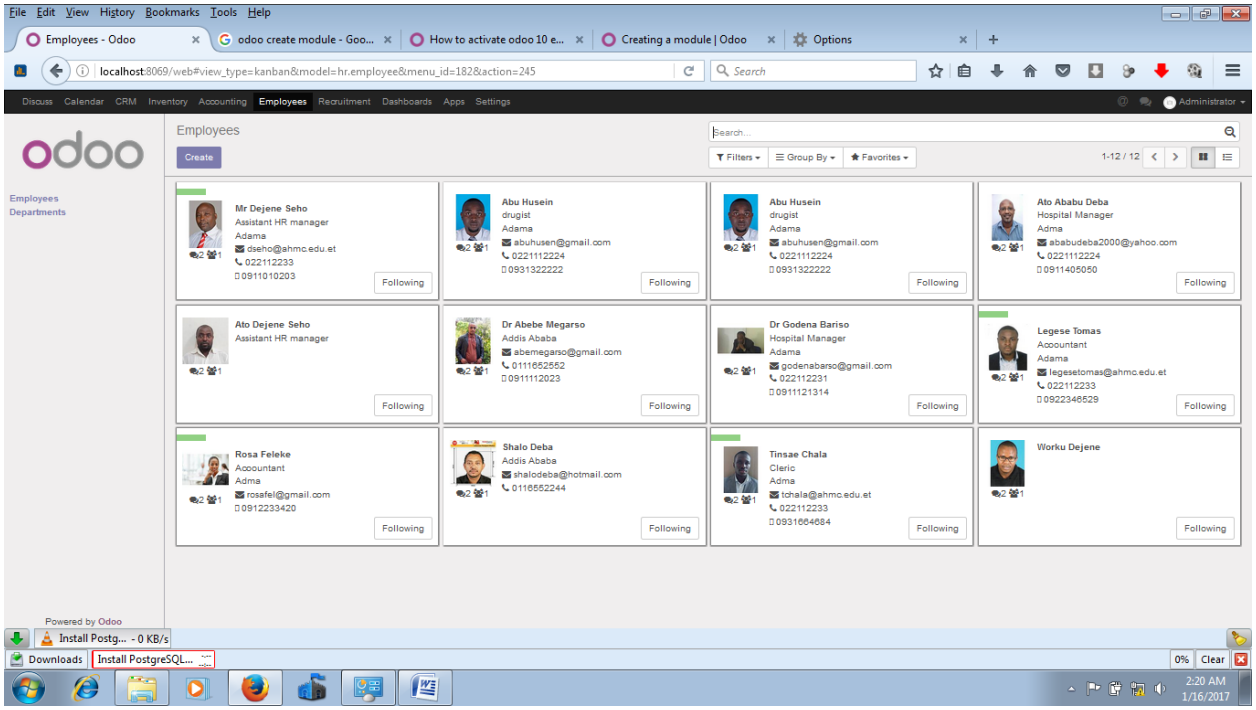

Figure 15: Odoo AHMC ERP System Design for HR Modules display

5.2.4. Accounting and Finance Module

The accounting and finance of hospital module is integrating the financial activities or sub systems such as: different accounts Payable for customers, for staffs, for vendors; accounts receivable like collecting cash from customers, from bank, etc. It also includes automated disbursements, budget execution, cost allocation, general ledger, general system, planning, project cost accounting, purchasing, fixed assets, and travel accounting.

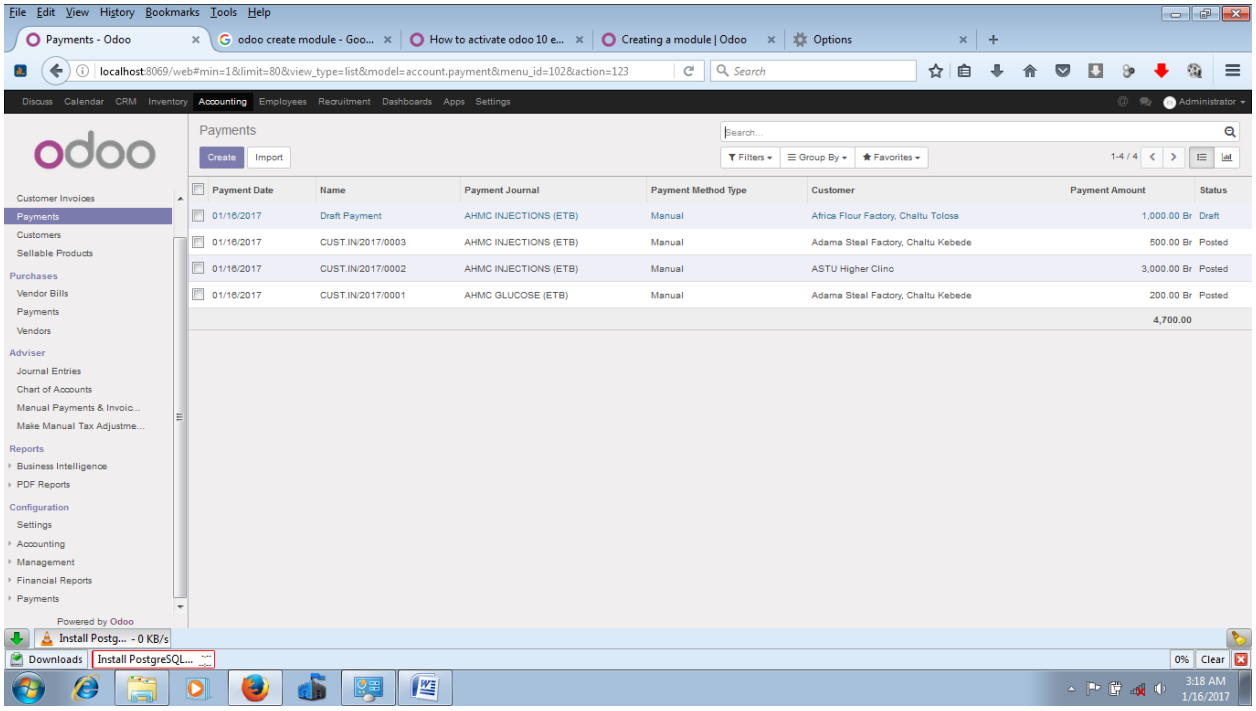

Figure 16: Odoo AHMC ERP System Design for HR Modules display

CHAPTER SIX

EVALUATION OF THE FRAMEWORK

This chapter deal with the evaluation of the designed framework has been discussed in focus. The overall evaluation of the framework was conducted through data collection tools like interview with concerned Hospitals' key personal, customers, and technical workers, questionnaire survey with some hospital workers.

6.1. Evaluation of the Framework for ERP Design in AHMC

In evaluating, all selected and contacted participants working in this organization were confident in supporting the idea of introducing ERP framework design are easy to use and affordable by everyone working in this organization of government office. Furthermore, as part of future improvement and real world implementation of the ERP framework design participants of this study suggested the involvement of more stakeholders such as AHMC researchers at the data processing module and addition of more ways of analyzing collected data to improve maximum utilization of administration data. Participants suggested the designee to include a way of doing descriptive analysis on the reported data to improve the work of decision makers. Interestingly, participants were suggesting features which were already included in the framework such as design to analyze data. The overall response for each question from the questionnaire is summarized in Table 7. The participants of this study evaluation were selected by the criteria of being an expert in AHMC IT experts and functional departments' staff office with the assumption that they have some knowledge of administration information systems and use this concept in their day to day activities. The priority was given to the people who had knowledge of the Administration information systems. Therefore, the administration directorate, team leader and expert at administration level were targeted. The first acceptance system was done with ICT expert and other office professions of hospital (data collector at AHMC who had experience with ERP framework processing. The ratings are **1(poor), 2(fair), 3(good), 4(very good) and 5(excellent**). The next table shows the results of the evaluation by experts.

6.3. User Acceptance

In the previous section the functional validity test was discussed. In this section user validity is checked. The system's appropriateness for system design should be confirming by undertaking User Acceptance system. If the system is deployed to the real system, experts have been involved to evaluate the system. And also, the system to provide solutions should be acceptable by experts. Therefore user acceptance was done with senior staff members and ICT experts.

Table 9: ERP System implementation Evaluation

		Performance value				
No	***Criteria of Evaluation***	***1***	***2***	***3***	***4***	***5***
1	System Clarity	0	0	1	4	5
2	Space for Data Storage	0	0	0	4	6
3	User Interface of modules	0	0	2	5	3
4	Providing Easy Search	0	0	1	5	4
5	Update Data System	0	0	2	4	4
6	Improving Better Communication	0	0	1	5	4
7	Duplication removal	0	0	0	5	5
8	Controlling Data confidentiality	0	0	0	3	7

On the Table 8 above the Framework for ERP design in AHMC Evaluation by ICT expert in the hospital. The ratings are 1(poor), 2(fair), 3(good), 4(very good) and 5(excellent) indicates as above table 5 shows the average value of responses for all the ten experts design in the ERP framework. Values more than 4.38 as response in favor of all the items evaluated in the framework verifies and validates that the framework is suitable for improving efficiency in ERP framework in AHMC. If we compare the overall mean score of all these factors, the highest priority is given to providing Controlling Data confidentiality (encryption, passwords) (4.7). The second highest priority is given to space for data storage (4.6) and duplication removal (4.5).

System Clarity is also among the top priority factors supported by all AHMC with a mean score of 4.4. The next higher priority (mean score 4.3) is given to providing Improving Interactivity for Better communication and providing easy search rest all the factors are also considered important by all Hospital functional units in the study.

Update data system, and user interface of modules are given the least priority though it is very important factor. This could be due to the fact that ERP implementation is still not complete in AHMC.

6.4. Result and Discussion

6.4.1. Survey Analysis

In this section the results of the study and interpretation of the findings would be presented. The first part presents the profile of respondents showing gender, age group, and level of education. The second section presents collection of data analysis of the study variables by using tables with consisting of percentage and mean. And it has contains the discussion of results and overall responses. It also deals with the analysis of data focus on four core functional modules of the AHMC. These are Patient Care Management Module, Human Resource Module, Accounting-Finance Module, and Pharmacy Module.

6.4.1.1. Data Analysis and Interpretation

- **Patient Care management department:** It includes the activities operated in the hospital environment that is considered as the core and basic modules thus includes all the activities for smooth conduct of patients cares in relation with various functional modules like accounting-finances, Pharmacy modules, and Laboratory modules and etc... It mainly includes patient's registration, patient file management, patient database, User interface system activities and etc.
- ***Human Resource*** **department*:*** This dept is needed to handle the information about all the recruitments, promotions and other professional records of faculty and another staff, employee attendance and various vendors for ERP.
- ***Accounting-Finance*** **department*:*** In dept supports the flow of money in the different financial information system within and between organizations. In order to handle all financial transactions like cash collection, account payment and account receivable, salaries payment and other payments and financial transactions.

- ***Pharmacy* department*:*** *This functional dept includes the activities like drug name, and brand, drug description and order, stock medications, dosage calculation, dispense medication and drugs receipt.*

Table 10: Demographic information of AHMC ERP System

Items	*Respondents*									
	Finance Dept		*Human Resource dept*		*Patient Management dept*		*Pharmacy Dept*		*Total*	
Sex	No	%	No	%	No	%	No	%	No	%
Male	4	66.67%	6	75%	8	66.67%	4	50%	22	64.71%
Female	2	33.33%	2	25%	4	33.33%	4	50%	12	35.29%
Total	6	100%	8	100%	12	100%	8	100%	34	100%
Educational Background										
10+3/diploma	2	33.33%	1	12.50%	4	33.33%	2	25%	9	26%
First Degree	4	66.67%	6	75.00%	8	66.67%	6	75%	24	70.59%
Master's Degree & above	0	0	1	12.50%	0	0	0	0%	1	2.94%
Total	6	100%	8	100%	12	100%	8	100%	34	100%
Age										
Below 25	2	33.33%	1	12.50%	2	17%	3	38%	8	24%
26-35	3	50%	3	37.50%	4	33%	2	25%	12	35%
35-45	1	16.67%	4	50%	4	33%	3	38%	12	35%
above 45	0	0	0	0	2	17%	0	0%	2	6%
Total	6	100%	8	100%	12	100%	8	100%	34	100%

The general interpretation of basic demographic information of the AHMC focused functional units' gender sample taken for survey questionnaire were analyzed from table 5 above, 4 (66.67%) of the Accounting-Finance Department male and 2 (33.33%) of the survey indicates females. In the HRM Department the gender survey shows about 6(75%) of the workers are males and 2(25%) of the workers are females. The Patient Management dept workers are males and 8(66.67%) of the sample taken are females and 4(33.33) of this departments are females. In the proportion of male at Pharmacy Dept, shows that 4(50%) and the females also 4(50%) of the workers survey represented. This indicates that most of the workers are males 22(64.7%) and 12 (35.3%) of the survey collected those highly experienced and selected informants in the hospitals. With regarding to educational qualification, most of the employees 24(70.59%), were First Degree holders while 9(26%) were 10+3 (diploma) holders and 1(2.94%) was Master's Degree and above holder. Therefore, educational qualification of the respondents indicated that they have the capable to provide valuable information with better graduate staffs and highly experienced workers. In relation to Age, 8(24%) of the respondents it has below 25 years youngest, 12(35%) it has for 26 to 35 years, 12(35%) were it have for 36 to 45 years, 2(6%) it has for above 45 years of the researcher to obtain dependable information, as the respondents were well familiar with the performance of their offices as a result of which they are able to identify good informants for this research performances including the issue of the problem under study.

6.4.1.2. Demographic Information of the Respondents

Respondent's demographic information of each AHMC functional areas are as follow:

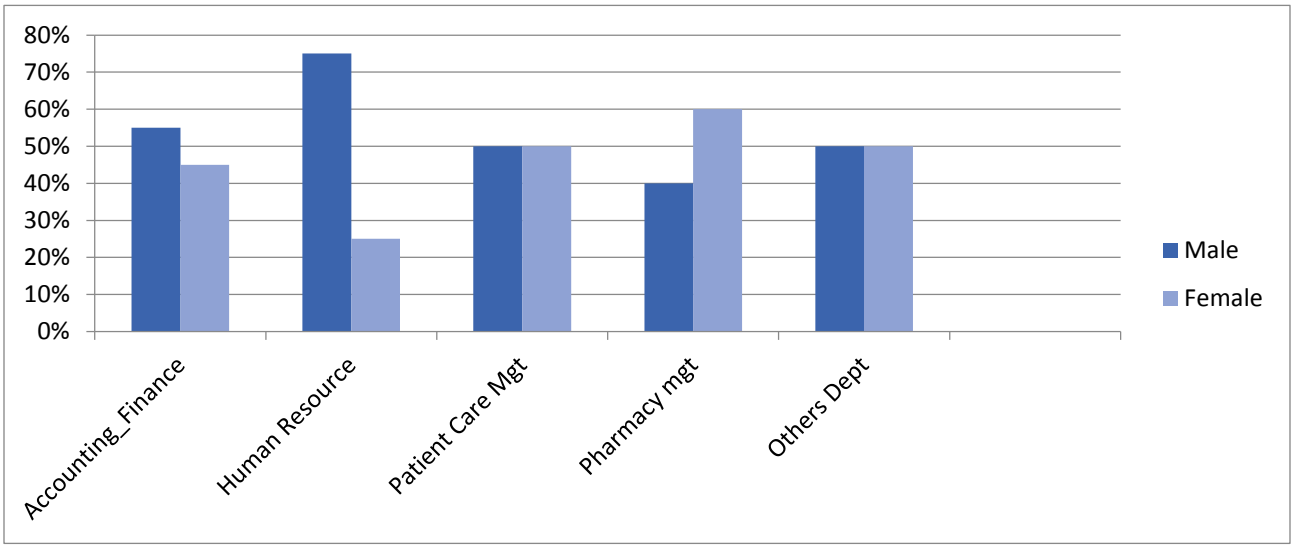

Figure 17: Demographic Information of Each AHMC Functional Areas

According to the informant data collected from the staffing composition of the Adama Hoapital Medical College proportion of most employee category was Human Resource department of total informants from this male informatm70% and Female 20%. And similarly, in patient care and other department informant were n both male and female data collected about 50% in the same percent. In pharmacy management department the proportion of data collected female employee is dominant based on the collected data which is about 60% coverage. In the accounting and finance department the data collected more informants were male and female 55% and 45% respectively.

6.5. Interview Results

According to all the interviewees' survey with hospital top management of each functional units and IT Workers, the concept of ERP system is attractive and the overall system implementation in the hospital is create better awareness for them. The basic goals of this ERP implementation in the hospital, which are business process standardization, integration and central data warehouse, are started with the ERP system with encouraging results even though these have still to be enhanced and extended. The main critical success factors functionalities and achievements of this ERP system in the hospital are very important. Even if the staff had no know how about ERP knowledge, their expectation of ERP implementation in the hospital that support many operations with integrating them into one server system. Once their interest is identified through interview, the framework designed and evaluated as above in the hospital using Odoo ERP software.

6.6. Questionnaire Survey Data Results

The basic CSF of ten factors identified as important for ERP success for the hospital was considered as very vital for the system implementation. So that this key items were distributed on survey questionnaire for confirmation and importance ranking by twenty-three respondents of staffs using sample selection from each department and twenty students and twenty customers of the hospital. Most of the survey responses were with "Important" and "Very Important" ranking as can be seen from the survey results summary in tables 6 below and the details in appendix 3. Based on the result of survey questionnaire on CSF for hospitals' the researcher analyses the collected data as follow.

According to Likert scale 5-point standard: 1=strongly disagree; 2=Disagree; 3=Undecided; 4=Agree; 5=strongly agree.

Table 11: Questionnaire Survey on IS on (CSF) for AHMC by No. of Respondents

s.no.	***Critical Success Factor***	***1***	***2***	***3***	***4***	***5***	***Average***
1.	Data accuracy	0	0	4	11	8	4.17
2.	Better data management	0	0	6	9	8	4.09
3.	Customer satisfaction	0	0	4	13	6	4.04
4.	Database backup and restore	0	0	7	13	3	3.83
5.	Training, documentation and knowledge transfer	0	0	2	12	9	4.3
6.	Top management support and commitment	0	0	3	10	10	4.3
7.	Integration ERP system and IT support team	0	0	3	11	9	4.26
8.	Adequate infrastructure and facilities	0	0	4	16	3	3.96
9.	Business process Reengineering	0	0	3	13	7	4.17
10.	Change management and communication	0	0	4	13	6	4.09

1. Data Accuracy

Data accuracy is an essential characteristic of correctly operating ERP software. The more accurate master information is in the system, the better information flow among the functional areas. It executes a result of the better customer's satisfaction and business performance achieved.

2. Better Data Management

ERP packages contain several modules, such as finance, human resource and customer and patient care management. Each module should be clear cut procedures and process of master data. Data incorporated thereon need to be accurate, complete, timely and consistent.

3. Customer Satisfaction

In ERP system integration the customer satisfaction is one of the pillars of the hospital objectives. As a result, the system expected to take great strides toward improving your customer satisfaction by improving and streamlining your business processes through an ERP solution.

4. *Database Backup and Restore*

In ERP system implementation, there should be also the system backup methods and restore system would be reserved by the system designer of ERP.

5. Training, Documentation and Knowledge Transfer

Most of the reports point to poor training as a major cause behind failed ERP implementation ERP changes the way hospital do business but, instead of training everyone in the hospital on how to do business differently, they are trained on new computer software.

6. Top Management Support and Commitment

Top management role in any company play a very great in implementing ERP system. They should be a positive commitment, enthusiasm and support of senior management for the project members. Top management commitment is the main critical for the successful implementation of an ERP system.

7. *Integration ERP System and IT Support Team*

According to the definition of ERP system is an attempt to integrate all functions across a company to a single computer system that can serve all those functions' specific needs." The hospital ERP system is trying to provide organizations with a total set of integrated applications that meet all the hospital functional units demand.

8. Adequate Infrastructure and Facilities

During ERP Design adequate infrastructures such as computers, network, hardware, software, and highly required to implement the ERP system in any organization. Enterprise infrastructure required that support of critical business processes.

9. Business Process Reengineering

Business Process Reengineering is during a redesign and reorganization of activities of enterprises and realization of business processes taking into account and application of involves changes in structures and in processes within the business environment. The entire technological, human, and organizational dimensions may be changed in BPR.

10. Change Management and Communication

The change management is a careful attention must be given to change management, as the ERP implementation would be involve changes to business processes. An organizational change management strategy should be developed that to maximize productivity and customer satisfaction as a direct byproduct of ERP technology. Communication is the most critical aspect of change management for an ERP implementation.

6.7. Discussion

To develop models that can show the hospital functional units' integration, Odoo ERP vendor was used. The Unified Model Language (UML) explains the hospital each modules using use case diagram, Class diagram, Sequence diagram and state machine. This UML model is the best that describe the hospital activities. According to respondents the system designed using odoo vender was a positive system that approves the following activities.

The system was easy to understand, increase customer satisfaction, reduce the hospital cost at large, helps the physicians in order to treat the patients and appointment them, the data redundancy was removed, the administrator easily made decision, and the odoo system integrate each hospital modules in easy way.

Moreover, the system was add data, update data, edit data, and can delete the data depend on the system functionality. Therefore, adding modules entity or attribute into the system that can improve the performance of system in solving problems. Additionally, the prototype provides a high percentage of the relevant systems for query which enable the user to use the hospital functionality. Therefore, systems performance of the ERP implementation for hospital is 82.8% accuracy. So this system proposed an encouraging result as the prototype system has given a high percentage of appropriate recommendations for the hospital. This shows that a promising result is achieved in the study.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATION

In the chapters, an attempt has been made to discuss the summary of major findings, conclusions, and recommendations. Thus, the concluding remarks based on the results of the study that has been made which is followed by the suggestion of future studies recommendations that need to be undertaken to fill other gaps by interested researchers.

7.1. Summary of Finding

- According to the study conducted in the hospital data collected, analyzed and evaluated the following finding is drawn. From the point of views from respondents' reply that the current hospital system is manual based system and disconnected one another with respect to working areas. Implementing ERP system software in the hospital brings all the functional units into one centralized data base server.
- Understanding of ERP system through questionnaire, interview and designed ERP implementation that integrate all working functional units simplify to generate report easily and decision making in well-organized manner and integrating four selected modules of the hospital using Odoo open ERP software.
- From this research summarizes that averagely over 82.8% of respondents of the AHMC agree to accept and support the ERP implementation in the hospital that should be radical move from manual working process to computerized system.
- Concerning suggestions of respondents about improving processes and workflow efficiencies across the four functional units of the AHMC are that, ERP would be create good working process, more efficient, more effective than the existing system if really applicable.
- From the evaluation has been made with key personnel of the hospital and ICT experts, the study had showed that the designing of ERP framework for AHMC seems to be applicable and necessary with using open ERP software Odoo software.

7.2. Conclusion

In view of the fact that, there are several factors that can affect the quality of service delivery in the hospital. Currently, Adama hospital Medical College uses paper based system in the hospital functional areas. The staff members are also not fully trained the use of computer application system. There is also the problem of hardware equipment in the hospital to operate the system.

Therefore, it has many problems related with the service delivered in the hospital such as the quality of service, and patient satisfaction. This research would contribute to better understanding of the use of ERP open source of Odoo software and solve the current problems in the hospital. The methodology used in this research was the techniques used for analysis and design of Hospital ERP design in this paper was Odoo 10.0 open source ERP software, PostgreSQL 9.5, and. Microsoft Visio 2013 was the tool used for the analysis and design of this system.

This research has tried to answer what factors are critical to determine the success of ERP system implementation. It has presented results of detail study of ERP implementation considering the case of ERP system in Adama Hospital. The main objective of the study is to design a framework for Adama Hospital Medical College using open source ERP system, Odoo that integrate all its functional areas in one system.

The study also has conducted detail interview discussions, questionnaire, observations and documents review.

Success factors such as study includes:, Data Accuracy, Better data management, Database backup and restore, Customer satisfaction, documentation and knowledge transfer, Top management support and commitment, Training-documentation and knowledge transfer, Integration ERP system and IT support team, Business process Reengineering, Adequate infrastructure and facilities, and Change management and communication are high ranking findings of this study as to be critical success factor for ERP system implementation in the hospital. There are also some contextual success factors considered as evaluative by top hospital managers and ICT Professionals of the hospital.

Furthermore, the research can be used to contribute to the ERP implementation using open ERP is can save the cost of purchasing other ERP software like SAP, and Oracle.

7.3. Recommendations

The following recommendations are given based on this study of designing ERP framework with an analysis to develop IS system in the AHMC. The hospital may use this research report as an initial document for implementation of ERP as a model. The hospital should integrate the rest functional units of the hospital (laboratory, logistic, purchasing, teaching modules, HMIS) while implement the system, for full functionality of the hospital. The hospital should provide training on basic computer skill and ERP system to its staff the hospital should recruit an IT professional to manage problems related to IT and ERP system. The hospital should provide a better infrastructure to deploy the system.

So, the researcher recommends and suggests the following points for further research works.

- Other Ethiopian organizations planning to implement ERP system can consider the critical success factors identified in this study as input for managing their ERP research.
- More single and multiple case studies of ERP implementation should be conducted in Ethiopian organizations to strengthen the findings of success factors.
- Each ERP critical success factor can be a research topic for further research.
- The ICT department should be encouraged with infrastructure in the hospital and training the staff with Computer system and ERP system very important.
- There are many different sub-modules under this hospital also have their own detail database such as doctors, nurses, and laboratory.
- Anyone who interest to integrate this system with other health stations or hospitals can also conduct in the future research.

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Appendices

Appendix I: Interview I

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY
SCHOOL OF ELECTRICAL ENGINEERING AND COMPUTING
DEPARTMENT OF COMPUTING

A. Appendix 1: General Interview Guiding Questions

Interview Questions

The importance of this interview questions is to design ERP system implementation for AHMC using open ERP software Odoo that is support for the development of an enterprise Resource Planning system for AHMC. The interviewer stores the answerers‟ reply using pen, paper, and voice recorder of mobile phone as well. I would like to thank for your cooperation and valuable information.

A. Interview For Expert/Professional Staff

- What is your working department?
- What are the functional areas of AHMC of existing system?
- Do you think these systems are problems?
- If your response yes, tell me some of the constraint?
- Which functional areas of the hospital are expected to be more important to implement ERP system?
- What you know about ERP system implementation? Tell me about it.
- Any ideas and comments of your experience on this research.
- What do you think should be fulfilled for ERP success from your experience in Ethiopian context?

B. Interview For Customers Or Patient English/Afan Oromo/

- Do you satisfied with the services delivered in this hospital?
  Tajaajila hospitaala fayyaa Kun kenutti hagam takka gamaddanii jirtan?
- What kind of problems you face during your visit this hospital?
  Rakkoolee akkamittu isin qunname yeroo hospitaala kanatti fayyadamtan?
- How do you think these services are modified?
  Tajaaajilli asitti kennamu osoo maal tae foyya'e jetanii amantan/ gorsa kennitu?
- What are the strengths and weaknesses / challenges of this research work?
  Qorannan kun ciminna isaatii fi dadhabinna isaa maal jettanii tilmaamtu?

Thank you very much again for your support!

Guddaa galatoomaa gaaffii fi deebii kanatti nu gargaaruu kessaniif

Appendix II: Interview II

Interview II

Write appropriate answer for each question

1. What is the current organizational structure of your hospital? Is that having a complete hierarchical structure?
2. How do you hiring the new employees in your hospital? How long time it take to hire the employee?
3. What are the functional areas that carry out in this hospital and how their activities under each area operated?
4. Who are the responsible body to receive drugs to store in the pharmacy and how?
5. What are the steps executed after patient registration system with doctor including handling and prescription?
6. Who is the responsible person to check and allot the availability of rooms and what he/she does if there is no available room for the patient in some medical operations?
7. Could you tell us the way of collecting payment from patient registration up to patient discharging and way of auditing? Who is responsible for auditing?
8. If IS system implemented in the AHMC what current problems do you expect solved?
9. Please tell us what problems do face on the current system?
10. Do you have any automated functional areas in the hospital currently?

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DEPARTMENT OF COMPUTING

Appendix III: Questionnaire I

Questionnaire to be filled by Experts/staff

RESEARCH TOPIC: Designing Enterprise Resource Planning (ERP) System for Adama Hospital Medical College/AHMC/

Dear Experts/Respondents!

The aim of this questionnaire is to collect information to fulfill the requirement to *Designing Enterprise Resource Planning (ERP) System for Adama Hospital Medical College* by taking AMHC to integrate all internal departments. Enterprise Resource Planning Systems are software packages that provide the complete integration of information of various functional processes within an organization. Enterprise resource planning (ERP) framework for Hospital the performance of organizations mainly depends up on the knowledge, skill and ability of employees. I would like to assure you that this study is purely academic and hence would not affect anyone in any way as all the information will be kept confidential. Rather, the results of this study are believed to be invaluable input to improve the practice of integrating different stakeholders and functional units. Therefore, your genuine and frank response to the questions is very vital for the quality and successful completion of this study. The accuracy of the information you provide highly determine the reliability of the study. Thus, you are kindly invited to respond to each question items carefully and responsibly. Your help is much appreciated and please don't hesitate to contact me if you have any questions.

Contact address :Mobile :0911017362, Email:muhe.tuke@gmail.com

General Direction

- You are not required to write your name.
- Respond to all closed-ended question items by putting (√) mark in the boxes and to all Open-ended ones by writing your comments on the spaces provided.
- It is possible to use Afan Oromo, Amharic or English in giving comments.

Name of Institution _____

Working Department/Units/ _____

PART I - PERSONAL DATA

-Please put (√) in the box

1. Sex: Mal☐ Female: ☐

2. Age:

Below 25 years: ☐ 26-30 years: ☐ 31-35 years:☐ 36-40 years: ☐

41-45 ears: ☐ above 45 years: ☐

3. Educational background:

I. Completed high school: ☐

II. Certificate/ Diploma: ☐

III. College/University degree: ☐

IV. Master's or doctorate degree: ☐

PART II: Questions Related to the Research Topic

4. In which functional unit do you work?

Financing: ☐ ICT:☐ Pharmacy: ☐

Patient care mgt☐ Human resource management: ☐ Others: ☐

5. Do you have basic computer skill to operate a common operation related to your work?

A. Yes B. No

6. If your answer for question one above is "Yes "what type of training?

A. Beginners B. Basic C. Advanced D. Other:

7. Please tell me the numbers of the hospital workers.

A. Below 200B. 201-300 C. 301-400 D. Above 400

8. Please tell me the number of patients served in this hospital daily.

A. Below300 B. 401-500 C. 501-600 D. Above 1000

9. Is there any IS (ERP) systems implemented or in the process in your organization?

A. Yes B. No

10. What is the current stage of IS implementation in your hospital?

11. Which department initiated the idea for adopting an IS system?

A. IT department B. HRM C. Accounting and Finance D.Pharmacy E. Patient care management F. Other

12. Do you face difficulty in performing your job related tasks under existing information system settings?

A. Yes B.No

14. If your answer for question12 above is "Yes", what do you think needs to be done to improve the existing information system support?

_____ _____

15. How do you rate your agreement for automating your department with computerized system?

A. Strongly disagree B. Disagree C.Neither-agrees-nor-disagrees

D. Agree E. Strongly agree|

16. Currently, where do you store the data related to your works?

A. On data base in file cabinet B. On Computer files folder C.Both D. Other

17. Currently, how much time it takes you to provide data needed by customers?

18. How do you evaluate the satisfaction of customers with the existing information system support?

A. Very dissatisfied B. dissatisfied C. neutral. D. |Satisfied E. Very satisfied;

19. If your answer for question 17 above is "Negative/dissatisfied/", what do you think is the problem?

A. Lack of training for existing staff on basic computer utilization

B. Lack of automation of the functional areas

C. Lack of better data/information management

D. Lack of appropriate software to support functional areas

E. Lack of knowledge and skill

F. Underestimating the benefit of information system G. All

20. Currently, when you request report or data from other department, how often do you get answers?

    A. Immediately. B. one day. C. about half the time. D. half day E. two days or more.

21. Do you agree if the functional units at AHMC are designed and consolidated under the ONE integrated system services?

    A. Strongly disagree B. Disagree. C. undecided D. Agree E. strongly agree.

22. How frequently do you get work related information from your lower level employees?

    A. Never B. Rarely C. Sometimes D. Very often E. Always

23. What types of system you are using currently in AHMC software/IS system?

24. How do you receiving and delivering information from and to your staff members?

    A. Manual based report B. Computer base. C. Both way D. Other

25. From which of the following functional units do you receive data / information?

    A. Accounting& Finance
    B. Patient care management
    C. Human Resource department
    D. Pharmacy Department E. All F. Other

26. Have you used or know ERP information system?

    A. Yes: B. No C. To some Extent

27. Mm If "No", how do you rate your agreement for using ERP in the future?

    A. Strongly disagree: B.Disagree: C.undecided D.AgreeE.stronglyagree

28. is there any efforts made to implement IS/ERP at AHMC?

    A.Yes B.No

29. If "No", what do you think was the reason?

    A. Lack of experts in the field
    B. Lack of financial resources
    C. Lack of material resources
    D. Lack of attention from the part of the management

30. Do you believe automation of the four main functional units in the Adama Hospital Medical College will improve productivity and better customer satisfaction?

    A. Strongly agree: B. Agree: C. Undecided: D. Disagree: E. Strongly disagree:

III. Please identify the level of your agreement on each Critical Success Factor according to (IS) ERP implementation success in your hospital.

How do you evaluate the existing IS system in regards to the following characteristics?

According to Likert scale 5-point standard:

1=Strongly disagree; 2=Disagree; 3=Undecided; 4=Agree; 5=Strongly agree.

s.no.	*Critical Success Factor*	*1*	*2*	*3*	*4*	*5*
1.	Data accuracy					
2.	Better data management					
3.	Customer satisfaction					
4.	Database backup and restore					
5.	Training, documentation and knowledge transfer					
6.	Top management support and commitment					
7.	Integration ERP system and IT support team					
8.	Adequate infrastructure and facilities					
9.	Business process Reengineering					
10.	Change management and communication					

Evaluation Questionnaire

1. Name of the Department: _____

2. Designing Enterprise Resource Planning is developed for Adama Hospital Medical College to integrate functional units to share data/information from one main server. Do you think this framework could improve the current system of your hospital?

Yes: ☐ No: ☐

3. Do you think that IS (ERP) could easy your workload; if really applicable in your office?

Yes: ☐ No: ☐

4. As IT expert; the designed ERP framework for your office fit with your current IT infrastructure?

Yes: ☐ No: ☐

5. If your office accepts this ERP framework design; what do you feel as IT expert?

Appendix IV: Performance Evaluation Points

Table below shows performance evaluation by leader expert question and evaluation criteria.

AHMC Evaluation by ICT experts and top managers

The ratings are 1(poor), 2(fair), 3(good), 4(very good) and 5(excellent).

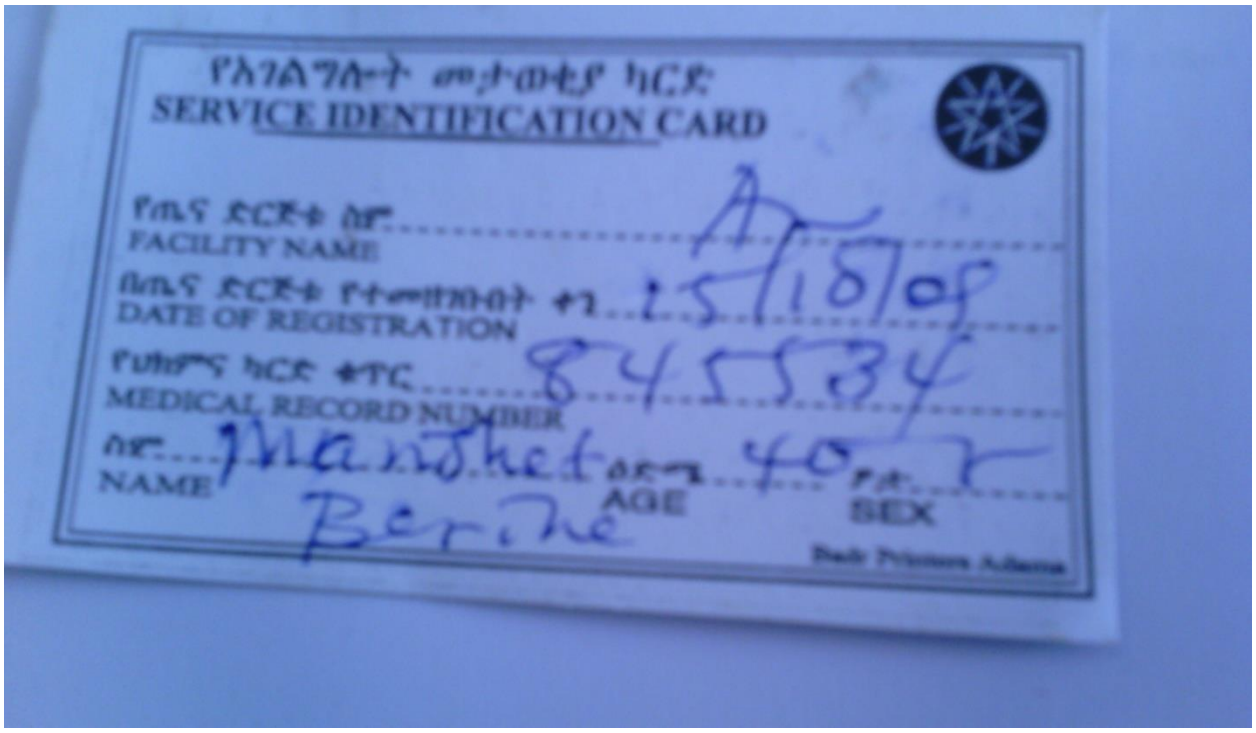
		Performance value					
No	***Criteria of Evolution***	***1***	***2***	***3***	***4***	***5***	***Average***
1	System Clarity						
2	Space for Data Storage						
3	User Interface of modules						
4	Providing Easy Search						
5	Update Data System						
6	Improving Better Communication						
7	Duplication removal						
8	Controlling Data confidentiality						

Thank you very much for your cooperation!

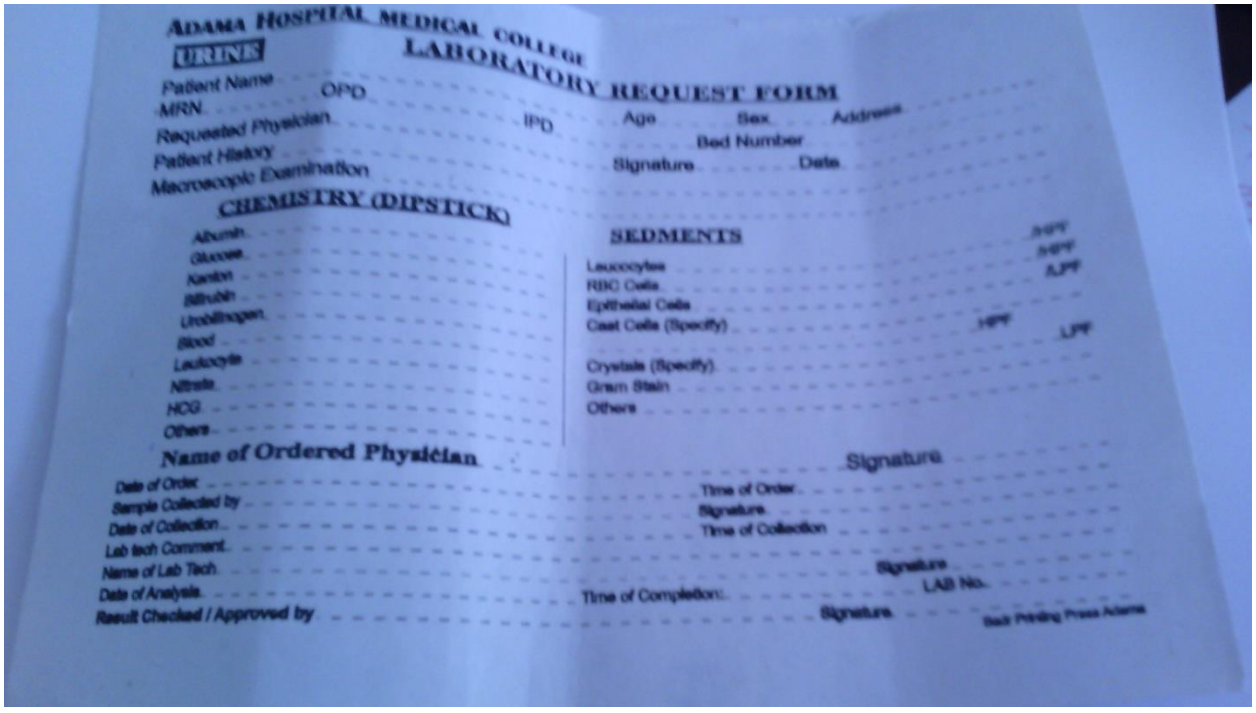
Mohammedaman Tukie
Adama Science and Technology University,
IS Department
Adama. Ethiopia
March/April, 30, 2017

Appendix V: Manual Formats used in the Hospital

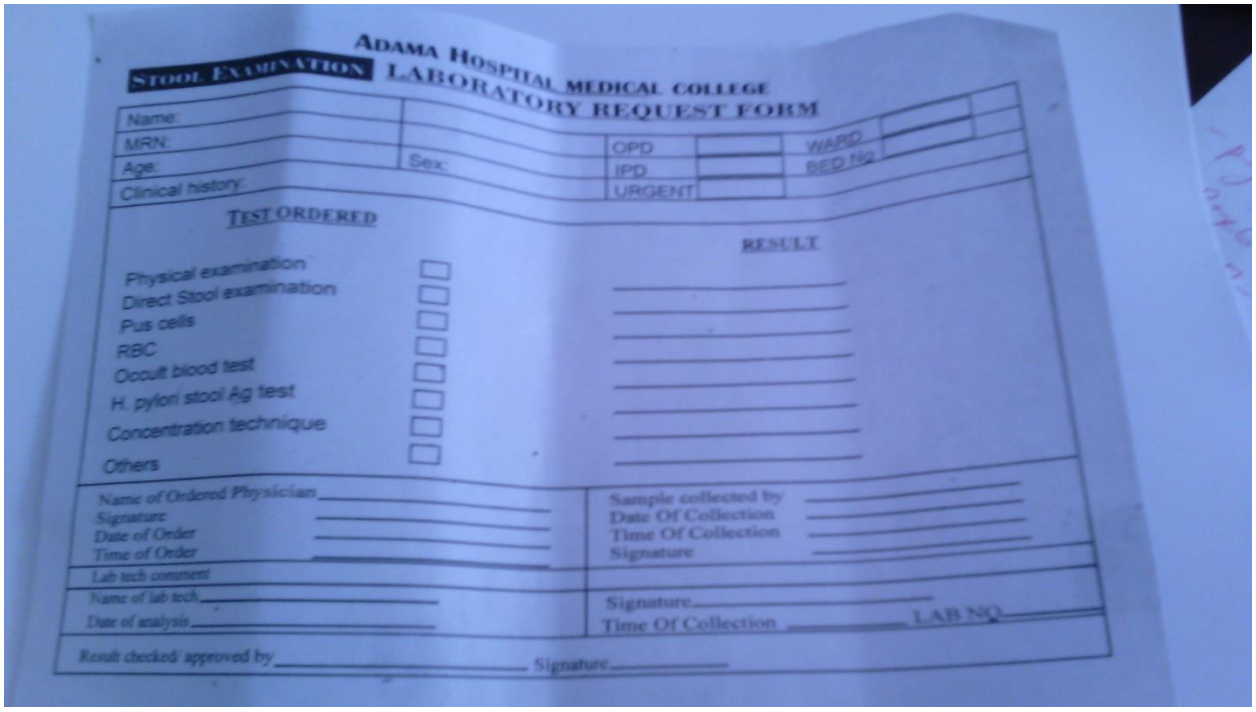
I. Identification Card of Patients



II. Laboratory Urine Test Form



III. Laboratory Stool Examination Form



ADAMA HOSPITAL MEDICAL COLLEGE
STOOL EXAMINATION LABORATORY REQUEST FORM

Name:
MRN:
Age:
Sex:
Clinical history:
OPD
IPD
URGENT
WARD
BED NO

TEST ORDERED

RESULT

Physical examination
Direct Stool examination
Pus cells
RBC
Occult blood test
H. pylori stool Ag test
Concentration technique
Others

Name of Ordered Physician
Signature
Date of Order
Time of Order

Sample collected by
Date Of Collection
Time Of Collection
Signature

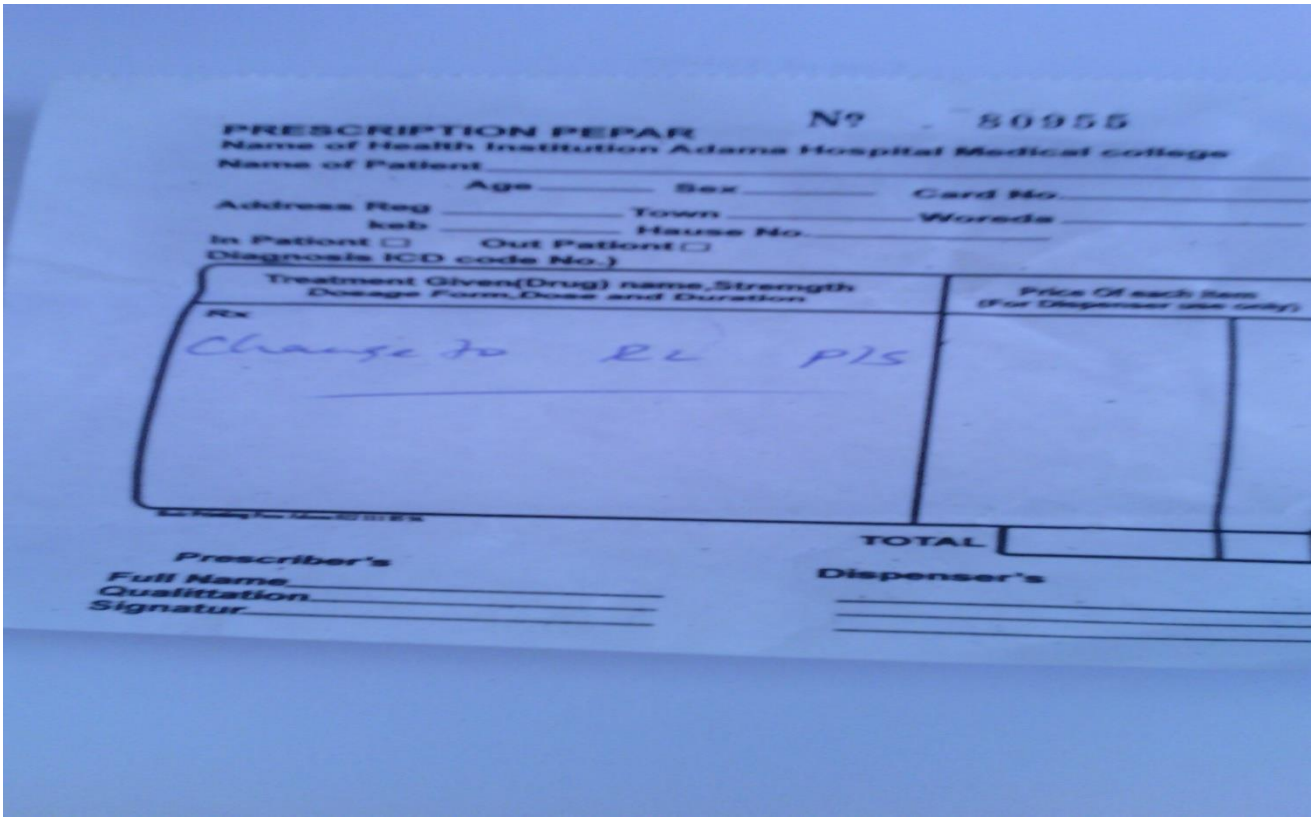
Lab tech comment

Name of lab tech
Date of analysis

Signature
Time Of Collection
LAB NO

Result checked/ approved by Signature

IV. Physician Prescription Form



PRESCRIPTION PEPAR
N? 80955
Name of Health Institution Adama Hospital Medical college
Name of Patient
Age Sex Card No
Address Reg Town Woreda
keb House No
In Patient Out Patient
Diagnosis ICD code No.)

Treatment Given(Drug) name,Strength
Dosage Form,Dose and Duration

Price Of each Item
(For Dispenser use only)

Rx

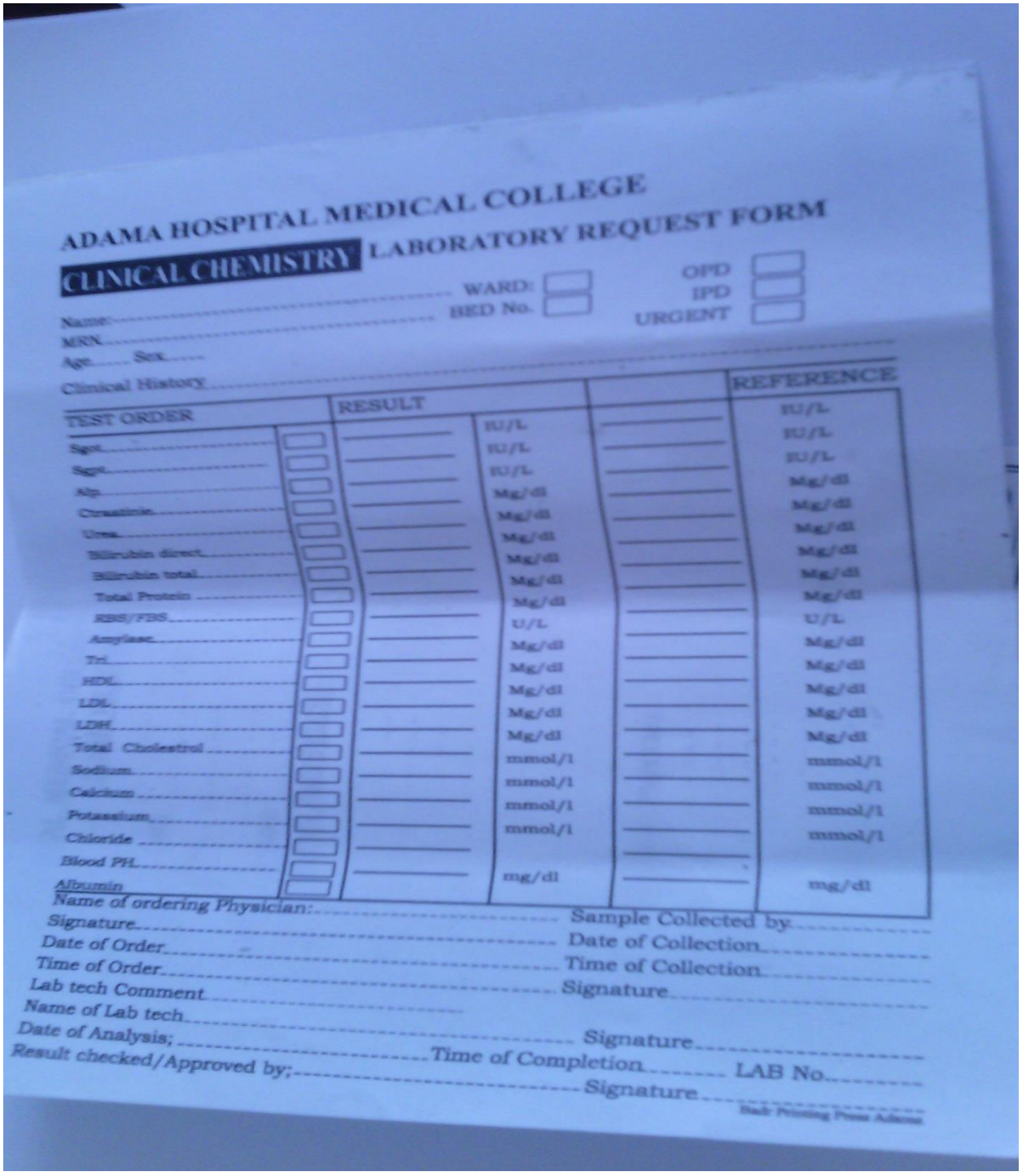
Change to EL PIS

TOTAL

Prescriber's
Full Name
Qualification
Signatur

Dispenser's

V. Clinical Chemistry Examination Form



ADAMA HOSPITAL MEDICAL COLLEGE

CLINICAL CHEMISTRY LABORATORY REQUEST FORM

WARD: OPD
BED No. IPD
URGENT

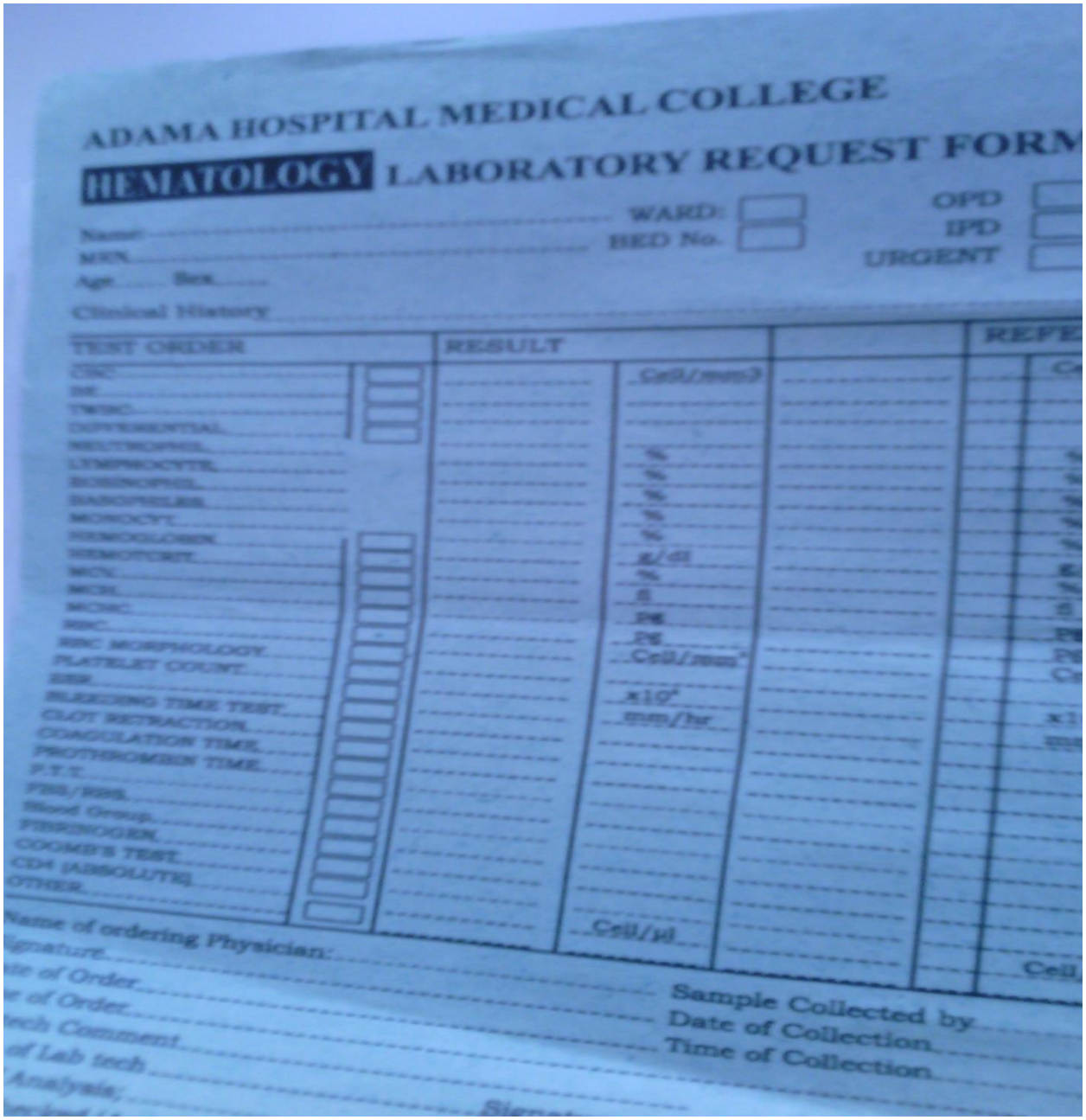
Name:
MRN
Age Sex
Clinical History

TEST ORDER	RESULT			REFERENCE
Sgot		IU/L		IU/L
Sgpt		IU/L		IU/L
Alp		IU/L		IU/L
Creatinin		Mg/dl		Mg/dl
Urea		Mg/dl		Mg/dl
Bilirubin direct		Mg/dl		Mg/dl
Bilirubin total		Mg/dl		Mg/dl
Total Protein		Mg/dl		Mg/dl
RBS/FBS		Mg/dl		Mg/dl
Amylase		U/L		U/L
Tri		Mg/dl		Mg/dl
HDL		Mg/dl		Mg/dl
LDL		Mg/dl		Mg/dl
LDH		Mg/dl		Mg/dl
Total Cholestrol		Mg/dl		Mg/dl
Sodium		mmol/l		mmol/l
Calcium		mmol/l		mmol/l
Potassium		mmol/l		mmol/l
Chloride		mmol/l		mmol/l
Blood PH				
Albumin		mg/dl		mg/dl

Name of ordering Physician: Sample Collected by
Signature Date of Collection
Date of Order Time of Collection
Time of Order Signature
Lab tech Comment
Name of Lab tech
Date of Analysis; Signature
Result checked/Approved by; Time of Completion LAB No
Signature

Badr Printing Press Adama

VI. **Hematology Examination Form**



ADAMA HOSPITAL MEDICAL COLLEGE

HEMATOLOGY LABORATORY REQUEST FORM

WARD: OPD
BED No. IPD
URGENT

Name:
MRN
Age Sex
Clinical History

TEST ORDER	RESULT			REFE
CBC		Cell/mm3		
DIFFERENTIAL		%		
RBC MORPHOLOGY		Cell/mm3		
PLATELET COUNT		x10³		
ESR		mm/hr		
BLEEDING TIME TEST				
CLOT RETRACTION				
COAGULATION TIME				
PROTHROMBIN TIME				
P.T.T.				
FBS/RBS				
Blood Group				
FIBRINOGEN				
COOMB'S TEST				
CD4 (ABSOLUTE)				
OTHER		Cell/µl		Cell

Name of ordering Physician:
Signature
Date of Order
Time of Order
Remarks/Comment
Name of Lab tech
Analysis:

Sample Collected by
Date of Collection
Time of Collection

VII. Financial Payment Invoice Form