

INVESTIGATING ENTERPRISE APPLICATION INTEGRATION (EAI) ADOPTION FACTORS IN HIGHER EDUCATION: AN EMPIRICAL STUDY

A thesis submitted for the degree of Doctor of philosophy

By

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DEDICATION

This thesis is dedicated with my love to:

My mother and my wife

My sons and beautiful daughters

Their support and encouragement made this achievement possible

Naseir Aserey

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Foremost, I would like to express my sincere gratitude to my advisor Prof. Sarmad Alshawi for the continuous support of my Ph.D study and research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my Ph.D study.

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PUBLICATIONS

The following publications have been produced as a direct result of this research:

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ABSTRACT

The Higher Education (HE) sector of a country is a key area indicating the progress of cultural, political and social growth and development. Public and social demands as well as technological developments add new challenges for this sector. Consequently, higher education institutions have changed and a more flexible IT infrastructure is required to enable them to adapt efficiently to competitive business challenges. Enterprise application integration (EAI) is a technology that effectively integrates intra- and inter-organizational systems.

Firstly a systematic review of the EAI literature was conducted. From this review, it was apparent that there are no theoretical models for EAI adoption and evaluation for higher education. Hence, this research contributes a conceptual model that includes influential factors derived from the literature and combines them with the proposed classification of influential factors for HE to produce an EAI conceptual model for the HE domain.

To validate this proposed model empirical research was conducted. Then, the model was tested using a qualitative case study approach by means of three case studies that were conducted at different universities. Exploratory, explanatory and interpretive data analysis phases were implemented to find what is the current EAI process of HE and how these institutions currently work. In addition, these phases were employed to identify the EAI adoption factors in HE. As a result of this analysis the conceptual model was modified because of complementary factors that emerged.

Therefore, the main contribution of this research is a comprehensive and novel model for EAI adoption in higher education area. The adoption EAI factors were identified by extracting a number of parameters from the empirical data. Several important factors that influence and assist the adoption of EAI in HE were identified. Hence, an additional contribution is the classification of factors in EAI adoption into technical and social factors which provides a better understanding of these factors. A further contribution is the derivation of a new classification of the EAI external and internal pressure factors. The development of a consistent model for the adoption and evaluation of EAI in HE is based on these factors.

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1 CHAPTER ONE: Introduction and Overview

1.1 Introduction

The application of information systems has become vital for every organization and it is a trend to integrate internal information systems with online services. Many organizations rely on a wide variety of collaborative applications to support their activities and to share resources (Iqbal *et al.*, 2013). An important part of this trend is the use of Enterprise Application Integration (EAI) technologies to address different strategic issues with respect to the information system and infrastructure of the organization. Özkarakacak *et al.* (2014) mentioned that EAI solves an existing problem that started when central processors no longer executed all applications.

The continuous developments in different sectors, including higher education, are stimulating the utilisation of e-commerce in order to improve e-business processes. Since higher education is an important sector for development, and in particular within the context of developing countries, it becomes doubly important. The institutions of higher education cannot be considered as discrete entities as they involve other components. For instance, the academic and administrative framework, staff and students all these components are performing their responsibilities at different levels within higher education. On the other hand, the introduction of information and communication technologies (ICT) has created the possibility of improvements to effectiveness and efficiency in education related processes, especially in the higher education sector (Ben Youssef and Dahmani, 2008). Several studies have highlighted that the EAI adoption models, or frameworks, are sector specific, e.g. local government, healthcare sector and private organizations (Kamal *et al.*, 2013; Chen, 2005; Khoubati *et al.*, 2006; Mantzana *et al.*, 2007; Themistocleous, 2004). Moreover, Benmerzoug (2013) reported that EAI is an active research domain. The incorporation of EAI in the higher education sector provides huge benefits. These benefits are encouraging the process of integration, which is ultimately implementing e-services and facilitating the transfer of information that assists collaboration as well as the decision-making process. It can be concluded that the EAI adoption models or frameworks in higher education are of the same importance, or even more important, as in any other sector.

1.2 Research Problem

Beynaghi *et al.* (2014) reported that HE plays a significant role in fostering the adaption and development of societies during times of global change to help them to compete and survive. Bektaş and Tayauova (2014) suggested that universities make an important contribution to the economy and social life. So universities' effectiveness is important for countries' organizations. Most HEIs implement a variety of information systems. Aserey *et al.* (2013) reported that several computerized applications supporting the academic and administrative functions operate as staff and student record systems arranged at different levels. It added that these systems can be classified as follows: Student Services Systems (SSS) for example, E-Management Education System (EMES), Online Student Services (OSS) and On Demand University Services (ODUS); Academic and Staff Services Systems (ASSS) for example, Educational Affair System (EAS), Performance Management System (PMS); Administrative Services Systems (ASS) for example, University Jobs System (UJS); University Bids System (UBS) and other Extra Services Systems (OESS) for example, Communications Systems. However, these systems lack integration and consistency due to isolated and fragmented computerized applications so HEIs have integration problems. Janssen and Cresswell (2005) reported that the contents and overlapping functionality in the applications are "isolated islands of technology". Cui and Chae, (2011) reported that legacy systems are vital to any organization but it is not an easy task to deal with them and since the redesign and the replacement of legacy systems are costly, they continue to be used by organizations. The legacy systems have poor performance and compatibility compared to modern alternatives but their evolution is a complex task. Also Ehikhamenor *et al.* (2014) mentioned that the legacy applications are difficult to upgrade and maintain and it is impossible to keep them up-to-date. They cannot be improved and they cannot meet the organization's prerequisite requirements (Janssen and Cresswell, 2005; Paradauskas, 2006). Kamal and Themistocleous (2006) showed that there are many problems due to lack of integration, such as data redundancy, inconsistency and high maintenance cost. Moreover, according to Paradauskas (2006) legacy applications are posing multiple serious problems to their organizations. The most serious of these problems are:

- Systems usually run on obsolete hardware which is slow and expensive to maintain
- Maintenance of these systems is more expensive since tracing faults is costly and time consuming due to the lack of documentation and a general lack of understanding of the internal workings of the system

- Integration efforts are greatly hampered by the absence of clean interfaces
- Legacy systems are very difficult, if not impossible, to expand

This, in fact means that HEIs have a problem to keep up with the rapid growth in enrolments and mounting pressure for change and they are unable to match requirements for expansion. Moreover, they are not good at handling the content of educational programs.

EAI provides substantial benefits, such as assisting with business process integration, facilitating e-service based transformation and supporting collaborative decision-making. Moreover, Özkarakacak *et al.* (2014) mentioned that EAI:

- Links various systems, applications and data sources across the organization
- Helps organizations to integrate multiple protocols, data sources and varying processes into a cohesive unit although it has old and new systems
- Supports business processes effectively through linking applications, whether purchased or developed in-house
- Is a process of integrating several applications so that information among these applications will be shared and applications might be executed with different environments, operation policies and programming languages
- Integrates individual applications into a flawless whole such that data and business processes exchange seamlessly across applications.

So, EAI has been initiated to tackle integration problems in a more flexible and controllable way (Stal, 2002). Strategic business solutions can be integrated within and across the component parts of the information system infrastructures of an organization using the EAI technologies (Sharif *et al.*, 2004). EAI can be described as the procedures and tools to modernize consolidate and integrate computer applications within an organization (Mckeen and Smith, 2002).

Thus, all the aforementioned problems illustrate that there is a need for HEIs to adopt integration solutions such as EAI to integrate their legacy applications in order to support coordination within organizations, enhance the decision-making process and provide better services within HEIs.

1.3 Significance of EAI for Organizations

Roztocky and Weistroffer (2009) stated that “EAI technologies are essential to integrate several Information systems, and hence a positive effect on business is expected”. Ehikhamenor *et al.* (2014) reported that the advancement of IT technologies and improved

end-user environments have highlighted the demand for EAI or at least have created the motivation to develop EAI. The impetus for EAI is that it permits a business-arranged approach to guide business structures as opposed to innovation driven business procedure reengineering. The EAI apparatuses create a system that join applications at the business object level. At the end of the day, there is a probability that usefulness will probably build within a brief period, if numerous organizations permit innovations from one another (Bajgoric and Moon, 2009). In practice, EAI could be actualized in four separate levels:

- Expanding customary information mix inside a regular model.
- Linking business forms and information at the requisition interface layer.
- Sharing business rationales all around the enterprise at the part level.
- Leveraging the client interface as the groundwork for incorporation.

Verify the suitable methodology to support the organization to administrate their cost. Chen (2009) reported that EAI integrates IS that are designed for multiple business functions. Significant benefits have been acquired for organizations which have integrated their IT infrastructures through EAI (Bass and Lee, 2002). The EAI approach has been taken up by organizations because of its capability to reuse existing machine applications to streamline forms and the relative accommodation of design rather than the modified reengineering needed to execute Enterprise Resource Planning (ERP). Some strategies such as incorporating proprietary middleware have recently underpinned EAI items. For example, Vitria, Active Software, Software Technology, and Cross Worlds are the widely used tools of EAI. A few limitations of EAI applications have been identified. In spite of the fact that the time taken to implement EAI is less than that needed for ERP's business methodology reengineering stage, it is in any case a lengthy task. Furthermore, fruitful EAI usage requires that there exist solid correspondence, coordination, and participation between data innovation and business faculty. While the EAI approach at first eases off the speed of execution, because of the need to guarantee understanding and combination around work force, generally it can end up being valuable as contrasted with the "push-situated" ERP usage. Initially, ERP authorises standard business techniques to business faculty, then requires business staff to disguise later those courses of action. Finally, EAI architecture requires business-mapping procedures. In light of the fact that EAI does not utilise institutionalized business handle like ERP, a basic need is to integrate the divided applications of business organizations that are also reliable in nature (Lee, Siau and Hong, 2003).

1.4 EAI and its Significance in HE

EAI has emerged to overcome integration problems in the organizational infrastructure. According to James Fenner (2011), EAI is the: “*the combination of processes, software, standards, and hardware resulting in the seamless integration of two or more enterprise systems allowing them to operate as one*”. Jun Tao, (2014) said that the issue of EAI is a critical one for modern organizations to address. In the context of HE, based on a critical review of the normative literature, EAI adoption has not been investigated in HE, thus research around this area remains limited (Aserey, 2013). Buchanan, (2013) reported that HE is vital to the sustainability and competitiveness of emerging educational organizations. Aserey (2013) reported that studies showed that HEIs use a diversity of information systems to support their academic and administrative services. However, this diversity of various and, in many cases manual, solutions causes numerous integration problems. Azevedo *et al.* (2014) said that the advancement of business and technology, globalization and improvements in competitiveness are factors leading enterprises to adapt to the most recent technology in order to overcome the technical issues of IS. Özkarabacak *et al.* (2014) mentioned that EAI solves an existing problem that started when central processors no longer perform all applications. Also, Sohimi (2011) reported that EAI has been become more popular due to the advantages that exist in the EAI component which can offer different services to the organization. So EAI will be benefiting the HEIs by making more educational services available to all of the HEI’s stakeholders. Chen Zhigang (2009) said that the most important thing is that EAI can help an enterprise provide new businesses rapidly, focus the clients, implement personal and customized services and adjust the business operation according to market requirements. Also EAI can promote an enterprise’s competitive advantages more effectively and make it adaptive to a rapidly changing market. Where, Kristoffer Renholm, (2011) mentioned that EAI will continue to be relevant as large enterprises continue to employ many different systems, even though cloud computing and the move to the web relocates systems from the enterprise itself. Moreover, Jadeja and Modi (2012) reported that the biggest concerns about cloud computing are security and privacy, since handing over crucial confidential data to another organization alarms some people, “So users will hesitate to some extent in adopting cloud services as they can't keep their organization's information under lock and key”. EAI evolved to overcome the limitations of ERP and other applications and legacy systems by providing an integrated organizational infrastructure (Janssen and Cresswell, 2005; Lam, 2005; Volkof *et al.*, 2005). It provides substantial benefits e.g. assists in business process integration, supports collaborative decision-making, results in reduced integration costs,

provides security and privacy of citizens' data, and results in developing flexible, maintainable and integrated IT infrastructures. The gap of this research founded since Aserey et al., (2014) reported that there is absence of theoretical models for EAI adoption in HE sector. From this point of view comes the impotence to tackle the problem of EAI adoption in HE sector.

1.5 Analytics in Higher Education

Information technology (IT) and its tools have been utilised in higher education for a long time. Likewise, with any new technology, a mixture of terms has been devised to describe ideas and practices. Yet a preparatory investigation of education and expert literature revealed inconsistent terminology. Despite the fact that these problems are not unexpected in a new and advancing field, the researcher accepts that this subject is now at a point where the standardisation of terminology is justified.

The best example of IT analysis is EAI since it utilises an integrated data driven approach to co-ordinate information between operational applications. All information about what data needs to move, when it ought to move, what changes to execute as it moves, what courses of action to utilise for disaster recovery, and so forth, has been recorded in the metadata of the EAI. These data plus application connectors are utilised at run time for synchronisation. Centre point and spoke, publish and subscribe, high volume, low idleness substance based steering are all key characteristics of an application of EAI. The application of EAI shows a set of applications combined by means of an innovative implementation. Depending upon the topology of the system, these designs are occasionally called an undertaking administration transport or reconciliation centres (Norris *et al.*, 2008).

1.6 Scope of the Research

Azevedo *et al.* (2014) reported that because of the growing need for IS integration, several solutions have emerged called EAI. It enables several forms of application integration with lower costs and less code. Besides, the context for IS integration is no longer in the applications structure, but it is now the organization as a whole. Roztocki and Weistroffer (2009) found that EAI is currently considered to be a well-established technology and has been implemented by several organizations. The main goal of the study is to identify the importance of EAI in the HES of Saudi Arabia since the main challenge is to sustain the standards of higher education. In recent years; several leading nations have been investing to develop new skills, research and learning backgrounds that are helping them to achieve

international standards in their higher education institutes. In addition, these efforts are also creating sources of competitive advantage within the global market of education. This success is vital to the Saudi Arabian institutes of higher education for the country's growth and economic development. Although the higher education institutes of Saudi Arabia are investing for sustained competitiveness, challenges are still on their way. The use of IT applications at universities is not only beneficial for the students but other employers and the national economy are also benefiting from the performance of higher education. Hence, the HEIs should provide a high standard of education and must be equipped with an appropriate environment so that they can serve as a source of learning and development. The HEIs are important in terms of making their contribution to the social capital of the country in addition to their main objectives to train, and educate people. These accomplishments cannot be possible without the application of information technology since, even a single business organization needs a fully implemented management system which can fulfil both the external and internal integration of its business operations (Kamal *et al.*, 2009).

One of the strategic tools to achieve this purpose is the EAI which provides support to the business of the organizations. In the middle of the 1990s, the approach of EAI was developed. The primary objective behind the development of this type of database was the integration of business operations of any organization within the low cost strategy framework in comparison to the existing programs and applications. In actual terms, EAI is associated with computer applications that are able to assist planning through their methods and tools within the organization's operational domain and improve its overall functionalities. On the other hand, EAI is the overall process of integration of different organizational processes. Ordinarily, an enterprise has existing legacy requisitions and databases and needs to utilise them while adding or moving to another set of applications that take advantage of the Internet, e-trade, extranet, and other new technologies. The phenomena of EAI might include advancing a completely new standpoint of a venture's business and its applications, figuring out how existing applications fit into the new view after innovating ways to productively reuse existing facilities while including new requisitions and data (Kamal, 2006).

1.7 Impact of the Research

Today, IT has become critical for the successful functioning of any enterprise. HE is an area of key importance especially in developing countries because it leads cultural, political and social development. Education helps prepare people to cope with these

challenges (Wu, 2007). The inability to meet the need for a much improved higher education system will make a genuine and observable difference. Higher education is specifically ranked as one of the most important factors in a country's development. The worldwide colleges have been moderated to legitimize and produce instruments that endeavour and encourage the transportability of information. There are exceptions to this general principle. A small number of organizations have been pushing the limits, with improvements in IT in higher education (Bertrand, 2010). Legacy systems are frequently seen as a problem, especially when they do not support current business objectives or are hindering possible developments. Additionally these legacy systems are normally substantial. The expense of maintaining them is extremely high and they have a tendency to prevent the business from reacting quickly enough to changes, as they are not sufficiently adaptable to permit significant modifications. With the development of data and communication techniques, such as information and communication technology (ICT), it is now feasible to enhance the proficiency and adequacy of administration inside HEIs. Thus, Enterprise Application Integration (EAI) gives significant benefits, for example supporting business process reconciliation, expediting e-Service based change, supporting collective choice making, reducing coordination costs and creates adaptable and maintainable combined (IT) frameworks. Furthermore, EAI is considered to be a good platform for interfacing different frameworks, applications, and information sources. EAI may be characterised as the unhindered sharing of data between two or more enterprise applications, or as a set of protocols that permit the development and exchange of data between separate applications and business processes. An EAI task is concerned with combining the IT applications in the HEIS. According to Ehikhamenor *et al.*, (2014) enterprise-wide business processes, e.g. e-business and supply chain management are supported by the integration of large numbers of information systems. These systems such as legacy and enterprise resource planning systems are integrated by implementing EAI. In addition, EAI has been identified as an integration solution for organizational frameworks and applications. In this way, EAI combines different strategies that are utilised to make data frameworks work together in the large enterprise like higher education organizations. In our Case, when application obtains other framework in the organization, different frameworks must be integrated within the institutions (Irani *et al.*, 2003).

Furthermore, Lam and Shankararaman (2007) said the business problems, that undertaking EAI can help solve include the following:

- Information integration: aggregating, ordering, and introducing data from different IT sources in one single perspective.
- Single point input: replacing the need for manual entry of data into several IT applications separately with data entry into a single IT application
- Process wastefulness: reducing the effort and time needed to complete business forms and eliminating manual errors
- Web channel integration: enabling Web based clients to accomplish and guide access to applications.

1.8 Aims of the Research

The main aim is to investigate and analyse the factors which affect the adoption of EAI in the HEIs. In doing so, the result is the development of an EAI model that may assist the HEI's decision making process for EAI adoption.

1.9 Objectives of the Research

The objectives of this research were to:

- Critically review the EAI literature to capture the significant factors in EAI adoption with a particular focus on higher education
- Examine and evaluate factors influencing EAI adoption in higher education
- Develop and propose a novel model for EAI adoption in higher education
- Test and evaluate the model within a practical environment and provide a novel contribution to the field of EAI adoption

1.10 Research questions

- How do the EAI factors influence higher education?
- Why are EAI factors used in building a conceptual model in higher education?

1.11 Outline of the Study

This research considers the adoption of Enterprise Application Integration (EAI) within the higher education sector of Saudi Arabia. The study comprises six chapters. The first chapter offers a brief introduction that will demonstrate the areas to be observed and topics to be covered. The second chapter is the literature review where a number of literature studies by various authors were gathered to illustrate the related ideas and theories. The third chapter introduces a conceptual model of enterprise application integration in higher

education institutions. The fourth chapter describes the methodology used for carrying out this research while the fifth chapter contains the analysis and discussion, which will focus on the areas covered in this research. The researcher takes into consideration the empirical data to revise the conceptual model. Finally, the sixth chapter presents an overview of the study and its findings.

1.12 Road Map

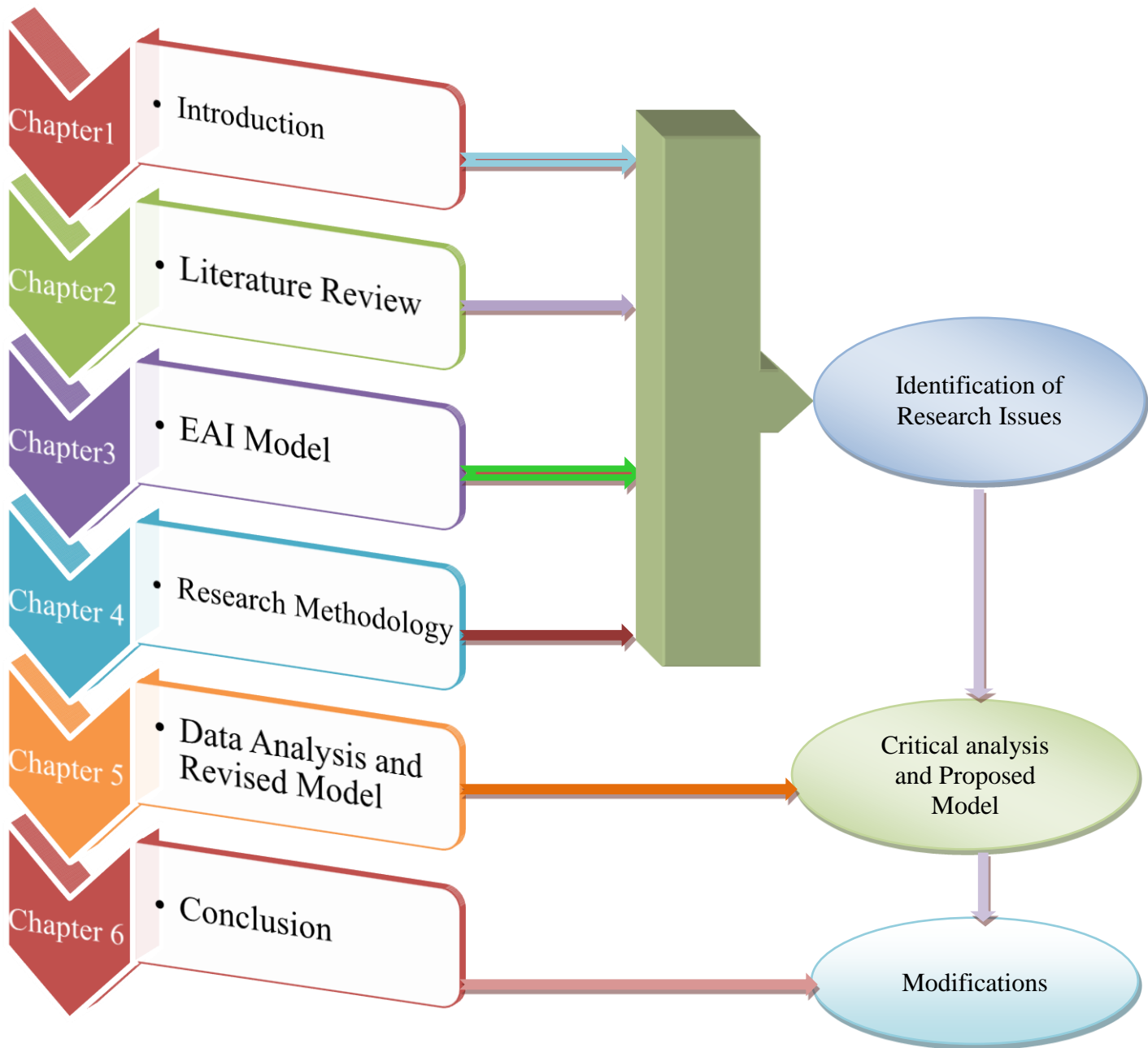


Figure1.1 Road Map

2 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter covers the existing literature of EAI from research papers since new developments have arisen from the early 1990s to the present. Information technology (IT) is a general term in the 21st century. However, in the 1990s the concept was very popular. Many large companies are now integrating IT systems to gain a competitive advantage in the industry. IT is a system of computer-based applications used for communication to save, manipulate and transmit data. The term IT is mostly used as a synonym for computer networks but this term also encompasses other technologies for information distribution such as telephones and televisions. IT is a term used for computer-based assembling, storing, retrieving and manipulating of information to support management decisions in designing, developing, implementing and monitoring the managerial strategies to attain or sustain competitive advantage in an industry. With new developments in data technology, organizations are helpless when they do not react to those innovations in a quick and appropriate way. Core competencies, nevertheless, are almost always created by using the compatibilities between systems to make them work together. Regularly engineering seems to lead businesses. However, it is imperative to analyse the similarity between innovations and the functionality of the current system. The same holds for venture incorporation. Organizations ought not to hurry into innovations. Top administration should first strive to comprehend their business needs for combining their efforts, and after that select a technique of undertaking integration. To attain agility and adaptability in organizations, there ought to be an excellent level of correspondence, co-ordination, and participation in human resources and data technology. In this sense, worldwide organizations have actualised the thought of combining business structures.. It satisfies the necessities of both organizations and clients.

This research focused on the utilisation of EAI process especially in the higher education sector. In the higher education sector, different institutes are competing based on the different programs that they offer. One of the most important issues for HEIs development is that every institute wants to be ranked first in survey lists in magazines. The thing that makes one institute different from another and makes it special is its efficiency which comes from reducing the level of risk, improving the education quality and the use of information technology. Use of EAI provides a competitive edge to one institute over

another by enabling it to manage the data and research in a way supportive to management. The need to research the impact of integration of IT systems in higher education is obvious (Hanson *et al.*, 2002). In this chapter, the researcher will discuss the existing research content and all the relevant factors regarding higher education institutes.

2.2 IT Integration Process

The persistently changing nature of the business arena has directed organizations to look for approaches to enhance their operation and increase their benefits. Managers have been pondering business process change, integration and change for some decades. Consistent with Harrington (1991) organisations have turned to business process change for numerous solutions as it enables organizations to:

- Concentrate on their clients.
- Keep the business' focus on courses of action.
- Furnish a system to prepare organizations to meet their future challenges.

Marchand and Davenport (2000) recommend that noteworthy changes might be achieved when organizations integrate and automate their processes at both enterprise and inter-enterprise levels. Azevedo *et al.* (2014) defined IS integration as the sharing of information and processes inside an enterprise or between enterprises. On the other hand, Peeraer and Van Petegem, (2012) mentioned that ICT is highly significant for the education reform agenda of different countries. ICTs have an important role for knowledge dissemination, efficient learning, and the advancement of more efficient educational services (Buabeng-Andoh, 2012). Kenneth Kernaghii, Justin Gunraj, (2004) reported that increasing the use of IT has been accompanied by growing of infrastructure that develop and manage IT tools, applications and policies and possession of large number of technologically skilled individuals, and added, the increased sharing and diffusion of information across the organizations can be effectively demonstrated through the remarkable growth of integrated service . Azevedo *et al.* (2014) reported that, the adoption of standards in IS integration has increased in the following aspects

- The integration of the internal or external processes within an enterprise
- The integration of all applications within an enterprise
- Supporting of the transactions in current IS
- Presenting of services available to others
- The complexity of the IS integration technologies
- The cost of IS integration

Moreover, (Themistocleous and Corbitt, 2006) said that IS integration helps data arrangement of organization with traditional technologies (for instance, distributed object technologies, interface-based technologies, and database oriented middleware) with new application technologies, e.g. message agents and adapters. Nah F. Fui-Hoon, Lau J. Lee-Shang (2001), reported that An enterprise resource planning (ERP) system is an application system that enables an organization to manage all resources by providing an integrated solution to present a process-oriented view of the business to: automate and integrate an organization's business processes; share data and practices across the entire enterprise; and. Produce and access information in a real-time environment. Themistocleous *et al.*, (2001) reported that ERP frameworks are incomplete answers for the automation and integration of business structures and ISs. EAI has been intended to underpin the integration of IS applications at intra- and inter- organizational levels (Zahavi and David, 1999).EAI is dependent upon situated integration technologies like application servers that permit organizations to fuse functions from unique frameworks.

2.3 EAI as an Integrating Concept

For several organizations, the integration of their various IS has been considered as a great challenge (Özkarabacak *et al.*, 2014). EAI has emerged as a reliable way to manage IT issues in a sophisticated manner, since EAI is capable of providing business solutions to different components of organizational information systems (Ana and Kresimir, 2009). Aserey and Alshawi (2013) reported that the preferences for EAI applications could be placed into five separate classes:

1. Managerial (for accomplishing additional standard profit for utilized venture)
2. Operational (for cutting the expenses of operation)
3. Organizational (for structured business processes)
4. Strategic (for coordinated effort between different suppliers and partners).
5. Technical (for co-ordination at distinctive levels that is information and process).

Therefore, EAI incorporates tools and techniques for planning, integrating and modifying computer applications within the organizations. Thus, it is responsible for transforming business processes and linking models to serve in ways that are more effective for improving intra-organizational performance. EAI is associated with the process-based integration approaches that cover the organization specific logics for processing data. Hence, EAI provides solutions to different organizational problems through integration. There is no doubt that nowadays business organizations are committed to develop IT infrastructure that can provide significant integration and benefits to enterprises. EAI under

the applications of information systems is responsible for establishing integration among people, departments, services and even organizations through modifying the traditional basis of doing business. Thus, five major benefits from EAI includes improvement in business operations, enhanced return on investment, reduction in operational cost, establishing strategic relationships and collaboration among suppliers and partners. These ultimately yield excellence in IT and technical operations through proper data processing. It has been a fact that developing an EAI system in any organization also faces some issues. These issues may be of a specific kind when the organization is a higher education institute (Sutherland and van den Heuvel, 2002).

2.4 Existing Research

There has been a limited amount of research done on the implementations of EAI especially in the higher education sector. Most research attention has been in the healthcare and private sectors. However, different models have been established in the market with relevant business processes and frameworks. But the adoption process is not easy, since factors like benefits, costs and barriers are also involved in determining the total worth for adoption. As far as higher education institutes are concerned, this can provide assistance to the adoption of EAI through decision-making analysis. It has been a fact that adoption of EAI in healthcare organizations is far different from higher education institute (Mantzana and Themistocleous, 2005). Some examples of the adoption of EAI in different organizations are as follows:

2.4.1 Healthcare Sector

There are several applications in healthcare serve various levels to support decision making process that function independently and their interconnectivity and interoperability has always considered a big challenge (Khoumbati, Khalil , 2003). Different healthcare reforms are to computerized and integrate healthcare information systems (HIS). However, the variety of business benefits in having an integrated HIS differs with organizational fit factors (Hung, Shin-Yuan (2014). Existing research has reported that proposed model for EAI should represent primary components like significance, issues and costs. Secondary components however, should incorporate motives behind adoption, assessment frameworks, IT infrastructure and support and motivation of managerial representatives and human resources. Existing research has not provided information about the accessibility of human resources and other social factors regarding the adoption of EAI especially in the healthcare sector. Therefore, the study of combinations of primary and

secondary factors could reveal improved approaches in healthcare sector. Themistocleous *et al.* (2009) reported that the non-integrated HIS are associated with less data and knowledge exchange and are reducing healthcare quality. Therefore, several medical errors have occurred that impact healthcare services. So these organizations have used EAI to integrate its applications to improve their services. Undertaking applications integration of intra and inter-organizational frameworks and process integration has brought about new solutions. It brings about additional organised business processes, builds co-ordinated effort around partners and realises process mixing. EAI furnishes an answer for intra- and inter-organizational frameworks and it integrates accepted traditional technologies, e.g. distributed object technologies, interface-based technologies, and database oriented middleware, and so on, with new application integration technologies, e.g. message agents and adapters, to underpin the productive correspondence with clients and business partners. Therefore, EAI can effectively fuse traditional applications and bundle frameworks and e-business results into an adaptable and rational platform. Due to this, EAI is generally implemented by different organizations to settle integration issues. The value added by EAI is paramount, as it reduces the expense of integration and the repetition of information. Proof from detailed analyses distributed in the range of EAI proposes a saving of half of the costs. Besides, EAI reinforces supply chains and furthermore enhances the relationships between organizations and suppliers. Additional profits that EAI bestows are information integration resulting in, dependable information exchange, a better security framework and exceptional quantifiable profit. EAI can additionally be utilised to make a reconciled foundation in health care organizations (Wei-Hsi Hung *et al.*, 2015; Themistocleous and Irani, 2002). Raghupathi and Tan, (2002) reported two key results of framework integration in the health care industry: internal integration of the frameworks and external integration. All of these could incorporate utilising EAI technology. This sort of integration can give critical profits to clinics and patients. Khoumbati *et al.* (2008) illustrated that the usage of EAI in healthcare organizations has acquired various benefits such as increasing the availability of the required information when and where they are needed. Better healthcare services were obtained when medical errors were reduced, patient satisfaction was increased and clinical process and support were integrated.

2.4.2 Banking Sector

Lam (2005) studied the important factors that affect EAI and several important factors for EAI systems were identified. This is based on a review of the literature in different areas, including Enterprise Resource Planning (ERP) systems. It serves as a bottom-up

methodology since its usage begins from the basic business processes. The EAI approach is arranged such that existing applications and business techniques are utilised to guide and integrate the various functionalities of an enterprise into a structure that is more adequate to parts of the whole. The EAI methodology is likewise planned as a top-down system, because of its business-mapping strategy. Li (2009) mentioned that EAI is an efficient method to implement commercial bank business systems and to develop information and data sharing. Furthermore, (Li, 2009) added that EAI optimizes business processes and contributes significantly to the integration of commercial bank application subsystems. Moreover, EAI empowers application integration over business object levels (Sutherland and Van Den Heuvel, 2002). Lam (2005) applied his model to the banking sector. The model includes three groups of factors, namely: top management support, the integration strategy and EAI planning and execution. In conclusion, it is found that EAI CSFs share many of the same CSFs as ERP systems and other information systems projects.

2.4.3 Manufacturing Sector

Application integration today has become a matter of the viable and proficient application of information technology and information based design. Some new assembling standards, for example virtual enterprise and mass customisation have brought about a distributed and self-sufficient assembling framework.

Liu *et al.* (2008) reported that EAI means IS for supporting manufacturing activities. This support is achieved by developing an integrated infrastructure to link disparate systems, data sources and applications within a corporate enterprise. From one view point, this will expand the competitiveness of a firm to respond to fast gathering dynamic changes in the business sector. This will increment the challenge of reconciling distinctive data and information frameworks found throughout the firm. This integration is called enterprise application integration (EAI). The philosophy for EAI has been developed for over a decade. However, no consensus has been arrived at. The decisions to develop information systems have been taken at the department level. Each department has chosen the best technology that suits its requirements (Santos *et al.*, 2008). Hence, EAI projects are included within the integration problem of the business.

EAI is becoming even more challenging because of the huge increase in different venture data and information frameworks. This study attempts a basic dissection of existing answers for EAI. The analyst acknowledges that EAI have two nonexclusive issues: syntactic integration and semantic integration. The principle issue of semantic integration can be reduced to the general issue of venture or business modelling. The primary issue of

syntactic integration amounts to the general issue of programming structural engineering of venture applications that empowers interoperability between any two-enterprise applications (Liu *et al.*, 2008).

2.4.4 Local Governments

This section covers the aspects of adoption of EAI by local government organizations and executive authorities. The proposed model for this purpose is committed to provide a methodology that defines an assessment for adopting EAI within the domain of local government especially concerned with decision-making. Kamal *et al.* (2013) reported that the operational structures of local government authorities are distributed in a way such that business processes are spread across departments and possibly across other government organizations. Consequently with such an organizational structure, the IT operations are harmonised with the principle information systems and the cross-departmental processes to bring about improved integrated services. On the other hand, Bigdeli *et al.* (2013) mentioned that Local Government Authorities (LGAs) are generally described as organizations with intensive information. Therefore, it is essential that LGAs share information effectively and their information requirements are satisfied. Although Inter-Organizational Information Sharing (IOIS) has been considered as a crucial aspect for the public sector, there is no available comprehensive framework to test the influencing factors which directly affect Electronic Information Sharing (EIS) among LGAs.

Similarly, less research is available on the utilisation of EAI in the local government sector and this lack is considered in the following perspectives:

- LGAs embrace new IT reactively in contrast with private organizations
- Lack of gifted staff and reluctance to embrace new advances, or absence of comprehension and understanding of EAI in LGAs
- LGAs have been exceptionally backward in adopting new technology
- LGAs are unable to respond proactively as technologies continually change and develop around them
- LGAs consider that the lack of certainty about the expenses and profits of embracing EAI is a focal issue
- Due to the absence of knowledge, LGAs are still hesitant to adopt EAI unless they are compelled to do so. This is other excuse for why LGAs might not know if and to what degree they should put resources into EAI and they are unable to estimate the benefits of these proposals.

The review produced a structure for EAI reception in LGAs. The structure is composed of four factors: cause, origination, proposal, and appropriation choice. The proposed model was utilised for the reception monitors, integration technologies and enhancement of IT framework operational matters. It proposes a precise of grouping the EAI appropriation variables according to their criticalness in the reception lifecycle stages. It was insisted that a process ought to be recognised throughout the adoption process of integration technologies within the domain of local government (Kamal and Themistocleous, 2006; Kamal and Weerakkody, 2010).

Additionally, , the research illustrated that EAI has the accompanying three fundamental sorts:

- Application-level EAI
- Data-level EAI
- Business process level EAI
-

Likewise the government information:

- Covers huge amount of information and spread over a wide range
- Requires an increased accuracy of the information
- Has particular bodies of information that need higher safety.
- Is affected by current policy
- Has an independent system through which information is conveyed.
- Has a variety of storage mechanisms

EAI incorporation of data assets of government framework identified within architecture, fittings, programming and forms, explicitly incorporated the accompanying four aspects: data, applications, and business process and interface integrations.

When EAI has been utilised as a part of an e-government framework, a researcher can build a conceptual framework for the e-government form the business integration of all application. Additionally, it can increase administration proficiency of with a specific end goal to integrate, administer and utilise the data assets even more completely, safely and quickly (Kamal and Themistocleous, 2006). Figure 2.1 represents the adoption model of EAI for local government authorities.

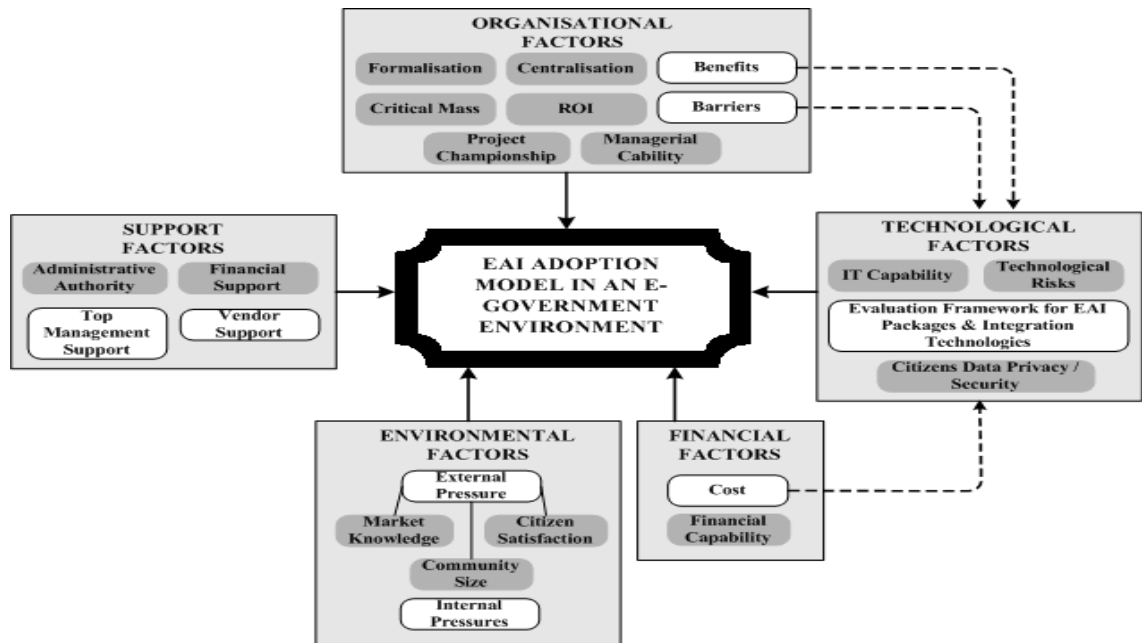


Figure 2.1: EAI adoption model for local government authorities (Kamal and Themistocleous, 2006).

2.4.5 Learning outcomes of Reviewing of the different sectors

A review of the different sectors of the EAI adoption literature indicates that the issues discussed earlier mainly emphasize overcoming their integration issues and improving their operations and functions, the concerns are related to a certain area. This means that these studies highlighted the EAI adoption models or frameworks which are domain specific, e.g. local government, healthcare sector and private organizations, so the EAI adoption model in HE could be based on the incorporation of these multiple views since the EAI is an active research domain, The incorporation of EAI in the HE sector as a new domain provides considerable benefits to this area.

2.5 EAI Adoption Factors

Further research could be done based on thorough analyses of every one of the components identified within the EAI selection exclusively. This is a territory where very little research has been done. Accordingly, the elements influencing the EAI selection in a distinctive categorisation ought to be concentrated on and dissected in order to understand the distinctive business functions. This will underpin the various studies and help them to understand completely the selected categorisation.

Themistocleous (2004) presented in a calculated model the components that influenced the adoption of EAI in the organization. These components specifically included cost, barriers, benefits, internal weight, external weight, IT foundation, IT sophistication, support, and

evaluation schema as demonstrated in Figure 2.2. This model could incorporate general persuasive factors from this model, such as cost, barriers, benefits, internal weight, external weight, and IT framework.

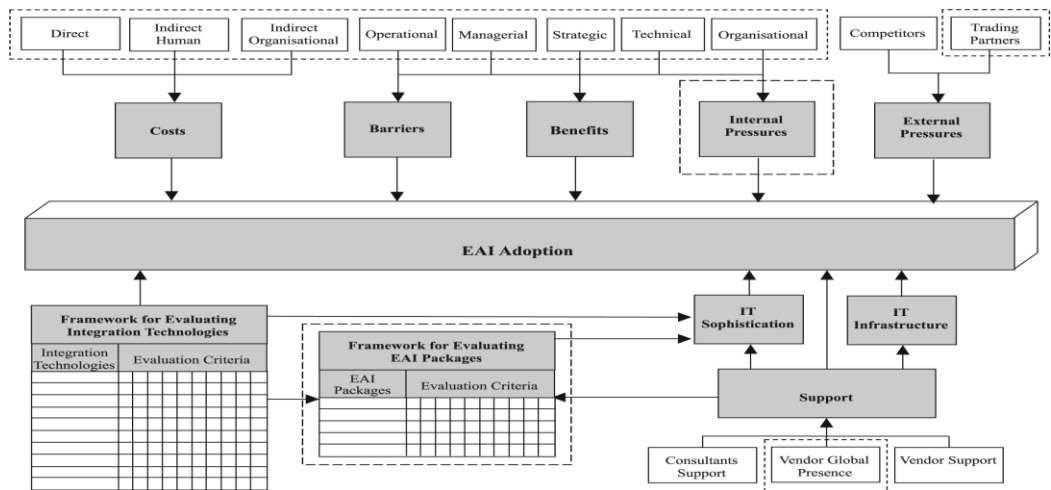


Figure 2.2: EAI model (Themistocleous, 2004)

Also, Wei-Hsi Hung *et al.*, (2015) determined the factors affecting EAI adoption, particularly in large healthcare organizations. These factors are categorized in three dimensions namely: technological, organizational, and environmental dimensions. These factors include several factors significantly affecting EAI adoption such as IT infrastructure, size, external pressure, internal pressure, and external support as in illustrated in Figure (2.3).

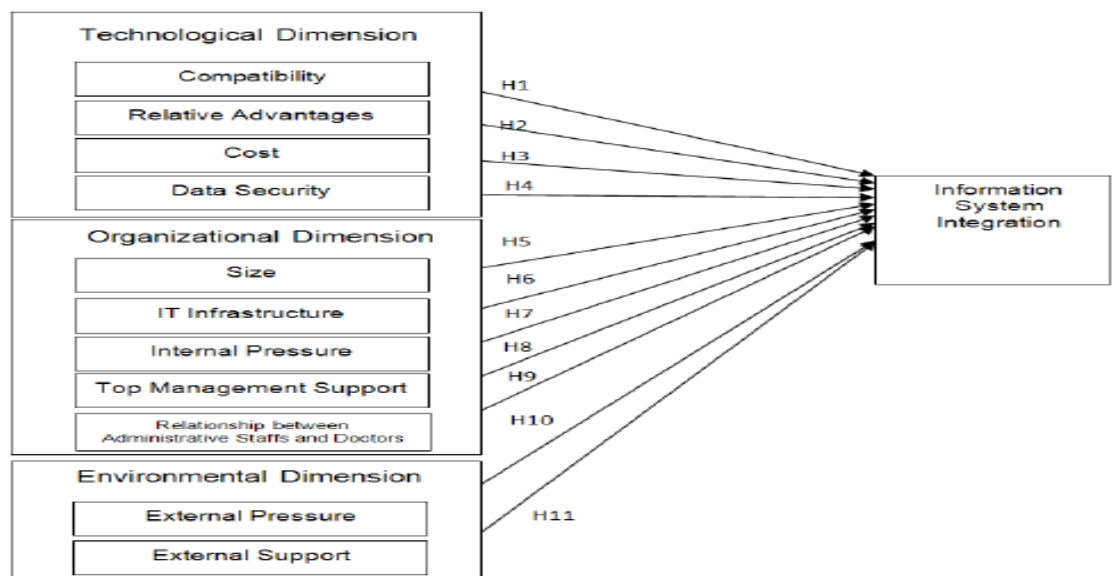


Figure 2.3: EAI model (Wei-Hsi Hung *et al.*, 2015)

There is a need for integration in any segment. Hence, further work will enhance the examination and help in better administrations and choice making. Therefore, different adoption factors have been identified namely: technological, organizational, environmental, support, and financial capability factors (Wei-Hsi Hung *et al.*, 2015).

2.5.1 Technological Factors

Ramdani *et al.* (2013) point out that the technological context has a high impact on enterprise application adoption. Some studies have indicated that the technology factors are the main factors affecting the decision to adopt EAI (Wei-Hsi Hung *et al.* 2015; Weerakkody and Jones, 2009; Aserey, and Alshawi, 2013). EAI adoption in the private and public domains is influenced by several factors when EAI adoption models are executed (Wei-Hsi Hung *et al.* 2015; Kamal *et al.*, 2013). Mantzana *et al.* (2008) and Bigdeli *et al.* (2013) indicate that the technological factors are related to the same set of factors. Therefore, these factors will be regarded as a group when examined and analysed. The technological factors include capability of maintaining IT networking, evaluation frameworks, technological risks and security of data.

- ***IT Capability***

Technological capability has been characterised as the main influential factor on organizations. Aserey, and Alshawi, (2013) and Bigdeli *et al.*, (2013) have illustrated that the technological factors such as IT capability are highly important issues since they influence the organization's decision to share information electronically. They pointed out IT proficiencies at the level of IT assets, IT staff learning and IT advancement of an organization. The usability and access of sufficient supplies in the organization is a major determinant of selection of technologies. In addition, the expertise of the work force is an essential variable that constrains the adoption of new advances. Thus, the governmental organizations contended that their representatives were not well prepared in utilising information technologies. Furthermore, this deficient preparation brought about resistance to change and utilisation, and underutilisation of computers. Finally, the complexity of the IT system determines the level of comprehension necessary for the administration and underpins the utilisation of IT to realise organizational targets. In this way, larger amounts of IT capabilities might influence EAI reception (Aserey and Alshawi, 2013; Kamal *et al.*, 2013).

- ***Evaluation Framework***

The market for integration platforms is greatly perplexing with an assortment of EAI applications and technologies taking care of diverse issues. Themistocleous and Irani

(2002) introduced a model that helped the selection of integration technologies and apparatuses. This model highlighted a blending of integration technologies that could be utilised to integrate an IT base. Such a system could be recognised as a device to enable choice for EAI selection (Khoumbati *et al.*, 2008; Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

- ***Technology Risk***

Issues identified with innovations are becoming a matter of concern. This is in light of the fact that the doubt connected with new technologies can make risk -adverse managers require higher rates of return before they will contribute. This makes engineering risk a paramount consideration for higher education representatives before they decide to choose from options for EAI adoption (Aserey and Alshawi, 2013; Sohimi and Binti Abbas, 2011; Kamal *et al.*, 2013).

- ***Data Privacy and Security***

Security and protection of subjects' information has always been vital. In an open and distributed domain, access control and validation systems are a vital consideration in higher education institutes. According to Wei-Hsi Hung *et al.* (2015) and Bigdeli *et al.* (2013) data security and privacy is undoubtedly an essential matter because citizens' data are confidential and there is a possibility of misuse of citizens' personal information by the LGA and its staff. As subjects' information might hold a proportion of the most significant data. For example, street numbers, credit history, obligations items (if any), financing and profits. Access to such data must be regulated since revelation to unauthorised parties might cause issues for citizens' security. Therefore, there is a need for a technology that furnishes the best security methodologies to higher education institutes (Aserey and Alshawi, 2013; Sohimi and Abbas, 2011; Kamal *et al.*, 2013).

2.5.2 Organizational Factors

Ramdani *et al.* (2013) showed that the organizational context has a high impact on enterprise application adoption Aserey and Alshawi (2013) and Bigdeli *et al.* (2013) reported that system failure in organizations can be caused by organizational factors. Unsuccessful project management, user requirements are not examined properly and the key stakeholders not being suitably involved are among these factors. The implementation process may be influenced by the role of top management and their effect on the degree of centralisation, size of organization, availability of finance, quality of human resources, and availability of internal resources (Ebrahim *et al.*, 2004).

Aserey and Alshawi (2013) reported that the organizational factors include formalization, centralization, critical mass, project championship, ROI, benefits, managerial capabilities and barriers.

- ***Formalization***

Aserey and Alshawi (2013) mentioned that the process of formalization defines the collection of procedures, which are clear in format having definite norms and instructions for handling and performing different tasks related to specific organizational operations. For instance, in higher education institutes, the management of the students' database is important in terms of their enrolment and the electronic storage of information about their admission, course selection, handouts, online papers and presentations and maintenance of students' portals. For that reason, formalization is responsible for creating a structured environment for the institutes or any organization, which is ultimately useful for designing the systems for planning and it includes the processing of information. On the other hand, written manuals and properly marked instructions can provide a more professional and formal environment that further removes any issues and helps the organization to successfully deploy the EAI adoption phase. It has been recommended that the adoption phase should consider the strategies of LGAs in terms of their adoption motives for EAI which ultimately lead to well-established deployment of EAI (Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

- ***Centralization***

The phenomena of centralization are important and significant with respect to the decision-making and authorisation concerns. For that reason, this conception of centralization is mainly involved in the organizational structure or especially in relation to hierarchy and authority issues. It is a fact that in any centralized organization, all the concerns regarding to decision-making are under the control of top/higher management. On the other hand, in comparison to the centralized organizational structure, the decentralised mode of organizational structure and the decision-making process is distributed among different departments or even different persons are involved in the procedure of decision-making. There is no doubt that the adoption of a specific IT system for the organization is dependent on approval from higher management, since the major portion of consideration and decisions come from the senior executives of the company. However, the IT department also plays a crucial role in convincing the top management about the IT system that the company really needs. For that reason, the conception of organizational structure

and centralization is also responsible for influencing the adoption of EAI in a particular organization (Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

- ***Critical Mass***

Bigdeli *et al.* (2013) considered critical mass as one of the factors that influences inter-organizational electronic information sharing and integration. It is an important factor and is playing a significant role in the adoption of EAI, or any other IT system, within the organization. For instance, the best example could be the EAI adoption by LGAs in which the decision for adopting EAI is also influenced by other government agencies, which have already established the adoption, or are in the process of adopting it. This indicates that organizations could be affected by other organizations in terms of similarities in size, operations, financial capabilities and budgetary constraints. These attitudes of organizations can be defined by the theory, which is recognised as “theory of Critical Mass”. This theory is effective in redefining the organizational relationship with other organizations. This concept indicates how to consider ways in which organizations having the same critical mass factors are responsible for influencing each other in terms of adoption of any IT system or EAI system. In addition, this behaviour can define the inter-organizational relations among them and thus produces impact with respect to the adoption of EAI adoption. For instance, an institute of higher education must consider the impact of progress of another institution with regards to EAI adoption before taking the final decision to implement the same within its organizational structure (Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

- ***Championship of Projects***

It has been a fact that any initiative is dependent on the individual thinking and perception about the motives that are involved in the development phase of a particular project. Championship is an important organizational factor and is also responsible for influencing the decisions for adoption of EAI system within the organizational domain. In practical terms, the terminology of championship defines the presence of an individual who is solely responsible, receives credit for taking IT initiatives in the organization or who is committed to developing IT systems for proper organizational operations. For that reason, the most important achievement of any champion is the successful adoption of an IT system along with ensuring that the implementation performs the organizational operations in the most authentic ways. Thus, individuals who are involved in the projects for implementing IT system are termed as project champions and they are actively engaged in promoting the motives behind the usage of IT systems in their organizations. These

individuals are not only involved in the implementation of an IT system, for instance EAI, within the organization but they also participate in the trouble shooting mechanisms. Hence, the presence of project champions is crucial for every organization. Higher education institutes must have this kind of facilitator who is responsible for making the adoption of EAI a successful project. Thus, project champions are the important facilitators in terms of adoption of EAI technologies with the higher education sector. There is no doubt that such facilitators have the potential to influence the adoption of EAI within the organizational domain because of their knowledge, skills and expertise (Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

- ***Significance of ROI***

An important factor is the Return on Investment (ROI), which is defined as the performance measure that is capable of evaluating the effectiveness and efficiencies of organization with its current investment in comparison to the existing investments. Adoption of EAI or any other IT system is part of the investment made by the organization. The comparison between cost paid and gain received by the company is one of the indications of successful EAI adoption and is mainly dependent on the high yield of gain compared to cost paid. Thus, a positive ROI is responsible for influencing investment related decisions. The ROI plays a significant role and is also important in the adoption of EAI, for instance in LGAs. This is because government agencies would usually spend less money in the establishment of IT systems within their domains compared to the implemented IT and EAI systems in other organizations or even in private companies. The main reason for spending less money or having a low investment ratio is due to the lower budget allocated for IT systems within their organizational domains. For that reason, these agencies become less interested in moving forward for IT investment and do not perform a ROI evaluation for taking effective decisions. This issue has led to the development of another factor that can also be considered as responsible for influencing the adoption of EAI (Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

- ***EAI Benefits and Significance***

An important finding reported by Themistocleous (2002) has expanded the list of benefits when the aspects of EAI are considered. These benefits cover the perspectives of operational, technical, strategic and managerial aspects. These are actively participating in the process of adoption of EAI in the organizations. Within the context of local

government authorities' models, the researcher explored the roles of mentioned aspects within the IT domain of higher education sector. The proper adoption of EAI in any organization is the symbol of proper communication and collaboration among individuals, units and departments. This ultimately improves the services of organizations and achieves effectiveness and efficiencies in operations. The researcher has highlighted the benefits of adopting EAI and recommended facilitators who should understand the significance of adopting EAI. Consequently, maximum efforts should be spent on implementing EAI systems within their organizations (Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

- ***Managerial Capabilities***

Managerial capabilities in organizations are ranked as an important factor (Bigdeli *et al.*, 2013). The abilities and capabilities of managerial level individuals are also important as a factor that plays a significant role in the adoption of EAI. These individuals have competencies and the potential to generate new ideas for implementing innovative IT systems. It has been a fact that IT systems are usually dependent on such individuals who influence other people to utilise their expertise in this medium. Therefore, IT technologies are the initiatives of those managerial representatives who have a technical IT background. Because of this context, managerial capabilities are the effective skills and expertise of managers through which they identify and highlight the current issues in the system along with the application of alternatives for addressing such issues. For instance, a manager with technical and IT knowledge is capable of developing diverse alternatives in order to solve the IT related issues within the organization. Thus, such characteristic of managers is also responsible for influencing the decision-making for adopting an EAI system in any organization. For instance, in higher education, university staff members should act as leaders, who bring potential outcomes through students' efforts. In the same way, these leaders can motivate the administration and other colleagues to collaborate with each other in the successful adoption of an EAI system within their domain (Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

- ***Barriers in the Adoption***

The implementation phase for any system often faces barriers. In the same way, the adoption of EAI systems in any organization, whether an LGA, any private firm or even higher education institute faces issues and barriers during its adoption phase. Similarly,

these barriers have been reported at the same levels: operational, technical, strategic and organizational levels within the organization. On the other hand, further studies have revealed other barriers such as cultural issues, political disturbances and the most important is the resistance to change. For instance, a higher manager takes the decision to adopt EAI without communicating with the employees and managers. This situation has ultimately led resistance to change which can be observed at any organizational level. Thus, barriers or obstacles may also be a factor when determining the adoption of EAI within the organizations. In addition, it has been reported that one of these barriers is linked to the cost of EAI adoption. Thus, cost is also considered as a barrier and organizations should consider this factor before proposing and implementing the EAI model (Kamal and Themistocleous, 2006; Kamal *et al.*, 2013).

2.5.3 Environmental Factors

Ramdani *et al.* (2013) points out that the environmental context has a high impact on enterprise application adoption. Environmental factors are important factors that would affect the outcome of information sharing (Bigdeli *et al.*, 2013). It is the field in which the organization conducts and influences its customers. One of the primary reasons for an organization's EAI adoption is that it could be driven towards the adoption by the actions of competitors. These factors establish connections with other organizations for better collaboration and expectations of citizens and business (Ebrahim *et al.*, 2004).

The environmental factors that have been considered in EAI adoption for an organization are external pressure, knowledge of market, community size, and internal pressure.

- ***Issues of External Pressure***

Regular expansions push organizations to seek better approaches to increment their productivity and look for feasible alternatives (Themistocleous, 2002). For instance, local government authorities connect with some stakeholders, either national or other administrative organizations: metropolitan powers, districts, unitary or shire powers, area board, region committee, ward and town committees. They continuously want better joint effort with organizations. Moreover, these nationals are continuously interested in better administration such as, instant question reaction, accessibility of information wherever is needed and information security. Consequently, this variable could be acknowledged for

the advanced EAI model (Wei-Hsi Hung *et al.*, 2015; Khoubati *et al.*, 2008; Kamal *et al.*, 2013).

- ***Issues of Internal Pressure***

Wei-Hsi Hung *et al.* (2015) and Aserey and Alshawi (2013) considered internal pressures as an important factor in EAI adoption model. The researcher has recognised this component as a fundamental in the adoption of EAI in higher education institutions. This component speaks to the numerous forces, for example specialised and managerial. Furthermore, these local governments and authorities have different drivers, for example enormous costs, nature of administration, correspondence mistakes, information security and protection, information repetition and honesty that affect the reception of new advances. These issues launch the selection of EAI in the organization.

2.5.4 Financial Factors

The financial factors include cost and financial capabilities for the adoption purposes of EAI within the organization.

- ***Financial Cost***

Expense is recognised as a huge element and numerous organizations perform a cost/benefit analysis before making a choice in regards to the organisation for improvement. Wei-Hsi Hung *et al.*, (2015), reported that the low costs can make the technology adoption easier. And added, however, the high costs make an organization unwilling to adopt new IT.

- ***Financial Capabilities***

Bigdeli *et al.* (2013) considered the financial capability as important factors which influence Electronic Information Sharing (EIS). Hence, it should be cautiously considered in the organization. The literature reports that fiscal competence alludes to organizations' capital accessibility for EAI selection. Akbulut (2002) stated that organizations with slack assets can manage expensive improvements, are resilient to disappointment, and can investigate new plans ahead of time of the genuine requirement

2.5.5 Support Factors

The support factors include financial support, support from the top management and support from vendors, suppliers and administrative authorities.

- *Financial Support*

The accessibility of monetary assets (speculation) to upgrade or construct the organizational IT framework is one of the strongest indicators of progress. For organizational development, particularly for receiving new innovations, budgetary backing is the key for obtaining and improving satisfactory levels of deployment and programming, and preparing end-users as required. In this way, more support and enhancement of backing budgetary may influence EAI adoption (Irani *et al.*, 2003).

- *Support of Top Management*

An important consideration that has been reported in the existing literature is the support from the top management of the organization since better IT integration is an indication of better communication and collaboration between the management and workforce. This is in the light of the fact that the encouragement from the top administration could be viable and compelling in encouraging EAI adoption. This is because senior managers might acknowledge progress and help energetically to keep up the quality framework and environment of the organization in a way that supports and sustains the improvement and appropriation of efforts. Therefore, the researcher has considered the top administration support as an important influential factor for EAI adoption (Irani *et al.*, 2003).

Factors	Sub-Factors	Items	Authors
Technological	Technological Risk IT Capabilities	IT infrastructure Personal IT knowledge IT sophistications	B. Ramdani D. <i>et al.</i> (2013); Wei-Hsi Hung <i>et al.</i> , (2015); Weerakkody and Jones, (2009); Aserey and Alshawi, (2013); Wei-Hsi Hung <i>et al.</i> , (2015); Kamal <i>et al.</i> , (2013); Mantzana <i>et al.</i> (2008); Bigdeli <i>et al.</i> , (2013); Themistocleous and Irani (2002); Khoubati <i>et al.</i> , (2008); Kamal and Themistocleous, (2006); Sohimi <i>et al.</i> , (2011)
Organizational	Formalisation Centralisation Critical Mass Championship of Project Student Educational Record Curriculum factor Significance of ROI EAI Benefits and Significance Managerial capability Barriers in the Adoption		Ramdani <i>et al.</i> (2013); Aserey and Alshawi, (2013); Bigdeli <i>et al.</i> , (2013); Ebrahim, <i>et al.</i> , (2004); Kamal and Themistocleous, (2006); Kamal <i>et al.</i> , (2013); W. Hillison <i>et al.</i> (2001); Daggett, (1997); Ching-Yaw <i>et al.</i> , (2007); Neill (2001) Massy, (2003); Bornman, (2004); M. Tsinidou <i>et al.</i> (2010); Themistocleous (2002).
Environmental	External Pressure Issues of Internal Pressure		B. Ramdani D. <i>et al.</i> (2013); Bigdeli <i>et al.</i> (2013); Ebrahim <i>et al.</i> , (2004); Themistocleous, (2002); Wei-Hsi Hung <i>et al.</i> , (2015); Khoubati <i>et al.</i> (2008); Kamal <i>et al.</i> , (2013); Akbulut (2002); Norris, (1999); Wei-Hsi Hung <i>et al.</i> (2015) and Aserey and Alshawi, (2013); Sun <i>et al.</i> , (2008); Catalunya, (2014); Ozkan & Koseler, (2009); Lu and Zhang, (2009); Yengin <i>et al.</i> , (2011); Croxtton (2014) ; Paechter <i>et al.</i> , (2010).
Financial Factors.	Financial Cost Financial Capabilities		Khoubati <i>et al.</i> , (2008); Irani <i>et al.</i> , (2003); Bigdeli <i>et al.</i> (2013); Akbulut (2002).
Support Factors	Financial Support Support of Top Management		Irani <i>et al.</i> , (2003); Kamal and Themistocleous, (2006); Kamal <i>et al.</i> (2013).

Table 2.1: Summary of EAI Factors Proposed in Various EAI Adoption Models

The foregoing analysis illustrates that there are several factors explained in the literature regarding EAI adoption but not in HEIs, however, there is a relative lack of literature regarding EAI adoption in HEIs. So, the gap in the literature on the EAI perspective is the absence of using EAI adoption in the area of HEIs application integration. On the other hand, these models and its adoption factors and sub-factors may present a general idea regarding EAI adoption in HEIs. Nevertheless, these theorised EAI adoption models may not produce the same consequences in HEIs. This may also be due to several differences in: (a) HEIs' culture, (b) HEIs' environment nature, (c) HEIs' operations, functions, and activities and, (d) HEIs' insight and motivation. In addition, after the above mentioned analysis of the literature it can also be said that there is a lack of EAI adoption models within HEIs. Thus, HEIs' decision maker's willingness to know the effectiveness of EAI adoption in HEIs environment is significant.

2.6 Lessons from reviewing EAI Factors

The researcher study and investigate applications for EAI adoption in several fields. However, there is an absence of theoretical models for EAI adoption in the HE area. This gap can be manipulated through studying other domains and applying the EAI adoption factors in the HE domain. So, the review of EAI adoption factors in other application areas reveals that there are many EAI adoption factors that can be applied in HEI domain such as technological, organizational, environmental and financial factors. This is because EAI adoption addresses the organizational integration issues from both the specialised and the business view. It consolidates a mixture of integration technologies to assemble a centralised enterprise functions. EAI addresses the need to incorporate both intra and inter-organizational frameworks through benefiting from diverse applications. There is a growing demand to coordinate the EAI frameworks in the organizations. The researcher suggested that the proposed EAI adoption model will be support in improving a decision making process - within HEIs

2.7 Why Does Higher Education need EAI?

HEIs looking for modernity in higher education through the usage of IT systems, these systems are capable of providing an opportunity to the higher education institutes to incorporate new data systems that can develop an integrated IT architecture. This integrated architecture enables the administration of the institute or university to manage properly the lifecycle of their students. This integrated lifecycle management of students' databases may become ultimately the source of technological solutions. Thus, like every

other business organization, higher education institutes and universities should learn to deploy properly the IT systems, which not only support and help students but also improve the return on investment and maintain the competitive advantage. In the modern era, EAI as an integrated system is capable of further expanding the information system for students. This is required by any university, since a university is a diversified organization which consists of different units. For instance, , purchasing management , human resources management , online students portals management and education management, students facilities management and the most important is the alumni development and research.. Higher education has some shortcomings along with its opportunities. At all times they are under pressure to be the best, and this leads to the issues where results do not meet with the objectives. Furthermore, adoption of multi IT systems by the colleges and universities is leading to high maintenance costs and more complexity in IT systems. All these lead to less or even no integration at overall HEIs applications. Therefore, EAI has emerged as a unique IT formula that includes new approaches which incorporate lower cost, reduction in IT complexity usage and provides increased IT capabilities. These capabilities allow the organization to invest more in additional or better services and these all together can lead to an integrated and informative organization. The future and the potential of higher education can be enhanced through considering the core activities of business (Pircher and Pausits, 2011).

2.8 Significance of EAI in Higher Education

HEIs such as universities are the organizations where associated staff and faculty are committed to create - knowledge society. Thus, modern universities are actively engaged in information transfer mechanism. HE like other industries, is obliged to provide services and meet certain sets of standards and needs (Cao and Li, 2014) so, HEIs invariably strive to pursue excellence and success in their processes. Ian and Martin (2014) believed that the emergence of education environment and technology has much more than a simple enabler accompanying such changes. It has been a considerable increase in the complexity of the higher education environment. Hussein and Mourad, (2014) reported that the innovation in HE is the new application methods and tools that enhance the educational system. On the other hand, IT enhances the traditional processes of information systems. The adoption of EAI is the part of planning that uses the services of the internet and information systems that promotes the possibilities of e-education, e-library, centralised and integrated systems to keep the administration and employees informed about support, solutions and decisions. Frameworks to uphold organization and attitude, to show which assignments at the higher

education institute or university ought to be implemented with electronic information handling and which basic information ought to be gathered. Hussein and Mourad (2014) stated that universities and HEIs are now bombarded with content and tools for sharing information through new technological innovations in the education area. Choice support frameworks to show how the existing reporting framework might be, how to accumulate and process basic information and in what form, is made available to administration for decision-making. For instance, information from each learner's application is entered as basic information. At the point when different reports are assembled a demographic overview develops. Possibly, more students in a certain year demonstrate on their applications that they will require money related assistance. Administration can utilise reports created from the basic information to weigh how many scholars paying full educational cost will concede in place not to surpass the money related to support plan. Where there is restricted mix between information gathering and choice back, information may be discovered in different shapes and consequently produce odd data. Data begins from the transaction between the need and its accessibility. This verifies that the data are required and it is essential to gather. HEIs might engage with the goal of sustainable development (Godemann *et al.*, 2014) though developing management education for sustainability is a complex challenge for existing HEIs (Lee and Schaltegger, 2014). The most essential managerial obligations for higher education institutions are keeping, supervision and administration of budgetary assets, scholar organization, organization of exams and human asset administration. These frameworks are frequently gained or modified as differentiated frameworks.

2.9 Summary

This chapter reviewed the related literature to identify research issues in the area of the EAI in the HE domain. It begins by reviewing the literature on IT adoption in other organizations. The review of IT adoption in HEIs reveals that there is no EAI adoption model in the area of HE. The researcher found many applications for EAI adoption in several fields. However, there is an absence of theoretical models for EAI adoption in the HE area. This gap in the literature dealing with this application can be explained by EAI being a relatively new research area specifically in the HE area. The researcher explained the current research on EAI adoption in various sectors such as, healthcare sector, banking system, manufacturing sector, local government, stock market, supply chain, information system lifecycle, and public sector organizations. However, it can be concluded that although these research studies may appear relevant EAI applicability and validity in HE

are different. HEIs differ from other organizations since they are big organizations with several IT systems. The HE applications are profoundly conveyed and comprise of different databases. In this manner there is an expanding demand for the adoption of EAI in HEIS. Based on these reasons and evidence found in the literature, it can be said that EAI adoption models for HEIs are missing. In this research, the researcher proposed a theoretical model for EAI adoption in higher education area. In the next chapter the researcher will produce a conceptual model that incorporates influential factors reported in this chapter and combines them with the proposed classification of HE influential factors to produce the EAI conceptual model in HE domain.

3 CHAPTERTHREE: EAI CONCEPTUAL MODEL IN HE

3.1 Introduction

It is apparent that several applications systems are deployed at different levels in Higher Education (HE), ranging from academic and administrative to staff and students record systems. Many of these systems suffer from different problems due to the lack of integration such as data redundancy, inconsistency and maintenance cost. Enterprise Application Integration (EAI) can provide substantial benefits to these systems, such as assisting with business process integration, facilitating e-service based transformation and supporting collaborative decision-making. EAI applications are the source of enhanced productivity, achievement and performance that ultimately lead to the attainment of operational benchmarks. On the other hand, higher education institutes should also recognise the significance of EAI as an important task for establishing the agenda for technology that helps the institutes to run smoothly. EAI helps the education sector to map complex technological aspects and develop integration among different departments of the institute. Thus, an effective implementation of EAI within the higher education institute is responsible for education management, fee collection, managing assets, improving tools for collaboration among the institute stakeholders, intelligent information systems, and integration with the ERP and students' applications. Thus, EAI within the educational institute is helpful in maintaining the records of students through network integration and IT infrastructure capabilities. Therefore, IT managers and administration should search for such opportunities and apply their potential for upgrading IT applications within their educational institute.

This chapter introduces a conceptual model to explain the outcome of using EAI in Higher Education Institutions (HEIs). The combination of the existing classification of EAI factors that influences EAI adoption process in HE and that leads to enhancing the implementation of EAI in HEI at both organizational and operational levels will be analysed.

3.2 The motivation of EAI Adoption Model in HEIs

Most HEIs implement several information systems. However, these systems lack integration and consistency. Information Technology (IT) has become critical for the successful functioning of any enterprise. Breakthroughs in IT have developed a unique global economy that consequently raises new challenges. Education helps prepare people

to cope with these challenges (Wu, 2007). HEIs have integration problems due to isolated and fragmented computerized applications. The contents and overlapping functionality in the applications are “isolated islands of technology” (Peristera and Tarabanis, 2000). Kamal and Themistocleous (2006) illustrated that there are many problems due to lack of integration, such as data redundancy, inconsistency and maintenance costs. EAI provides substantial benefits, such as assisting with business process integration, facilitating e-service based transformation and supporting collaborative decision-making. This in fact means that HEIs have a problem with keeping up with the pace of change because of the rapid growth in enrolments and mounting pressure for change and they are unable to match demands for expansion. Moreover, they are not good at handling content of educational programs.

Significant benefits have been acquired in organizations which have integrated their IT infrastructures through EAI (Bass and Lee, 2002). For example, Themistocleous *et al.* (2001) provided information on the use of EAI and the benefits that result from it. These benefits were classified as organizational, managerial, operational, strategic and technical. In addition, EAI has a motive to integrate separate applications into one. This allows the data and processes to communicate with each other across an application (Stal, 2002; Sharif *et al.*, 2005). Many organizations have deployed EAI solutions (Khoubati *et al.*, 2008).

This chapter will present a conceptual model of EAI to be adopted in HEIs. Referring to chapter 2, this model includes a number of consistent influential factors for EAI adoption in addition to the factors that are adopted from HE area. The proposed EAI adoption model is intended to support the decision makers within the HEIs. It gives an integrated view to facilitate information access and reuse through the integration of multiple information systems. Moreover, data from different information systems are combined to gain a more comprehensive basis to satisfy the educational needs.

There is a need to improve another model that backs instructive organizations to maximize the benefits of all these systems when embracing EAI results and help them in upgrading their IT foundation operations. HEIs have to follow a strategic approach to integrate all these individual applications in a coordinated way. In particular, this model when applied at HEIs will reduce data redundancy, data inconsistency and high operational and maintenance costs. In contrast, it will increase sharing of services, interconnectivity of applications and improve privacy, security, and the standards of data sharing. This chapter aims to identify factors that enable the development a novel conceptual model for the EAI to be adopted in HEIs.

3.3 EAI adoption

Today IT applications are considered to be essential for the continuation and success of any institution. Irani *et al.* (2003) stated that the continuing evolution in technology in the world requires a follow-up of each innovations resulting from this development, especially the IT issue. Themistocleous *et al.* (2009) referred to the new research concerned with the adoption of EAI and found the best methods and solutions to be implemented to achieve the necessary integration. There are limited available studies for EAI adoption in the higher education area. Most of the EAI adoption models are in healthcare, small and Medium Enterprises (SMEs) and in the private sector (Kamal *et al.*, 2013). These models implement EAI adoption through a set of important factors. These factors can be reused in different EAI frameworks since they can be considered as common factors, such as benefits, barriers and costs. On the other hand, the student satisfaction factor is a domain specific factor and thus, it can be used only in educational organizations. In addition to this, there are differences indicating that the factors influencing the decision-making process for EAI adoption differ from one organization to another. This is obvious due to the different nature and size of each organization. Hence, the set of factors used to support EAI adoption in healthcare organizations differ from those applied in educational organizations. According to Kurnia & Johnston, (2000) any adapted model needs to be refined and tailored to match the context it is applied to. Thus, based on the review of EAI and integration technologies adoption studies as illustrated in chapter two, extensive literature reviews of factors affecting the adoption of EAI have been conducted in several areas such as:

- Healthcare Sector (Wei-Hsi Hung *et al.*, 2015; Khoumbati *et al.*, 2003; Mantzana *et al.*, 2008; Themistocleous *et al.*, 2009).
- Banking System (Lam, 2005).
- Manufacturing Sector (Liu *et al.*, 2008).
- Local Government (Kamal, 2009; Kamal and Weerakkody, 2010; Liming *et al.*, 2010).
- Stock Market (Roztock and Weistroffer, 2009).
- Supply Chain (Themistocleous *et al.*, 2004; Chen, 2005).
- Information System Lifecycle (Irani *et al.*, 2003).
- Public Sector Organizations (Ebrahim *et al.*, 2004).

The literature review indicated that Mantzana *et al.* (2007) and Khoumbati *et al.* (2008) combined several factors from Themistocleous *et al.* (2004). Chen (2005) reported that the

perceived industry and governmental pressures are external forces that influence the adoption factors for SMEs. Furthermore, through studying the adoption factors for large enterprises, the authors focused on several aspects to show why large organizations need to adopt integration technologies, such as internal needs and technical aspects to improve their services. Chen (2005) illustrated that despite the fact that large firms relied on their internal requirements to improve their services, the SMEs focused on the external forces. All the factors mentioned earlier have been empirically evaluated in tens of cases in various sectors, e.g. healthcare organizations, local government and the stock market. Hence, the researcher can state that EAI adoption may be influenced by these common factors. So, this research uses the factor-oriented approach (Kurnia and Johnston, 2000) for investigating EAI adoption in HEIs. Consequently and in the same context, the researcher may consider these factors as important for EAI adoption in HEIs. In chapter two, the applications of factors that maintain IT and integration technology adoption in the HE domain are reviewed. The identification of new factors which are necessary for the development of the EAI adoption model in an HE environment is considered.

3.4 EAI Adoption Factors in HE

Higher Education Institutions may provide a number of services such as student services, academic and staff services, administrative and other services. Among others such attributes distinguish HEIs from other organizations. Therefore, other relevant areas that support IT and integration technology adoption in the HE domain, are critically reviewed. The literature review showed that HEIs used a diversity of information systems to support their academic and administrative services. However, this diversity of heterogeneous and, in many cases, manual solutions caused numerous integration problems. EAI has been initiated to tackle integration problems in a more flexible and controllable way (Stake, 2010). Strategic business solutions can be integrated within and across the component parts of the information system infrastructures of an organization using the EAI technologies (Sharif *et al.*, 2004). EAI can be described as the procedures and tools to modernize consolidate and integrate computer applications within an organization (Mckeen and Smith, 2002). Essentially EAI is a wide concept that covers business processes, business models and organizational renovation (Sharif *et al.*, 2004). After examining a number of EAI applications in chapter two several factors assisting the adoption of EAI in such areas can be constructed. Thus, for establishing an effective system of EAI, the factors of adoption are similar and they require proper co-ordination and integration to develop a novel conceptual model. These factors are as follows:

3.4.1 Technological Factors (TFs)

The technology that "enables e-learning delivery consists of a broad range of services, from the facilitation of individual distance learning courses, to complete learning management systems" (LMS) such as Blackboard (Martin, 2008; Claar *et al.*, 2014) . All the technology factors have to be addressed for successful eLearning (Ahead, 2013; Shelley, 2008; Martín-Rodríguez *et al.*, 2014; Al-Qahtani *et al.*, 2013). From these investigations and due to our survey results we found that the technology is an important factor in EAI adoption in HE. So, the TFs might be inspected and investigated as a vital factor in EAI adoption as basic elements in HE domain. The factors influencing the adoption of TFs are as follows:

- a. **Technological Risk (TR):** TR identified by utilizing another technologies could be recognized a center of concern. This is in light of the fact that the TR is the risk associated with technologies can make TR adverse managers require higher rates of return before investment Kamal *et al.* (2009) noticed that studies on TR anticipates have depicted issues such as, organizational fit and technologies planning. TR must be taken into account when considering the adoption of EAI in HE area.
- b. **IT capabilities:** G. Kruss *et al.* (2015) reported that universities need an enhanced understanding of how they can respond to the changing technological capabilities and skills needs of firms, particularly in relation to their professional and occupational programmes. IT capabilities refer to IT infrastructure, sophistication of an enterprise and IT knowledge of the personnel (Akbulut, 2002; Kamal *et al.*, 2003).
- c. **IT Infrastructure:** Mohd Hanafi *et al.* (2010) mentioned that because of the need to increase infrastructure facilities, research should be done prior to making infrastructure improvements and facilities should be provided for special education students in order to increase comfort as well as the quality of teaching and learning methods. Higher education institutes and universities should have IT integration otherwise it can affect students' services. Thus, infrastructure for IT systems is an adoption factor for EAI in the higher education sector.
- d. **IT Sophistication:** IT sophistication is closely associated with the extent to which an organization desires to have an integrated IT system within its domain. This is also an important adoption factor for higher education institutes and universities. Numerous technologies are available in the market and, thus, there should be a proper evaluation method for this matter. The best method for evaluating such technologies is the utilization of decision-making strategies within the

organizational structure. An important factor is the compatibility and suitability of IT integration within the culture of the organization and this can act as a factor in considering the adoption of EAI in the higher education sector.

- e. **Data Management and Personal IT Knowledge:** The most important task in the HE sector is the management of student databases in which electronic details of the students are stored in an integrated IT system. Similarly, online students' portals which are also linked with the integrated IT system can serve students in many respects, such as curriculum design, course selection, online handouts and lectures, online tests and exams and online evaluations reports. These are considered to be a major benefit that can be obtained through the deployment of an EAI system. This not only improves the satisfaction level of students and instructors but also improves relationships within the learning community (Mantzana and Themistocleous, 2005; Kamal *et al.*, 2013).

3.4.2 IT Supportive Factors (SF)

IT supportive factors include data security and privacy and an evaluation framework that can support the adoption of EAI.

- a. **Data Security and Privacy:** This has been acknowledged as a significant variable in an open environment. Security of people's information has consistently been crucial. Key security capacities, for example privacy, are administered through the organization's own particular set of guidelines. In this way, it shows a significant challenge to the organization's security provisions over with integrated system (Lam and Shankararaman, 2007). Likewise, organizational members' concern about data protection and secrecy of the particular information has been a discriminating hindrance in its execution. The information of HE that was established in a distributed database permits the right to gain entrance to student and staff data. In this manner, questions have been raised concerning who has admittance to these data and how to avert unauthorized access. This is of high importance, as the technology is debilitated by potential unauthorized access. HE must take into consideration the methodologies that address security and protection issues.

Evaluation Framework: EF is a combination of integration technologies that can be used to integrate an IT infrastructure. Such a framework can be considered as a tool to support decision-making for EAI adoption. EF such as frameworks for evaluating integration technologies and EAI solution software determine the

technologies that can be used to integrate IT infrastructure (M. M. Themistocleous, 2004). So, frameworks facilitate organizations to overcome the confusion in the selection of EAI software solution (M.M Kamal et al., 2009). Such a framework could be adopted as a standard decision making tool for choosing what EAI system to adopt.

3.4.3 Organizational Factor (OF)

The literature indicates OF as a significant factor for many organizations when adopting EAI. OF is a source of structures, processes and attributes that constrain or facilitate the adoption of any application. Several dimensions can be part of the organisational context which can influence the implementation process of e-government. Examples of such factors are: the role of senior management, budgetary status, the level of centralization, formalization, and the nature of human assets, measure of slack of accessible assets, and size of the organization (Ebrahim *et al.*, 2004). This factor incorporates the following:-

- a. **Formalization:** This includes the presence of clear methodologies, standards and formal methods for doing organizational assignments. Remarkably formalized processes that create a structured and organized environment might be useful for systems planning and information processing. In addition, composed methods and a more formal environment will wipe out any ambiguities and might expedite EAI adoption. Nevertheless, the different bureaucratic structures of HE institutes may affect EAI reception.
- b. **Centralization:** This includes the degree of power or decision making power in an organization and it incorporates in decision making and power advanced system. Since decision making for IT is typically concentrated at the top level of hierarchy while in decentralised structures decision-making is distributed across different hierarchical levels. , consequently the level of centralization may affect the speed of EAI adoption in HE.
- c. **Managerial Capability** Managerial capability is the availability of personnel who have enough competencies for the creation of new ideas is one of the important factors for EAI adoption since the innovations are likely to be proposed by individuals who have expertise in a particular discipline. Particularly, IT innovations tend to start from ingenious application devised by managers with a technical background (Kim & Bretschneider, 2004). Therefore, managerial capability of manager, which can be defined as the ability to identify problems of the current systems, and to develop and evaluate alternatives to improve the IT

capacity of the organization, appears to be a decisive factor influencing EAI adoption (M.M Kamal *et al.*, 2006). So managerial capability helps in the development of students' records and curriculum development.

d. Student Educational Record (SER):

W. Hillison *et al.* (2001), reported that the Family Educational Rights and Privacy Act (FERPA) defines “education records” as those records, files, and other issues which:

1. Contain information related to a student; and
2. Are maintained by an educational agency or institution, or by a person acting for such an agency or institution.

Hillison *et al.* (2001), citing Daggett (1997), defined an education record as any student information that is recorded or maintained by a school or person acting for a school, including independent contractors (e.g., graduate teaching assistants and private attorneys). So, the change of student records, such as giving up enrolment, graduation and completing a course, is not a programmed work in the administration of student records, but it has complex and dynamic features and has a long cycle. The approved application contains personal data such as: name, address, DOB, gender, nationality and academic details such as name of course and funding status. SER should be considered because it provides essential data and detailed information obtained from the approved application. Moreover, data related to the progression record and the administration of student records, such as change of course or serious disciplinary and any other information.

e. Curriculum: The curriculum offered by a college or school specifies the topics to be studied by students. It is the set of courses, and their content, based on a general syllabus.

According to Ching-Yaw *et al.* (2007) the curriculum is considered to be at the heart of quality in higher education. They added that the curriculum varies from one university to another, and makes one more successful than the another. According to Leckey and Neill (2001), the universities need to ensure that there is a standard curriculum. A regular assessment of the curriculum, courses offered, teaching skills, and material used are needed to achieve the intended outcome (Massy, 2003; Bornman, 2004). Courses should be meaningful, valuable, and beneficial to a learner's career prospects. M. Tsinidou *et al.* (2010) Further, students believe that elective modules are quite important since they provide the opportunity to customise their studies and gain an insight into areas of specialisation as early as possible. In HE, successful online course have to achieve several

requirements as described in Kennedy (2014), Grace *et al.* (2012) and Krause (2015). It is important for the "online instructors, administrators, and course designers to find ways to balance course assignments with the desire to maintain levels of course interaction that are key to student success in online courses" (Temizer and Turkyilmaz, 2012; Anthony, 2012).

3.4.4 Environmental Factors (EFs)

This is the area in which the organization conducts and influences its customers. Organizational adoption of EAI could be driven by the actions of competitors and may establish connections with other organizations for better collaboration. These factors include:

- **Internal Pressure (IP):** This factor has been widely reported in the normative literature as an important factor in EAI adoption models (Chen, 2003). Pressures include technical and managerial factors inside an organization. These factors are essential in initiating the adoption of EAI in organizations. There are several internal pressures in HEI. Chen (2009) has considered the stakeholder as an internal pressure since they influence the adoption of web services in organizations. The stakeholders in the HEIs may include the working individuals such as students and instructors and their influence can represent an internal pressure factor for EAI adoption in the HEIs.
- **Student Satisfaction (SS):**
SS has become one of the most significant goals of e-universities. Due to its importance, many scholars have attempted to evaluate SS using integrated models (Sun *et al.*, 2008 ; Catalunya, 2014), a hexagonal e-learning assessment model (Ozkan & Koseler, 2009). Student Satisfaction has to be considered as an important factor in establishing international rankings among the universities all over the world and helping university staff members in making decisions for developing academic programs. SS is considered a significant concept and cannot be neglected in higher education (Xiao and Wilkins, 2015). In addition, SS has become one of the major goals of HEIs (Temizer and Turkyilmaz, 2012). As it was explained in the "five pillars of quality online education", SS is identified as the most important key to continuing learning (Bailie, 2015). Thus, HEIs have to expend more effort on the concept of SS in order to succeed and survive in the competitive elearning markets to enhance the educational process to meet the expectations and needs of learners. So , SS is one of the most important issues in the educational process. The SS factor has to be considered in the adoption of EAI within HEIs. This will create a positive relationship between learner attitudes and the new EAI model.

- **Instructor Satisfaction (IS):**

Instructors' attitudes toward e-learning will positively influence student's satisfaction due to the strong relationship between the instructor's quality of teaching and learner's perceived satisfaction (Lu and Zhang, 2009). Moreover, instructors play an important role in the success of online learning. However, there are many criteria that have to be acceptable for a good online instructor. Many of these criteria are explained in Yengin *et al.* (2011), Croxton (2014) and Paechter *et al.* (2010). Yengin *et al.* (2011) reported that online instructors have the most critical role as the most important actor in the learning environment. Satisfaction is one of these factors that affect the usability of the system which also directly affects instructors' performance. Instructor satisfaction with the e-learning system in higher education is linked to many applications. For example, easy access to course materials either to establish new courses or modify existing ones and the ability to access the library or students' attendance records. Instructors' attitudes toward e-learning will positively influence student's satisfaction, so it has to be considered in the proposed model.

- **External Pressure (EP):** This is pressure from other parties outside the organization. For instance, an organization may be pushed to search for new ways to enhance its efficiency by increased competition. Better collaboration is expected when an organization interacts with several stakeholders and governmental organizations. Better services, such as instant query response, data security and the availability of data, wherever it is required, are demanded by citizens. This factor can be considered when the development of EAI model is tackled.

- **Learning Community (LC):**

Rolando *et al.* (2014) reported that our current state of society which is based on the large flow of information and knowledge, through information and communication technology, requires a policy of continuing education for the use of technology in the educational process. Rolando *et al.* (2014) added that the use of virtual communities (VC) has enhanced social relations through the internet. The larger educational institutions are able to adopt more sophisticated and advanced information technologies compared to smaller institutions. Lee *et al.* 2011 mentioned that when teaching staff are engaged in professional learning communities (PLCs), they are more likely to demonstrate greater confidence and commitment to transform their teaching and learning practices and willingness to explore education innovations, and develop enthusiasm for collaborative work. This will increase the sense of collective efficacy

that is pivotal to an institution's success in enhancing student learning outcomes and create a sense of engagement and provides a vehicle for teaching staff and administrators to work collaboratively and constructively. Thus, the LC factor would influence EAI adoption in HEIs due to interactions that enhance learning achievement. Users' satisfaction will be improved by assessment feedback when an e-learning system provides more diversified assessment tools and methods.

3.4.5 Financial Capability (FC)

FC includes the organization's accessible capital for technology selection. Kamal *et al.* (2013) reported that financial factors affect the EAI adoption in organizations. Akbulut (2002) stated that an organization that has slack assets can bear the cost of large-scale improvements, can absorb disappointment, and can investigate new thoughts ahead of time of the real need. Nonetheless, HE institutions have various drivers such as better educational services. The institution capital available has efficient decision making that motivates the adoption of new technologies like EAI in HE institutions. The effective factors here are:

- a. **Return of Investment (ROI):** Simanaviciene *et al.* (2015) reported that the data have shown that the results of investment in higher education can be either positive or negative. Positive investment in higher education depends on the cost of study, living costs, expected wage increases and an individual's personal qualities. So, investment in higher education is a principal factor for decision making to be adopted in HEIs. It should be productive or at least there are benefits. HEIs are reluctant to invest without significant ROI. This can be attributed to:
 - Lack of skilled staff or opposition to adoption of new technologies
 - HE organizations have been very slow or even unprepared for technological transformations
 - Low allocated IT budgets in the HEIs will prevent the transition to EAI
- b. **Cost:** Institutional economy and funding, tuition and courses fees cost of both technology and access are the most important sub-criteria that reflect on student satisfaction of the acceptance involvement in e-learning. Cost-criteria are investigated in many articles such as Lo *et al.* (2011) or Rezaie *et al.* (2012). According to these studies, and due to survey results, cost is an important factor that determines the adoption of EAI in HE. It has been suggested that deployment of EAI is linked to the reduction of cost as part of integration.

Factors	Sub-Factors	Items	Authors
Technological	Technological Risk IT Capabilities	IT infrastructure Personal IT knowledge IT sophistications	(Martin, 2008; Claar <i>et al.</i> , 2014); (Ahead, 2013; Shelley, 2008; Martín-Rodríguez <i>et al.</i> , 2014; <i>et al.</i> , 2013); Kamal <i>et al.</i> (2009), G. Kruss <i>et al.</i> (2015); (Akbulut, 2002; Kamal <i>et al.</i> , 2003); Mohd Hanafi <i>et al.</i> (2010); (Mantzana and Themistocleous, 2005; Kamal <i>et al.</i> , 2013).
IT Supportive Factors (SF)	Data Security and Privacy Evaluation Framework		(Lam and Shankararaman, (2007); Themistocleous (2002)
Organizational	Formalisation Centralisation Student Educational Record Curriculum factor Managerial capability		Ebrahim, <i>et al.</i> , 2004; W. Hillison <i>et al.</i> (2001); Ching-Yaw <i>et al.</i> , (2007); (Massy, 2003; Bornman, 2004; M. Tsinidou <i>et al.</i> (2010); (Kennedy, 2014); Grace, <i>et al.</i> , 2012); (Krause, 2015); (Temizer & Turkyilmaz, 2012; Anthony, 2012).
Environmental	Internal Pressure Student Satisfaction Instructor Satisfaction External Pressure Learning Community		(Chen, 2003); Chen (2009); (Sun <i>et al.</i> , 2008 ; Catalunya, 2014); (Ozkan & Koseler, 2009); (Xiao & Wilkins, 2015); (Temizer & Turkyilmaz, 2012); (Bailie, 2015); (Lu and Zhang, 2009); (Yengin <i>et al.</i> , 2011; Croxton, 2014; Paechter <i>et al.</i> , 2010). I. Yengin <i>et al.</i> (2011); L.G.R. Rolando <i>et al.</i> (2014); (Lee <i>et al.</i> 2011).
Financial capability	Return of Investment Cost		Kamal <i>et al.</i> (2013); Akbulut (2002); Zaneta Simanaviciene <i>et al.</i> , (2015); (Lo <i>et al.</i> , 2011; Rezaie <i>et al.</i> , 2012)

Table 3.1: Summary of EAI Adoption Factors in HE

3.6 The proposed HE-EAI adaptation model

As indicated earlier, different EAI models have highlighted that several factors influence the EAI adoption in their respective domains. These models have several factors in common such as: benefits, barriers, IT infrastructure, costs, internal and external pressures . The researcher identified and analysed new factors related to educational environment as described earlier. To provide a better understanding, these factors have been categorised into the following two aspects as shown in Figure 3.1:

1. Technical aspects:

- Technological Factors (TF).
- IT Supportive Factors (SF).

2. Social aspects:

- Organizational Factor (OF).
- Environmental Factor (EF).
- Financial capabilities (FC).

By studying these classifications, the researcher found that EAI in higher education can be implemented through the interaction between the technical aspects and social aspects. Moreover, it was found that some sub-factors which are contained within the technical and social aspects can be adopted in the model. The proposed HE-EAI adaptation model will integrate the multiple information systems within HEIs through a combination of the required systems in use. In addition, the proposed model will provide an integrated view to facilitate information access and reuse of the integrated information systems. Data from different complementary information systems are combined to gain a more comprehensive basis. This comprehensive basis satisfies the educational needs.

The proposed model reduces data redundancy, data inconsistency and high operational and maintenance cost. This is through sharing of services; interconnectivity of applications, privacy and security, and the standards of data sharing will be improved significantly. These improvements through integration of the multiple information systems within HEIs can be achieved through combining the required systems. The integration of multiple information systems is intended to facilitate information access and reuse. Figure 3.1 represents the overall adoption factors of EAI in HE institutes.

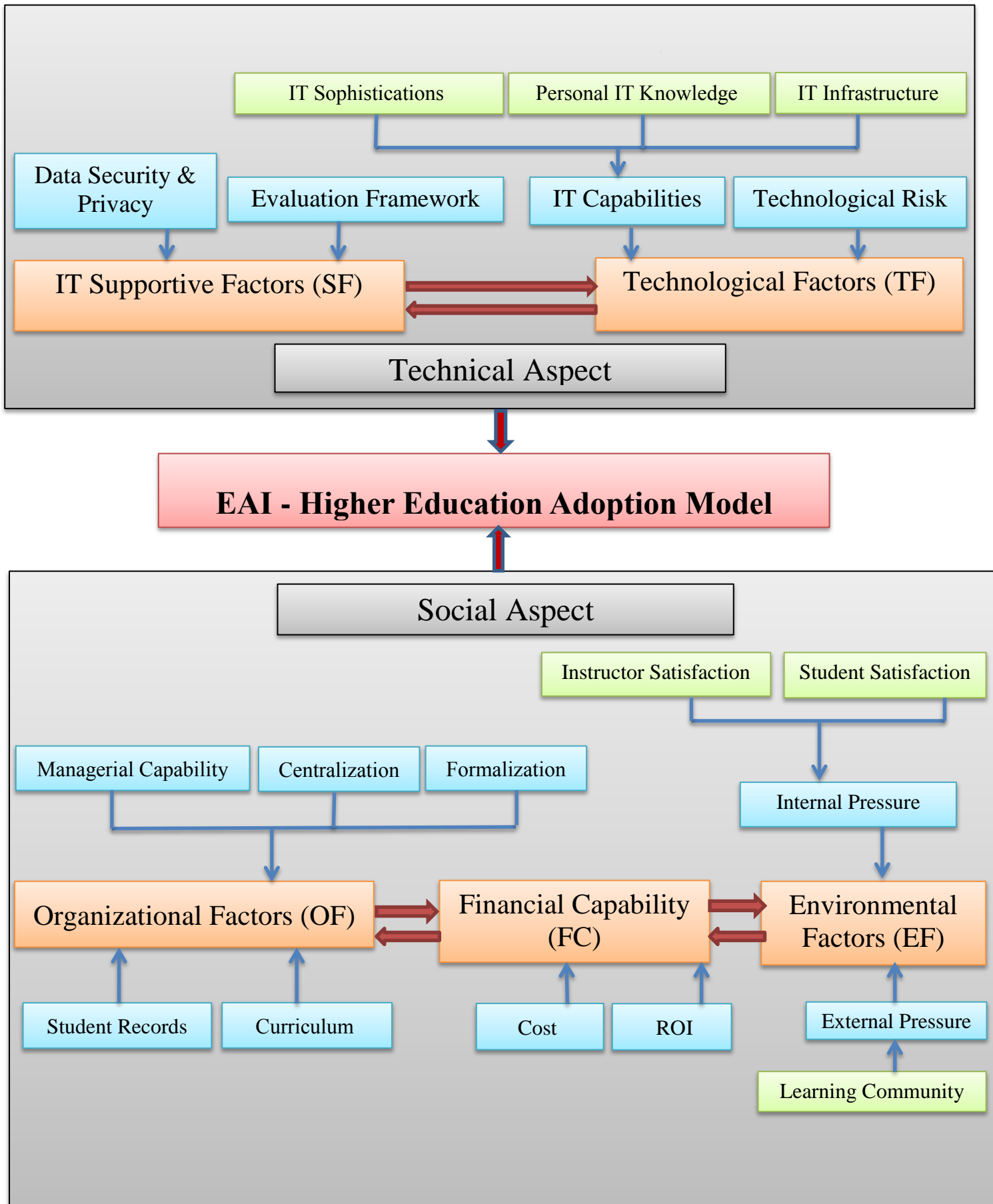


Figure 3.1: Adoption factors for EAI in higher education sector

3.7 Summery

The researcher demonstrates the gap in the literature dealing with the absence of theoretical models for EAI adoption in HEIs area. The literature illustrates that the implementation of EAI in the HEIs is considered as a new field of research. Hence, the lack of well-established theoretical and conceptual models means there is a need to identify factors that influence the decision making process for EAI adoption. Also, the literature determines several EAI adoption models that provide an understanding of the concepts, principles and factors behind EAI adoption in the various domains. The existing EAI adoption studies are based on the factor-oriented approach illustrating several factors influencing EAI adoption. Thus, following the research trends the researcher considered the factor-oriented approach for this research. In doing so, several researchers in the areas of the healthcare sector, banking sector, manufacturing sector, local government, stock market, supply chain, information system lifecycle, and public sector organizations have been studied to select the factors that form the proposed EAI model in HE domain.

In spite of numerous current IT applications in the HEIs, there is still an increasing demand to integrate these applications to benefit from their capabilities. This chapter introduces a novel EAI adoption model for a university. Moreover, the combination of the existing classification of EAI factors with the HE factors were analysed to enhance the implementation of EAI at any university on both organizational and operational levels. The integration of multiple information systems gives an integrated view to facilitate information access and reuse. Data from different information systems are combined to gain a more comprehensive basis to satisfy educational needs. The proposed Higher Education Adoption Model (HEAM) incorporates various predictable and persuasive factors for EAI adoption other than incorporating the factors that are adapted from the areas (e.g. personal fulfilment, scholar record, educational program, study group, and teacher fulfilment). The researcher expects that the proposed EAI selection model will support the advancement of a comprehensive EAI and will help the leaders within the HEIS when making decisions to embrace EAI in reality.

In the next chapters, the proposed model will be applied to investigate the effect of EAI reception in HE. Also, the researcher additionally aims to guide the recognised components which affect the EAI adoption. Furthermore, it will recognise the causal relationship between the variables of the model at every phase of the selection process that impact the general execution and EAI appropriation choice of the HEIS.

The proposed EAI adoption model will enable the understanding for EAI and assist the HEIs decision makers. For instance, EAI adoption model can:-

- Help to establish a prominent ranking position among the international universities.
- Assist the management, faculty, staff and governing bodies in decision making across the board in its resource and academic program development.
- Support academic activities at all levels

4 CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

The research methodology that is followed in this research will be described in this chapter. The research methods will be the same as those commonly used in the field of information systems. Firstly, part one describes the positivist and the interpretivist methodologies. This discussion demonstrates that the interpretive approach is the most appropriate for the research in this thesis. From there on, the researcher has clarified why qualitative exploration has been utilised. The researcher presents the details of an appropriate research strategy, which justifies the adoption of a case study research strategy. Finally, this methodology is transformed into a protocol, which described data collection tool where data deduced from the organization of the proposed case study.

4.2 Research Perspective

4.2.1 Research Paradigm

Research methodology is defined by Leedy & Ormrod (2001) as “the general approach the researcher takes in carrying out the research project” (p. 14). Several philosophical approaches are available for IS research including: (1) scientific (positivism); (2) critical; (3) interpretivism and, (4) post-positivism. These approaches rely on quite different assumptions about the nature of knowledge, and demand considerably different approaches to research, with Irani et al. (1999) among others, having discussed their respective characteristics.

Research methodology has been defined by Leedy and Ormrod, (2001) as “the general approach the researcher takes in carrying out the research project” (p. 14).. Qualitative research may be based on positivism or post-positivism. Post-positivism assumes ‘the existence of a reality that can be apprehended accurately but also imperfectly and probabilistically’ (Alvesson and Karreman, 2011). Several research methodologies may be used for information systems (IS) research including: scientific (positivism); critical; interpretivism and, post-positivism. These methodologies depend on very distinctive suppositions about the way of data collection significantly diverse. Van Wynsberghe and Khan (2008) talked about their separate aspects regarding methodologies in research.

Research systems are different techniques, plans and calculations utilised within research. All the systems utilised by an analyst throughout an research study are termed as research strategy. They are arranged, experimental and worth unbiased. They incorporate hypothetical systems, trial studies, numerical plans, measurable methodologies, and so on. Research systems help us gather specimens, information and help find an answer to a problem. Especially, investigative research systems call for descriptions dependent upon gathered realities, estimations and observations and not on thinking alone. They acknowledge just those illustrations which might be confirmed by researches. A research technique is an efficient approach to tackle an issue. It is an investigation of considering how a research is to be done. The strategies by which analysts go about their work of describing, clarifying and foreseeing phenomena are called research techniques. It is likewise characterised as the investigation of systems by which learning is picked up. Its point is to give the work arrange of exploration. Mukhopadhyay and Gupta, (2014) said that among these paradigms, the two most important ones followed in qualitative strategy research are positivism and interpretivism. Therefore, the research related to IS and IT concepts proposes that the approach of positivism is somewhat overpowering the concept of epistemology especially in relation to information system and its researches. However, the research has further argued that if information system could demonstrate itself as a proof of positivism then formal suggestion can be obtained. This further helps the researcher to extract quantifiable variables from the research. On the other hand, existing literature reported that interpretivism is also considered important as far as it is concerned with the research studies of the social sciences. For example cognisance, imparted significances, language, archives, apparatuses and different ancient rarities.

4.2.2 Theoretical Perspective

The research approach that is utilised is the interpretivist approach. The researcher argues that for the purpose of this thesis, since it looks to describe, comprehend and interpret phenomena through the significance that individuals allot to them, the interpretivist approach generates comprehension of the setting of the IS. Mukhopadhyay and Gupta, (2014) reported that the 'interpretive paradigm is used for 75 per cent of the research design'. Even more decisively, the interpretive methodology is more consistent with the ultimate goal of this research. Therefore, the interpretive approach has been selected as an appropriate underlying research assumption for investigating EAI adoption in HEIs For these reasons:

- The introduction, literature review and the model presented in Chapters one, two and three illustrate that there are numerous social, managerial, societal and specialized concerns identified with the reception of EAI adoption in HEIs. These components give an impression of being numerous, complex and interrelated. Subsequently, the factors affecting EAI adoption in HEIs cannot be differentiated from their organizational, specialized and social setting. In this manner, there is a need for a research approach that will permit the researcher to comprehend the procedure of receiving EAI adoption in HEIs, and additionally all the factors that affect it.
- There are no hypotheses, experimental measures of variables or recognized recommendations in the examination accounted, so positivism cannot receive this.

This was allowed us to identify and understand in a more holistic picture, the proposed phases of the developed EAI adoption model of HE selection through the conducting advanced (IT) inside the educational institutions. Therefore, the researcher concludes that to investigate EAI adoption in HEIs, there is a need for the interpretivist research approach. Since HEI's appropriation is a known phenomenon and the plan of this research was to concentrate on the elements that affect choices made by individuals, such as, IT supervisors and IT experts, who work in the education establishments in HEIs.

4.2.3 **Qualitative Research Methodology**

It is important for a specialist to outline a philosophy for the chosen issue. One might as well note that regardless of the fact that the systems recognised in two issues are the same but the procedures may differ. It is vital for the researcher to know it is not just the research techniques that are important to undertake the research but additionally the research philosophy. Comprehensively, there are two sorts of research philosophy: qualitative and quantitative. Mukhopadhyay and Gupta, (2014) reported that 'Generally, interpretive is associated closely with qualitative research while positivist is associated with quantitative research designs'. The researcher utilised the qualitative approach, and later utilised logical systems and procedures to analyse the information. Qualitative examination is an all-encompassing approach that includes insight. Qualitative research is additionally seen as an unfolding model that happens in a natural setting that enables the researcher to improve a level of details from a high degree of the real experience (Creswell, 2013).

This is ordinarily a one-on-one process in which a researcher poses questions directly to a single person. The inquiries regularly require not just data and slants, but permit the

questioner to test the abundance of feelings and inspirations identified to the point. Researcher uses qualitative information to help illuminate speculations, convictions, disposition and furthermore inspirations. Qualitative work is frequently a first stage on the grounds that it enables a researcher to adjust the dialect that will be used within quantitative Instrument Qualitative research might be depicted as any type of research produce findings not landed at by actual experience or different method of quantification. Hence, it will be more appropriate than quantitative, as qualitative research method could be utilised to better understand any phenomena how little is yet known. In addition, to increase progressively in depth information that may be difficult to convey on quantitatively. Leedy and Ormrod, (2005) reported that qualitative approach is less structured in description since it details and formulate new theories. Sofaer (2002) proposed that a qualitative methodology is more suitable as it could be utilised to: (1) explore little known phenomena, for example EAI in higher education, (2) validate the EAI conceptual model, (3) ex mine in depth the phenomena in its common setting, (4) provide considerable flexibility throughout interviews and observations and, (5) gain experience from practice.

Plan and Strategies	Examination Strategies
<p>1. Naturalistic request: Studying genuine scenarios as they unfold characteristically; non-manipulative also non-regulating openness to whatever rises (absence of decided stipulations on discoveries).</p>	<p>1. Exceptional case introduction: Assumes that each case is exceptional and special; the first level of examination is continuously accurate to, regarding, and catching the portions of the distinct cases being considered; cross-case dissection accompanies from and hinges on upon the nature of singular careful investigations.</p>
<p>2. Developing outline adaptability: Openness to acclimating analysis as comprehension extends or scenarios to change; the scientist abstains from getting bolted into unbending outlines that kill responsiveness and seeks after new ways of finding as they develop.</p>	<p>2. Inductive examination and innovative combination: Submersion in the items and specifics of the information to run across critical examples, subjects, and interrelationships; starts by investigating, then affirming, guided by explanatory standards instead of standards, finishes with an inventive combination.</p>

<p>3. Deliberate examining: Cases for study (for instance, individuals, associations, groups, societies, occasions, discriminating rates) are chosen in light of the fact that they are “data rich” and illuminative, that is, they offer handy signs of the wonder of investment; examining, then, is pointed at knowledge about the marvel, not observational generalization from a specimen to a populace.</p>	<p>3. All-encompassing point of view: The entire wonder under study is comprehended as an intricate framework that is more than the total of its parts; keep tabs on complex interdependencies and framework motion that cannot significantly be decreased to a couple of discrete variables and straight, cause impact relationships.</p>
<p>Information Collection and Fieldwork Strategies</p> <p>4. Qualitative information: Observations that yield detailed and complete information, thick depiction; analysis in profundity; meetings that catch steer citations about individuals' close to home points of view and encounters; careful investigations; cautious report survey.</p>	<p>4. Connection affectability: Places discoveries in a social, chronicled, and transient connection; cautious about, even doubtful of, the probability or weightiness of generalizations crosswise over time furthermore space; underscores rather watchful near case investigations and extrapolating examples for conceivable transferability and accommodation in new settings.</p>
<p>5. Individual experience and engagement: The scientist has run contact with and draws near to the individuals, scenario, and wonder under study; the scientist's close to home encounters and bits of knowledge are an imperative part of the analysis and discriminating to comprehension the marvel.</p>	<p>5. Voice, viewpoint, and reflexivity: The qualitative examiner claims and is reflective about her or his own voice and viewpoint.</p>
<p>6. Empathic lack of bias and care: An empathic stance in questioning looks for vicarious comprehension without judgment (non-partisanship) by indicating openness, affectability, regard, consciousness, and in addition more responsiveness; in perception it methods being completely exhibit (care).</p>	<p>6. A valid voice: Passes on credibility and dependability; complete objectivity being unthinkable and immaculate subjectivity undermining validity.</p>
<p>7. Powerful frameworks: Attention to process; accepts change as continuous if centre is on an individual, an association, a group, or a whole society; consequently, aware of and mindful to framework and scenario motion.</p>	<p>7. The specialist’s centre: Comes to be adjust comprehension and delineating the global legitimately in all its multifaceted nature while being self-scientific, politically consciousness.</p>

Table 4.1: Properties of qualitative methodology Source: (Patton, 2002)

As expressed, a qualitative research approach is hence used to direct this research since this approach is most appropriate for to implement it because:

- As illustrated in Chapters one, two and three, there is lack of studies regarding EAI adoption in HE. Thus, qualitative research may support the researcher to study EAI in its natural setting, and learn from practice within HEIs. This may also allow the researcher to understand the nature and the complexity of the EAI adoption process within HEIs.
- Qualitative methodology investigates little-known phenomena like the selection of EAI adoption in HEIs.
- Qualitative methodology examines in profundity the complex courses of action of choice made in HE through EAI adoption in HEIs.
- Qualitative methodology validated the calculated EAI model to be adopted in HEIs.

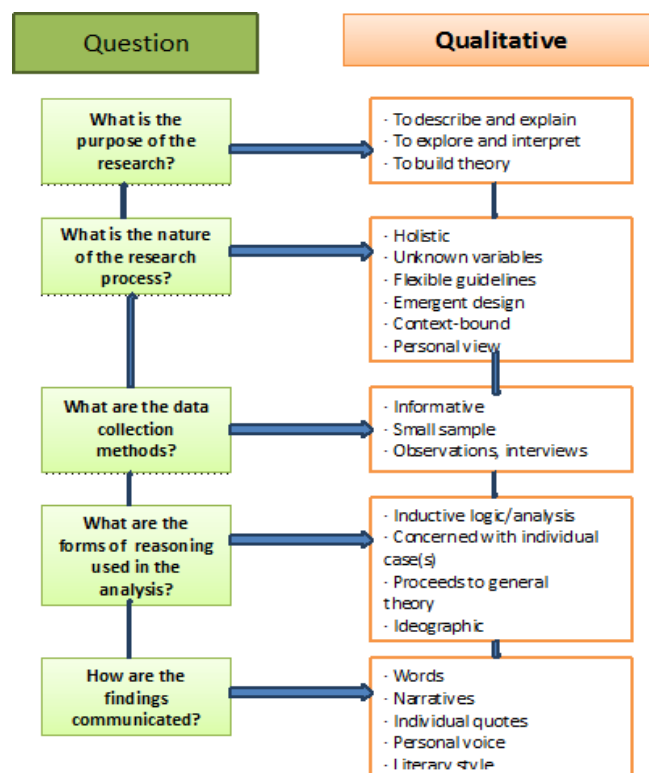


Figure 4.1: Characteristics of qualitative research

Source: (Creswell and Clark, 2007; Leedy and Ormrod, 2005)

4.3 Empirical Research Methodology

The Empirical Research Methodology Framework has three phases, namely: (a) research design, (b) data collection, (c) data analysis (Jankowicz, 2000) as depicted in figure 4.1 These phases are illustrated as follows:

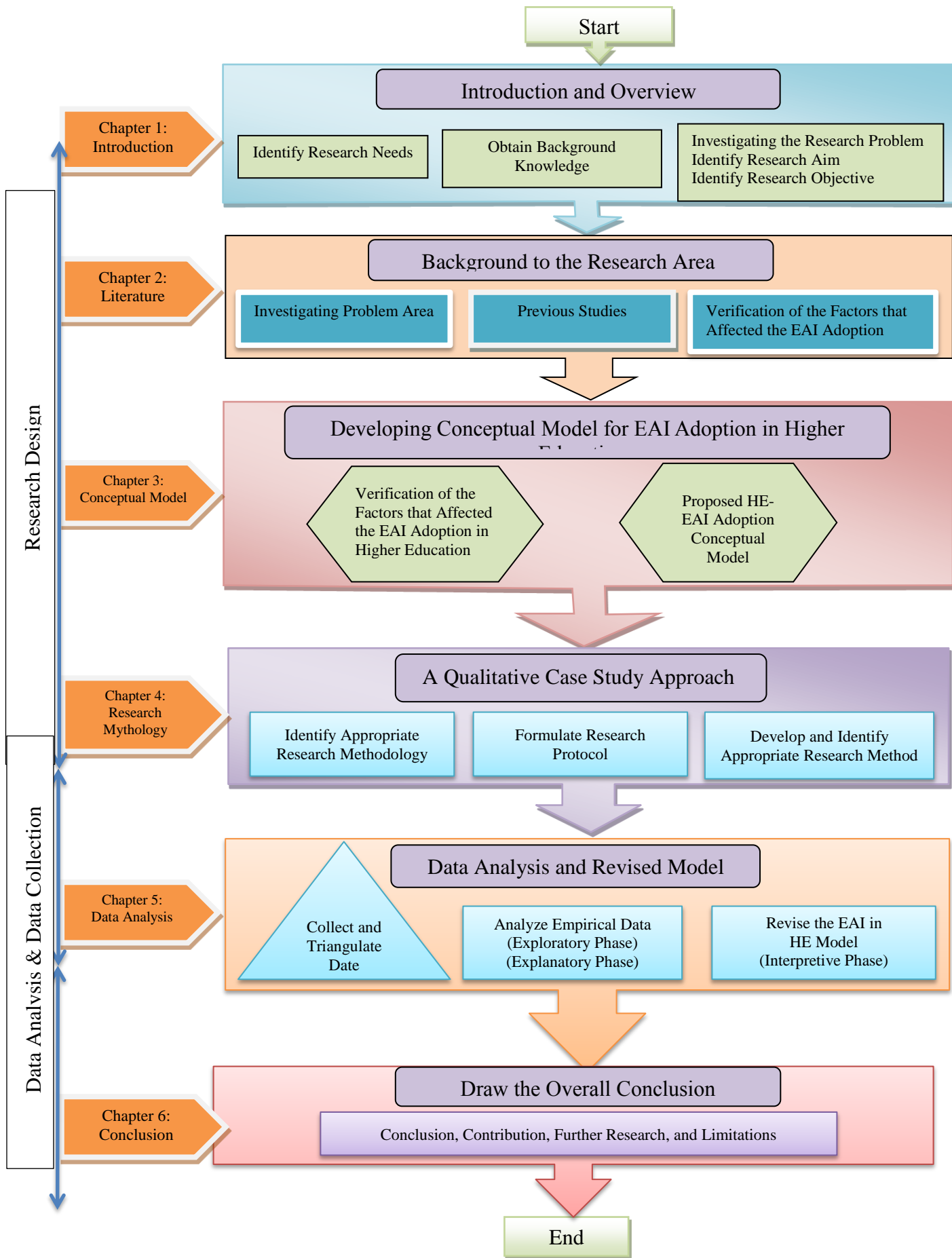


Figure 4.2: The Empirical Research Methodology Framework

4.3.1 Research Design

The first part of the empirical research methodology is the research design. The starting point is to obtain the background of the area under study through: identifying research needs, obtaining background knowledge, investigating the research problem, and identifying the research aim. Next, review the literature, to develop an understanding of the research area under investigation. From the literature review, several research EAI influential factors will be identified for a more focused literature review (EAI adoption in general). This leads to a specific research area and identifies the research need. Using the literature review, the development of the EAI adoption model is developed to represent the intended empirical research. Based on the needs of the empirical study, it was decided that the appropriate research methodology should be used to formulate a research protocol and develop and identify appropriate research method. A multi-case study strategy was implemented through the employment of qualitative research methods. The empirical research data analysis of case studies will be placed during the investigation of the three case studies at KAU, KSU, and KFUPM to verify the availability of required data. The empirical evidence that will be derived from the case studies will allow us to draw empirical evidence then to formulate the findings and draw the conclusion of this research. This will be used to develop the EAI adoption model in HEIs.

4.3.2 Data Collection

The methodology of assembling and measuring data on variables of investment is called data collection and defined as the process of data collection. Data collection is a deliberately made style to enable one to answer expressed exploration inquiries, test theories, and assess conclusions. The information accumulation part of research is normal to all fields of study including physical and social sciences, humanities, business, and so forth. While systems shift by order, the accentuation on guaranteeing precise and legitimate data gathering continues as before. The significance of correct guaranteeing and appropriate data collection is essential since, despite the field of study or characteristics of the data (quantitative or qualitative), precise information accumulation is a key to ensure the trustworthiness of the research. Both the determination of proper data collection tools (existing, adjusted, or recently improved) and unmistakably portrayed directions for their right use diminish the probability of mistakes.

Koro-Ljungberg *et al.* (2012) mentioned that documents, artefacts, observations, and interviews are the common methods used by qualitative researchers to collect data. Interviews are most popular in qualitative research as a method of data collection.

Interviews may be structured, semi structured or unstructured (Robson, 2011). The method of data collection for the following case study implemented multiple sources. These include observational research, interview records, existing literature and organizational documents. Data from multimedia files that were available on the internet were also utilised.

- ***Data Collection through Interviews***

One of the regular viewpoints is the need to collecting data could be inferred from various techniques, which incorporate interviews , documentation, observations, phone interviews, field notes and taped social communication or questionnaire surveys (Heaton, 2004). Data gathering is a vital part of research. Information accumulation is a confusing and hard undertaking. Generally, it is also exceptionally difficult to say which is the best strategy for information gathering. O’Leary (2004) commented that “collecting dependable information is an extreme assignment, and it is worth recollecting. That one technique for information gathering is not inalienably superior to an alternate.” Interviews are a precise method for talking and listening to individuals and are an alternate approach to gather information from people through discussion. The analyst or the questioner frequently utilises open inquiries. Information is gathered from the interviewee. The researcher needs to recollect the questioner’s perspectives about the theme are not of significance. The interviewee or respondent is the essential source of information for the research study. Interviews are of three types, structured, semi-structured and unstructured (Gill *et al.*, 2008). The researcher utilised the interview as the method for collecting primary data from the university representatives regarding the adoption of EAI in the perspectives of higher education. The selected university representatives for interview purposes are the Dean of the IT faculty, IT managers and IT specialists who were involved in the adoption phase of EAI. The researcher utilised both face-to-face and telephonic mode of interviews to collect the relevant information from the participants. In order to understand the data collection strategies adopted by the researcher, Table 4.2 represents the summary of the data collection techniques used by the researcher.

Technique of Data Collection	Sources Utilised in the Study
Documentation	Records from IT department of the university Peer-reviewed journals Periodicals Papers Online publications and material on the Internet
Archival Records	Records from organisation

	Information from existing record on IS
Interview Sessions	Semi-structured Structured Un-structured
Physical Equipment's	Different equipment's included software and hardware
Observational Research	Data collection through formal and informal ways for conducting meeting through interviews

Table 4.2: Techniques utilised for data collection in the current study

In all the three case studies (at KAU, KSU, and KFUPM), the researcher held several interviews within KAU, KSU, and KFUPM through interview agenda (see appendix. It was not conceivable to interview all the KAU, KSU, and KFUPM stakeholders. For this analysis, the researcher has used a coding system by denoting a letter to each department and indicating related quotes from the interviews.

- a. The Deanship of Information and Technology (DIT) supports the KAU's strategy of creating an educational and cultural community. Therefore, the researcher has selectively interviewed distinguished and significant employees who would explicitly handle EAI adoption within DIT as shown in table 4.3

No.	Position
1.	Deanship of Information Technology Vice Dean
2.	Chief Administrator of E-Management Programs
3.	Information Security Quality Manager
4.	Portal Department Manager
5.	Network Engineer MCSE-CCNP
6.	Servers Department Manager
7.	Technical Affairs Administration
8.	Network and V.C. Engineer
9.	Chief Administrator of Academic Programs
10.	System Engineering Department Manager

Table 4.3: case study stakeholders of the KAU

- b. The Deanship of E-transactions and Communication (ETC) is responsible for all IT infrastructures in KSU. So, the researcher has interviewed elite employees who would be considered in EAI adoption within ETC as illustrated in table 4.4.

No.	Position
1.	Dean of E-Transaction and Communication
2.	Vice-Dean Development and Quality Affairs
3.	Vice Dean for Technical Affairs
4.	ICT Infrastructure Director
5.	Application Department
6.	ERP (MADAR Project) Technical Manager Application and e-Services Department Consulting
7.	Director & Quality Dept.
8.	Head of Computer Section Deanship of Admission and Registration
9.	Consulting and Manager of Deanship
10.	Administrative Assistant Deanship

Table 4.4: Case study stakeholders of the KSU

- c. The Information Technology Centre (ITC) is responsible for KFUPM IT infrastructures management. Therefore, the researcher has interviewed a number of selected employees who would be involved in EAI adoption within ITC as depicted in table 4.5.

No.	Position
1.	Director, Information Technology Centre (ITC)
2.	Manager, Systems Operations and Support ITC
3.	Technical Manager ITC
4.	Assistant Manager of Academic ITC
5.	Manager Administration Information System ITC
6.	Manager Business Support Department
7.	Manager Project Management Office
8.	Technical Manger

Table 4.5: case study stakeholders of the KFUPM

- ***Significance of Face-to-Face Interview in Research***

The researcher used this type of interview technique to gather relevant information from participants according to their convenience. McLeod *et al.* (2011) reported that the involvement of participants themselves through face-to-face interviews is the best way to understand the social processes. So, the face-to-face interview mode of meeting and interaction, or an individual meeting, is presumably the most prevalent and most relevant type of information gathering. It has been expressed as the best type of information accumulation when one needs to minimise non-response and amplify the nature of the gathered information. Thus, face-to-face meetings are regularly used to request data in matters that might be acknowledged to be exceptionally delicate; for instance, information

gathering on marketing trends at universities for the Master's degree admissions. These interviews represent the focal points and main data source of face-to-face discussion as top of essential operational contemplations for fruitful meetings. By a wide margin, the fundamental focal point of the meeting is the proximity of the questioner, which makes it less demanding for the respondent to either clarify responses or request elucidation for things in the questionnaire survey. Questioners can utilise visual supports, e.g. show cards, to aid respondents to settle on a choice or decision.

These interviews have a notable advantage of empowering the researcher to make a rapport with respondents and empathise with them. Such interview sessions yield the most astounding reaction rates in overview research. They additionally allow the researcher to establish highest responses and, when fitted, look for collecting data. Impediments incorporate being unrealistic when vast examples are included, as they are drawn out and difficult to deal with (Leedy and Ormrod, 2005). Personal or face-to-face interview sessions typically require more time and preparation than other research systems for every meeting. This is especially correct of in-house meetings, where travel time is a main consideration. Moreover, every higher education institute has its own aspects. It draws its students from a particular educational background, and its curriculum profile likewise affects the sort of students who are attracted to study there. These qualities might vary from the target market and make non-realistic result.

- ***Significance of Telephonic Interviews in Research***

Other than personal interviews, the researcher also utilised telephonic interviews for obtaining data as another primary source of data collection. Phone meetings, or telephonic interviews, are utilised widely in quantitative research.. Conversely, moderately few qualitative studies utilise phone meetings. When qualitative phone meetings are mentioned, they have a tendency to be delineated as the less engaging option compared to close and personal interviews.

The phone meeting is an acknowledged approach for quantitative information gathering; it is a primary study method and the most broadly utilised research instrument within developed countries. Reported favourable advantages of phone interviews incorporate less expense and travel, capacity to achieve topographically scattered respondents, capability to manage questioners, and improved questioner wellbeing. Reported disadvantages of phone interviews incorporate restricted phone scope in certain ranges, more level reaction rates, need for short meeting term, and non-attendance of visual or non-verbal signals (Sturges and Hanrahan, 2004).

- ***Significance of Observation in Research***

The other technique for data collection is observation. The phenomenon of observation in research is defined as an instrument that is discriminated to the change and improvement of another item or administration (VanWynsberghe and Khan, 2008). The tool of observational research ought to be used when intending to make changes to, or improve another item or administration that has a human association. It is imperative to examine the ways that individuals interact with various items and administrations. The most imperative expertise of observational research is distinguishing the human element of each item that is developed. A precise strategy for information gathering is where extensive preceding and observational research takes place. Data collection such as, the type of recording, when it is recorded, how frequent, or to what extent the preceded behaviours happen. By comparison, informal observational research is unstructured, and might structure the basis of anticipated organized perception. The structured observation strategies are seen as fewer destinations than organized perception. The observer may concentrate on behaviours without a reasonable hypothetical structure, and may not be coding the behaviours in a dependable, i.e. repeatable way. The opposite perspective is that a theoretical model cannot represent reality. Observation is a standout amongst the most significant devices utilised within item advancement and creation.. This observation is valuable to both the respondent and the researchers. The outcomes of the observational research are certainly making clients excited and open up new markets. Thus, observation is basically about altering the psyche of individuals. There are unusual items left to be revealed, in as much as individuals keep their eyes open for persuasion (Polkinghorne, 2005).

1. Sampling Strategies

A sample for the study will be selected by implementing a sampling strategy criterion in order to perform the interviewing in the exploratory research phase. Senior managers, particularly from the research and development department in HEIs were targeted. The strategy of intensive sampling was followed by selecting the sample of the HEIs case study in the explanatory phase. Staffs from three universities were selected for interviewing in the exploratory phase. This was decided to ensure that the judgment was based on sufficient knowledge of universities' background and their processes. It is obvious that EAI development involves IT departments and their managers, and hence the study included a review of the IT departments. Information from participants was used as a sampling criterion in the interpretive phase. The researcher particularly targeted the participants of these sample thorough interviews.

2. *Sample Sizes*

The sample size was a minimum of eight to ten interviews in each university. This is considered as a sufficient size to ensure that viewpoints from different perspectives are covered (Gray, 2009). In the HEIs case study, the sample size depended on the number staff from IT departments who are available to be interviewed.

- ***Procedure for Data Collection***

The reason for qualitative studies was to describe the point of view from the members' perspectives through interview sessions with the university representative, especially who were concerned with the IT department and EAI deployment within its domain. The second tool for collecting the data was based on the observational research. Gill *et al.* (2008) said the expectation of the analyst was to listen to members or watch them in their regular surroundings. Despite the fact that qualitative examination strategies make it troublesome to anticipate how information can be gathered through interview sessions and the telephonic mode of obtaining information along with observation. The researcher had the commitment to consider the actual results of the interview and to weigh both profits and potential mischief. The challenges inalienable in qualitative analysis might be reduced by recognize and the use of well-created ethical standards, explicitly self-governance, beneficence, and equity. Thus, the participants of the research were ensured, and the names of the members were excluded from the demographic area of the meeting agenda. The presentation document was attached to all questions driving force for two reasons: first to introduce the researcher and the motive of the research study while the second was to guarantee that every participant's identity would be secured and not revealed.

- ***Methodological Triangulation***

Research bias is acknowledged as a peril in utilising qualitative research methods (Massey, 1999; Stake, 2010). Therefore, to protect the quality and legitimacy of data, information triangulation was utilised to defeat the risk of utilising a qualitative research approach within this study. Triangulation is intended to give a research more adaptability and exactness of research, notwithstanding enhancing the quality and legitimacy of the study (Jackson, 1999). The need for triangulation additionally emerges from the moral need to affirm the legitimacy of research methodologies and to certify the conventions used (Stake, 1995; Yin, 2014).

When reduced to a simplistic concept, triangulation means a convergence of data, where multiple separate pieces of information sourced by different methodologies, sourced by diverse techniques, would indicate the same conclusion. This makes data triangulation possible, which provides stronger substantiation of theory. The research studies depict numerous sorts of triangulation that is triangulation can happen from different viewpoints (Stake, 2010):

- Theory: Which includes the utilization of some frames of references in the examination of the same set of information
- Data: Where an endeavour is made to assemble or watch through the utilization of an assortment of research systems, consequently guaranteeing that a hypothesis is tried in different ways.
- The researcher: Where various eyewitnesses, coders, questioners /or investigators are deployed in the same study.
- Methodological: Where two or more information gathering methods are utilized in a single study to build the validity of interpretation.

In social examination, the term is utilised to allude to the perception of the research issue from (no less than) two separate focuses. This meaning of the term is utilised within qualitative, quantitative research and in connection with joining them together. Triangulation is frequently compared with applying diverse methodological methodologies. Prior to non-reactive estimation and multi-quality multi-technique framework examinations, the beginning stages to improve this thought of triangulation has taken place. At first, triangulation was perceived as an approval procedure. Anyhow, in a broader comprehension, four types are recognised. Essentially, Merriam (2014) reported the triangulation is a convenient method to be used in qualitative research. In the event that specialists chose triangulation, a few sorts of triangulation might be utilised: information, examiner, hypothesis, methodological, and natural. Triangulation could be utilised to extend the researchers' comprehension of the issues and boost their certainty in the discoveries of qualitative studies. Triangulation of information consolidates information drawn from distinctive sources at diverse times, in difficult circumstances or from distinctive individuals. Surveyor triangulation is portrayed by the utilisation of distinctive eyewitnesses or questioners to adjust to the subjective views of people. Triangulation in qualitative assessment might be accomplished by gathering information from numerous sources, in various ways, and gathering various types of information on different courses in various subjects. In this research three sorts of triangulation were specifically utilised: (a) informational and data wise (Denzin, 1989), (b) methodological and, (c) interdisciplinary

triangulation (Patton, 2002). Triangulation is sometimes used to allude to all occasions in which two or more research routines are utilised. Consequently, it could be utilised to allude to multi-method studies in which quantitative and qualitative research techniques are combined to give a more finished set of findings than could be arrived at through the use of one of the methods alone. In any case, it could be contended that there are great analysis behind holding the term for those particular events in which specialists look to check the legitimacy of their data by cross-checking them with an alternate strategy. In this research, information, methodological and interdisciplinary triangulations were utilised, as summarised and delineated in Table 4.3 below.

Case study	Triangulation Type	Sources for Data Collection
KAU	Data	Research reports, interview interpretations, records from organisations and observational records
	Interdisciplinary	Organisational culture, management style, IT, IS and EAI systems
	Methodological	Documentations, previous records, interview records, observational research and physical objects
KSU	Data	Research reports, interview interpretations, records from organisations and observational records
	Interdisciplinary	Organisational culture, management style, IT, IS and EAI systems
	Methodological	Documentations, previous records, interview records, observational research and physical objects
KFUPM	Data	Research reports, interview interpretations, records from organisations and observational records
	Interdisciplinary	Organisational culture, management style, IT, IS and EAI systems
	Methodological	Documentations, previous records, interview records, observational research and physical objects

Table 4.6: Type of triangulation Used in the Research

Information triangulation in this research includes utilising distinctive wellsprings of data within a request to enhance the legitimacy of a study. These sources are liable to include, reports, white papers, deliverables, organizational records, and perceptions. This sort of triangulation, where the researcher utilises distinctive sources, is perhaps the most prominent on the grounds that it is the least demanding to execute. Interdisciplinary triangulation includes the concentration on all existing information systems, management, and the culture inside the KAU, KSU, and KFUPM to research their co-ordination.

Methodological triangulation includes the utilisation of various qualitative strategies to study higher education inside the KAU, KSU, and KFUPM, such as credentials, interviews, observations, physical ancient rarities, and archival records. For instance, documentation and meetings could be contrasted while checking whether comparable outcomes are constantly discovered. Assuming that the conclusions from each of the techniques are the same, then legitimacy is secured.

4.3.3 Data Analysis

The exact research data analysis of careful data analysis was set throughout the investigation of the KAU, KSU, and KFUPM to confirm the accessibility of needed information. The exact confirmation that was determined from the research endeavours permitted the researcher to make an observational determination. An exact confirmation then was utilised to reach the inferences and findings of this research, which detailed the last key system for EAI selection within the higher education sector. Data analysis consists of exploratory, explanatory, concluding, and interpretive phases. It provides further related data to the EAI adoption factors in the HE field. These data will be used for the analysis of the proposed EAI adoption model in HE through the following phases:

a. Exploratory Phase

The exploratory phase investigates and discovers the process of EAI adoption in HE from its practical point of view, by investigating the available knowledge and current practice in the HE environment. This involves selecting a method of interviewing to interview experts at the universities under study. The benefits of this approach will be presented later in this chapter. Moreover, the proposed EAI framework was validated in this phase. Furthermore and according to these interviews, the conceptual framework can be enhanced by performing the required design changes.

b. Explanatory Phase

A particular university, as a case study, is implemented in the explanatory phase to complete the collected data in the exploratory phase, by taking into account EAI adoption factors in HE processes in more detail. After a holistic overview of the process is gathered from the exploratory phase, why and how the process is executed will be found out by the explanatory phase. This enables additional understanding of how and when a user is engaged to enhanced recognition of the EAI adoption factors in the HE domain.

c. Interpretive Phase

The interpretive case study occurs in combination with the explanatory case study. The design of the EAI conceptual model in HE was refined in this phase according to the analyses of the empirical work (Gray, 2009). The HEIs practice should either support the claims in the literature, or actually describes the constituents of the process that take place in the present HE and may be left undiscovered through the literature search. This study explored the EAI factors in the HE environment, and focused on particular factors affecting the adoption of EAI in HE. These factors can provide a view of the revised model which attains a level of acceptability in the HE area.

d. Concluding Phase

This phase concludes different research threads and validates the findings against the proposed EAI adoption model.

- **Analysis Method**

The essential task throughout data analysis is the identification of common topics in individuals' description of their experience. The methodology of qualitative information examination has utilized numerous structures, but at the same time it is essentially non-scientific in nature. Throughout this study, information dissection was included looking at the significance of individuals' power and activities. Information might be gathered through a combination of methods, such as documentation, archival records, meetings, perception and physical objects. However, information was gathered regularly by in-depth discussion with members. In the wake of deciphering the meetings, the researcher ordinarily had taken the following steps (Creswell, 2012):

1. Identified explanations that were identified with the theme: The researcher differentiated the important from immaterial data in the meeting. The pertinent data were divided into minor portions, e.g. phrases or sentences that reflect every particularly considered item.
2. Groups' explanations of important units. The sections were aggregated into classifications to reflect different viewpoints which showed the significance of the phenomena as they were encountered while looking for dissimilar views. The inquirer built and acknowledged different courses in which distinctive individuals experienced the same phenomena.
3. Constructed a composite: The various meaning identified were utilized to advance a general depiction of the occasion as individuals regularly experienced it.

Investigation began when information was gathered, then dissection identified guided choices with further information accumulation. Finally, the effect was a general portrayal

of the phenomenon, as seen by the individuals who had existed in the case studies under investigation.

- **Case Study Method**

Creswell (2003) and also VanWynsberghe and Khan (2008) have characterised a careful investigation as research that “investigates in profundity a system, an occasion, a movement, a procedure, or one or more people”. Case studies are convenient in giving a multidimensional picture of a setup (Whitman and Woszczyński, 2004). There are diverse sorts of detailed analysis, for example exploratory, expressive and logical, contingent upon if they are utilised to reply “what?”, “how?”, or “why?” research questions individually (Yin, 2014). The case study detailed analysis methodology will focus on the adoption procedure of EAI in higher education. It will investigate the selection phases of HE sector that have been validated by the educational establishments; the research objects were KAU, KSU, and KFUPM. This accelerated the classification of the components that repress or advertise the choices for appropriation at a specific stage, and consequently accept the proposed adoption framework that has been created. Thus, in this research the researcher carefully utilised exploratory investigation. This was on the grounds that the examination concentrates progressively on inquiries of the “what?” sort (for instance, “what are the components that affect the selection of EAI in higher education (HE)?”). Careful investigation looks into procedures that are especially relevant to certain sorts of issues, such as those which look into hypothesis at their early developmental stages. To test the proposed EAI calculated schema, the researcher selected KAU, KSU, and KFUPM that face numerous identified issues with their existing IT frameworks. For example absence of: co-ordination of IS inside the KAU, KSU, and KFUPM, combination of research and advancement, correspondence between staff and scholars from induction and. These restrictions expedited together developed an IT base by combining the existing IS. In this research, a solitary detailed analysis procedure was utilised to investigate and comprehend the EAI reception in educational institutions. A qualitative methodology can offer a “comprehensive” perspective of the included courses of action and an acknowledgment of the point under research. As expressed in the previous chapters, the reception of EAI in higher education is another topic that has been little researched. Thus, the utilisation of a qualitative research study method was acknowledged by the researcher as fit for concentrating on the phenomena of EAI appropriation. As a qualitative system, a detailed analysis methodology was utilised within numerous investigations of IS. Notwithstanding, to the best of the researcher’s knowledge, such a methodology has not been utilised within

the territory of EAI. This is traced to the fact that there is an absence of distributed investigative exploration of the reception of EAI in HE. The same explanations, as those reported above, would explain that appropriation of EAI in HE is another research territory. Accordingly, for all these explanations, the researcher decided that detailed analysis procedure is suitable for the exploration shown in this research. The multiple-detailed analysis methodology might be suitable, since a solitary research study may not give sufficient information that might defend the preceding model of the higher education sector. The explanation behind this was that the proposed vital schema of HE was important to recognise the elements that affected the reception of every stage, which helped the researcher to look at detailed analyses. Considering the careful investigation, the researcher applied and utilised multiple sources of information and data such as observation, face to face interview, structured interview, etc....

4.4 Ethical Considerations

The researcher has taken research ethics into account before and throughout this study and the complete study was conducted consistently with those standards. Usually, qualitative researchers concentrate their exploration on investigating, inspecting, and portraying individuals and their regular surroundings. Installed in qualitative exploration are the notions of relationships and power between researchers and participants in the research. The desire to take an interest in a research study relies on a contributor's ability to impart his or her experience.

4.4.1 Autonomy

Orb, Eisenhauer and Wynaden (2001) said that any sort of research ought to be guided by the standards of respect for individuals, beneficence, and justice. They acknowledged that respect for individuals is the recognition of participants' rights, including the right to be educated about the study, the right to choose unreservedly whether to take an interest in a study, and the right to withdraw at any time without punishment. In a qualitative research study, this guideline is honoured by educated assent, which means making a sensible adjustment between over-educating and under-updating. It additionally implies that participants practice their rights as self-governing persons to acknowledge voluntarily or decline to take part in the study. Assent has been alluded to as an arrangement of trust, and it requires continuous renegotiation (Munhall, 1988).

4.4.2 Beneficence

A second ethical principle nearly connected with research is beneficence—doing well for others and preventing harm. Beneficence in some scenarios might be taken to the great as paternalism. However, a paternalistic approach indicates the denial of autonomy and flexibility of choice and ought to be avoided.

4.4.3 Justice

The rule of equity alludes to equivalent offer and reasonableness. One of the significant and unique characteristics of this rule is avoiding misuse and ill-use of participants of the research. The researcher showed that the adherence to the rule of equity in qualitative research studies was showed by recognizing vulnerability of the participants and their commitments to the study.

4.5 Summary

The aim of this section is to present a basis for the choice of an appropriate research method for this thesis. This section discussed the research methodology used within this thesis. This could not just give the research process an overall developed framework, but to give a comprehension in the broadest conceivable terms. A discussion of the epistemological stances and their suitability was given first. In finishing along these lines, the researcher advocated the utilisation of an interpretivist stance for the research. From there on, quantitative and qualitative exploration methodologies were examined. The researcher recommended that, for Variety of reasons, in the context of this research a qualitative methodology was more proper and appropriate. Such explanations included the point that a qualitative methodology could be utilised to: explore little known phenomena like EAI selection, look at deeply complex forms (EAI appropriation), inspect the phenomenon in its characteristic setting and gain experience from practice. At that point, the sorts of examination systems that were accessible and explanations behind selecting specific ones were furnished. In this manner, the utilisation of detailed analysis methodology in this research was investigated illustrated. Besides, different research endeavours were utilised in this research to investigate and understand the selection and assessment of EAI. Furthermore, the utilisation of research strategy was laid out and explained, and arguments for the suitability of specific strategies were furnished. Accordingly, different techniques for information gathering were utilised by the researcher throughout this research, incorporating: interviews and meetings, documentation,

observation, archival records, and investigation of physical objects. Subsequently, the research analysis used in this research and the utilisation of information triangulation were depicted. Associated with this, this section presents the careful investigation convention for this research. This case studies protocol was an essential tool that acts as action plan that was ready for the experimental enquiry. Taking into account this protocol, the researcher utilised detailed analysis for points of views to permit others to identify their experience to the result of this research. Subsequently, the work exhibited in this thesis could give a broader comprehension of the sensation of EAI appropriation with respect to the higher education sector. Frequently the information gathered was not integrated enough, and provide a broader understanding of understanding of the EAI adoption in HE.

5 CHAPTER FIVE: DATA ANALYSIS AND REVISED MODEL

5.1 Introduction

This chapter introduces the analysis of the completed empirical work, and is presented according to the research phases: exploratory, explanatory and interpretive. The structures of the themes of analysis will be outlined. These themes were depicted in the findings by giving each interview text a number (or a code). The references were linked to interviews, documentations and observations for each phase using coding schemas. The analyses of the interview findings were deduced from the content analysis and introduced under separate headings. At the end of the chapter a conclusion will be presented to summarise all the phases. The conclusion draws the threads of the findings and empirical work of the different phases. The conceptual framework design was modified based on the empirical findings. These design implications will be explained in a separate section headed “Design Action”.

5.2 Exploratory Phase Overview

The purpose of this study is to identify and classify themes by implementing content analysis related to higher education within Saudi universities. These themes include:

1. Technological Factors
2. IT supportive Factors
3. Organizational Factors
4. Environmental Factors
5. Financial Capabilities

The interviews at three Saudi universities were analysed under the five listed themes. A number of key ideas that represent the characteristics of the university’s perspective were identified by the thematic analysis. The factors that influence or contribute to the process of development and its holistic interpretation were provided by the results. The design of the conceptual framework was related to the concluding summaries of the findings.

5.2.1 Themed Analyses for Exploratory Phase

The exploratory phase consisted of empirical study applied in HEIs, aiming to learn current practices from the industry. Interviews were conducted with the proposed experts from three universities in Saudi Arabia. Moreover, the researcher used observation and written documents to extract the required information. In each case, senior managers involved in

IT constitute the sample of interviewees. After sending the research ethics (Appendix B2) and obtaining the approval, IT managers who met the sampling criterion were informed, and letters sent out specifically to them together with an agreement and an interview agenda forms (Appendix B). These managers were regarded as the experts because they have sufficient knowledge about IT development and they were able to express their views and concerns about the future of their departments. The interviews and observations were conducted at each university's respective location and on its website for each case. The interviews were conducted as semi-structured interviews according to the design presented in chapter four. All interviews were audio recorded and transcribed for later analysis. Useful comments were written down for follow-up discussion.

The findings from the interviews were linked to the EAI conceptual framework in this section. The reliability of the results was strengthened by the use of various types of data from both the literature and the interviews. The coding system for the analysis was performed by denoting each university or case by a letter: A, B and C to represent one of the three universities from which members of staff were interviewed. Letter A denoted King Abdulaziz University (KAU), letter B denoted King Saud University (KSU), and letter C denoted King Fahd University of Petroleum and Minerals (KFUPM).

5.2.2 Background of the three universities

This section describes the backgrounds of the three case study universities. It includes a short description of each of them then background of the integration problem. The integration problem of the three universities could be understood by looking at various influential factors, including the modifications of existing problems and by referring to the following quotations from the staff of universities. "A lot of our problems are due to nonintegrated systems" so the integration normally improves the performance of existing systems (University A). "The quality of higher education process can be significantly improved by Information Technology" (University B). "Using IT can create new approaches to reach the student and staff satisfaction and enhance student participation in the higher education process" (University C). It can be stated that EAI would improve management of staff and students in the community by empowering them for self-management. To express the problem, the factors and the environment of the existing system should be identified. The following is a brief background for each case.

KAU case study

1. KAU Case study description

King Abdulaziz University carries the name of the founder of Saudi Arabia- God bless him. This university was established in 1387 H / 1967 G as a national university aiming at spreading higher education in the western area of Saudi Arabia. This dream has come true through the continuous efforts of the loyal citizens of the country. King Abdulaziz University includes two separate campuses according to Islamic regulations one for males and another for females. Each of these campuses is provided with all cultural, recreational and athletic facilities, in addition to a big library equipped the most up-to-date technology to serve students and teaching staff. Within four decades, the university became one of the outstanding higher education institutions on the local and international level (for more details, see appendix A1).

2. Background of KAU Integration Problem

The KAU has turned itself largely and successfully into an electronic university. It is targeting in this context its strategic plan II to institutionalise all the aspects of this identity while emphasizing the continuous improvement of its quality. The main aim is to develop the efficiency of the university in serving both its internal and external constituencies. According to this plan, the applications of such identity could provide better services to academic leadership, staff members, administrators and students. On the other hand, it will effectively enhance the connections among all the KAU units and the relations and connections between the university and the community for their common interest. In addition, it would give a high-quality support to the relations with international universities and associations. The electronic identity will be institutionalised through spreading the culture of electronic transactions and developing the practical skills, applying electronic management with all its procedures and perspectives, expanding the frontiers of distance learning and developing the quality of the KAU websites and electronic portals. The expansion of e-learning is designed to include an online syllabus for the majority of taught courses, in accordance with the attendance system, and to publish distance learning materials. The expansion of such disciplines will be at all levels: bachelor's degree, higher diploma, and master's and doctorate degrees (for more information see appendix A1).

KSU case study

1. KSU Case study description

Establishing Saudi Arabia's first university was a response to the educational and professional needs of a young nation. Abdulaziz Al-Saud, proclaimed the King in 1932, began laying the foundations for modernizing his country and establishing an educational system. In 1953, Saud, the eldest son of Abdulaziz, acceded to the throne upon his father's death. He would soon institute the Council of Ministers and establish the Ministry Education (for more details see appendix A2).

2. Background of the KSU Integration Problem

The KSU has built an effective electronic university. It is targeting the connection of its strategies to systematise all the views of this character while underscoring the consistent change of its quality. This is focused to advance the proficiency of the college in serving both its interior and outer voting demographics. Essentially the KSU has to tackle the following issues:

- Poor reply times for clients and business forms
- Missed administration levels for discriminating business capacities
- Security breaches
- Inadequate administration
- Gaps and limitations in governance
- Assessment issues and challenges

The KSU has four major challenges to deal with:

1. **File Transfer:** One provision composes an index with an alternative that can be later perused. The requisitions need to be arranged according to the filename and area, the organization of the index, the timing of when it was composed and read, and who is able to delete the record.
2. **Shared Database:** Different requisitions impart the same database pattern and may be located in a solitary physical database on the grounds that there is no copy information space and no information must be exchanged from one requisition to the other.
3. **Remote Procedure Invocation:** One requisition uncovered some of its purpose so it might be accessed remotely by different provisions of a remote system. The access happens continuously and synchronously.

4. **Messaging:** One requisition distributes a message to a regular message channel. Different provisions can read the message from the channel at a later time. The requisitions should coincide on a channel; the organization of the message and the correspondence are asynchronous in nature (for more information see appendix A2).

KFUPM Case study

1. KFUPM Case study description

King Fahd University of Petroleum & Minerals (KFUPM) were officially established by Royal Decree on 5 Jumada 1, 1383 (23 September, 1963). The first students were admitted a year later, on 23 September, 1964, when 67 young men enrolled in what was then named the College of Petroleum and Minerals (CPM). Since that time, the university enrollment has grown to a level that is expected to exceed 8,000 by the 2009 academic year (for more details see appendix A3)

2. Background of the KFUPM Integration Problem

The KFUPM achieves great success in being a virtual university. In this context it has prepared a strategic plan to institutionalise all business with the emphasis on quality improvement. The aim is to develop an effective and efficient university to serve students, professors, administrators and the Saudi community. The required institutional character will be achieved through performing many tasks: the deployment of e-culture, development of the individual practical skills, and application of electronic administration in all procedures and operations, expanding distance learning strategies and developing the KFUPM portal. The expansion of e-learning with curriculum design and the deployment of distance learning will be expanded for all levels of study: bachelor degrees, higher diploma, and master's and doctorate degrees.

In addition to EAI adoption and integration challenges among the universities mentioned, the interviews also revealed some other important components of the research that will be presented later in the study (for more information see appendix A3).

5.2.3 First Theme: Technological Factors

The first theme obtained from the interpretation of the interviews is technological factors which includes the capability of establishing IT systems. This factor can be evaluated by the university which can take the necessary actions to reduce risks. The participants in the interviews' sessions accepted the significance of IT in the educational sector. However, their concern was related to the integration that promotes sharing of information among departments and units. It is a fact that a university is an important business organisation where satisfaction of students, staff and faculty is of the same importance as that of customers to any business organization. They agreed that integration has an important role in achieving targets. At the same time, they raised the point that the institution and its IT personnel should have proper knowledge of IT capabilities to enable them to easily evaluate their functionalities in relation to technologies. The universities have not created simplified solutions to EAI issues since their previous knowledge was not utilised to obtain conceptual as well as structural information for EAI frameworks. However, proper evaluation can assist in providing knowledge for IT representatives to classify the EAI components and to create functionalities for developing integrating technologies. An important issue was concluded during the interview session, which is the resistance to change and adoption of a particular new IT system. This was due to the incomplete policies and communications among users, staff and students about the usage of even simple IT systems. Thus, there is a great need that users should understand the perspectives and objectives behind the usage of an IT system and whether it is part of EAI or any interacting link on the students' portals. The integrated commercial centre is to a great degree unpredictable with differing qualities of EAI items and innovations tackling distinctive sorts of issues. Thus, universities are trying to put forth a schema that helps the choice of reconciliation between innovations and devices. This structure highlights a fusion of integration innovations that could be utilised to mix an IT base. Such a framework might be recognised as an apparatus to uphold choice making for EAI selection. The participants pointed out some risks, such as minimum usage or uncertainty that could lead to a huge reduction in IT investment. Security and protection of essential information has persistently been vital. In an open and distributed system within the domain, access control and validation instruments have an essential part to play in universities. Subjects' information might hold a percentage of the most vital data, for example addresses, expense credits history, obligations (if any), subsidies and profits. Access to such data must be regulated in the light of the fact that exposure to unauthorised users might cause issues for

subjects' protection. Therefore, there is a need for a design that furnishes the best security methodologies to educational institutes.

5.2.4 Second Theme: IT Supportive Factors

This theme, as obtained from the interview sessions, is related to IT support factors. The deployment and implementation of any IT system requires different types of support. The participants identified that the most important support factor for EAI adoption was financial support. There is no doubt that in the course of adopting advanced and enhanced IT, financial assistance is essential for developing software and hardware. This could be achieved via training of users. The IT representatives added an important perspective that was related to higher managements support. They further reported that enhancement might rise enduringly since top administration might acknowledge enhancement and help earnestly. This will keep up the quality framework and climate of the organization in a way that upholds advancement reception. Consequently, the researcher (interviewer) acknowledges that the top management is always a persuasive element for EAI selection.

5.2.5 Third Theme: Organizational Factor

This theme as identified from the interviews' interpretations is related to the organizational factors. Important information based on the perspectives of the participants was obtained. The formal environment and established policies of IT implementation within the universities are essential to approve EAI adoption. Thus, adoption of EAI is directly linked with the decision-making strategies. There is no doubt that most of the established policies are coming from the pool of higher management, and thus top management can persuade organizational users to accept the adoption of EAI. The encouragement and support to IT personnel to actively take part in EAI adoption planning should be considered. This has led to the capabilities of IT managers, experts or department to encourage people to adopt IT. However, IT experts pointed out that higher management should support their perspectives and help them to develop clear objectives for EAI adoption so that goals can be achieved.

5.2.6 Fourth Theme: Environmental Factor

The fourth identified theme is the environmental factor. The interviewees reported that internal or external environmental issues have big importance. Stakeholders, for instance, are considered to be the most important influential external factor of the adoption of EAI. The IT experts added that creating an EAI system is necessary to identify the target markets. The identification of EAI within the university premises initiates innovation along

with the infrastructure and financial assistance. Users' satisfaction, such as students' satisfaction with using portals, is crucial for the evaluation of services and their standards. Internal pressure, including the roles and responsibilities of certain IT representatives, cost issues and privacy, are also factors. The representatives reported that the capabilities of IT personnel, operational costs and security concerns are the main causes of unsuccessful EAI adoption. Adoption of EAI without definite objectives may be responsible for increasing operational cost. Consequently, universities may limit their investment in adopting EAI.

5.2.7 Fifth Theme: Financial capabilities Factor

The last identified theme is the financial factor. The interviewees illustrated the importance of cost or return on investment (ROI) to the university. The cost factors could influence the adoption of EAI within higher education institutions.

5.2.8 Summary and findings

The analysis of the interviews' with the selected university representatives will be presented in this section. The researcher has utilised the adoption factors as the basis for this study; the idea was driven by the literature and recent research. The overview of the methodology will be presented and will be followed by exploring the case studies of the universities at which the integration issues were mostly reported to the university management and their stakeholders. The interview session covered five aspects including, case studies of integration, technological factors, IT support components, organisational factors and environmental factors. The interviews' further revealed that these factors are mainly associated with the perceived benefits, cost analysis for integration and infrastructure, motivation and, ultimately, outcomes.

5.3 Explanatory Phase Overview

The identified themes from the exploratory phase were implemented to analyse the collected data from case studies of the higher education institutions (for more information see appendix B). The internal and external communications with users were used to show how the data were collected from users, who used them and how they were used. As mentioned earlier in chapter four, the case study strategy was applied to perform this research. King Abdulaziz University (KAU), King Saud University (KSU) and King Fahd University for Petroleum and Mineral (KFUPM) were selected to implement the system of EAI within the university domain. The approach was utilized to demonstrate the issues encountered by these institutions during the adoption of EAI within their domains.

Interviews were considered as the primary source for collecting the data other than the secondary sources. Face-to-face and telephonic interviews were utilised to gather the appropriate data. The participants were the Dean of the IT department and IT managers and specialists in the field. Similarly, in order to attain an in-depth review of the EAI adoption factors, interview sessions with the other mentioned universities' representatives were also conducted. The interviews and data were collected as themes for further consideration. Data analysis was performed by the qualitative research method, as indicated in chapter 4, since the study was purely based on the qualitative mode of research. The five themes were used to analyse the integration challenges of the universities and later the adoption factors were identified. The themes are presented in the following sections.

5.3.1 Themed Analysis for Explanatory Phase

As mentioned earlier in the previous section and in chapter four, the researcher held several interviews within KAU, KSU, and KFUPM. The discussion has included the detailed analysis of the EAI adoption factors within KAU, KSU, and KFUPM.

KAU CASE STUDY

1. Deanship of Information and Technology (DIT)

The researcher held several interviews within KAU, especially within the Deanship of Information and Technology (DIT). Figure 5.1 indicates DIT which supports the KAU's strategy for creating an educational and cultural community. Therefore, the researcher has selectively interviewed distinguished and significant employees who would explicitly handle EAI adoption.

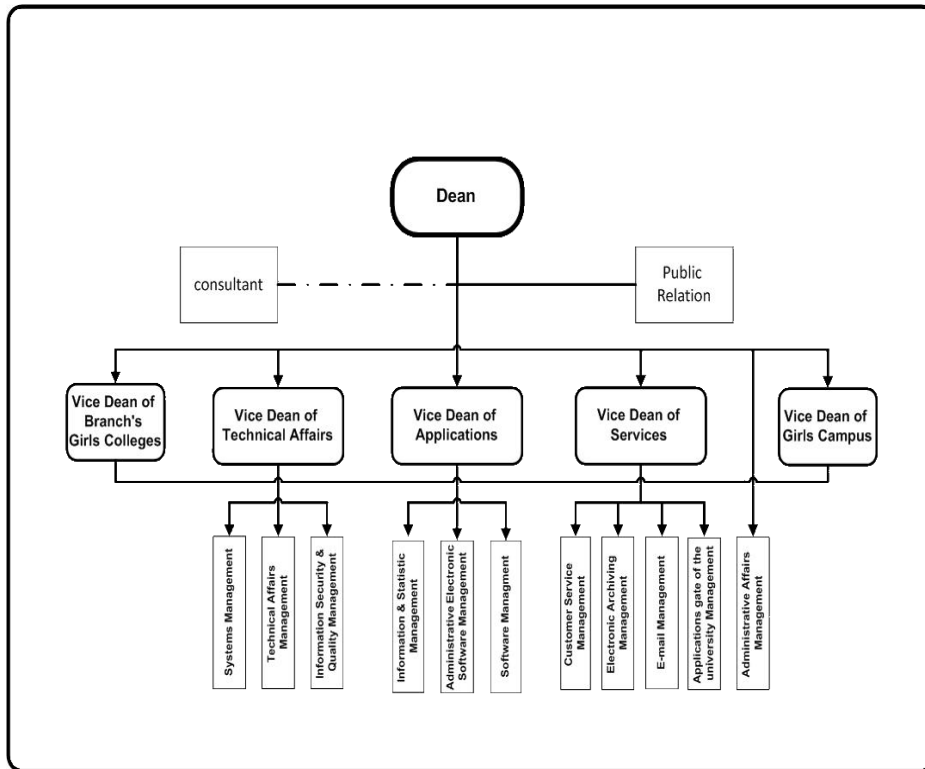


Figure 5.1: Organizational structure of DIT

2. KAU factor analysis

The researcher held several interviews within KAU. It was not practicable to interview all the KAU, KSU, and KFUPM stakeholders. For this issue, the researcher analysed and discussed each the EAI factors in the following section.

- **First Theme: Technological Factors**

The first theme that was obtained from the interview interpretation and includes the following sub-factors:

- **Technological Risk:** all KAU interviewees mentioned that technological risk has to be considered while integrating the HE applications. For example, the Information Security Quality Manager-KAU said: *“There is a need for an engineering that furnishes the best security methodologies to educational institutes within KAU to avoid any Technological Risk”*.
- **IT Capabilities:** It consists of IT infrastructure, personnel IT knowledge and IT sophistication. All interviewees at the three universities have the similar point of view that IT capabilities is an important factor in the EAI adoption process in the HE domain. For example the Network Engineer at KAU said *“IT Capabilities play a vital role in the EAI adoption in a higher education institution”*.

- **IT Infrastructure:**

All the participants within KAU reported that the IT infrastructure in HE institutions should be considered as a factor that affects EAI adoption in HE institutions. All the interviewees reported that there are 4 IS separate applications. For example, the Chief Administrator of Academic Programs-KAU said: *“KAU IT infrastructure was built on a central integrated fibre optic infrastructure that was based on two main core switches which were linked to 14 aggregated nodes; each node aggregated to several buildings and each building has a main switch that is connected to distribution floor switches to provide UTP 1 GB endpoint connectivity”*.

The Servers Department Manager-KAU spoke about IS within KAU: *“There are four separate IS applications backed the major operational needs of the KAU.”* He also added: *“Most of KAU systems cannot share business rules and data since the communication among these systems is poor. Hence, these inefficient systems cannot automate straightforward processes. Moreover, similar data might be stored in multiple locations”*.

According to the interviewees and the researcher’s observation of the DIT’s IS architecture, it added up to four separate IS applications that backed the major operational needs of the KAU. These applications acknowledged the core applications in light of the fact that they served mission-basic business functions of the KAU:

- The KAU portal and some other supportive networks running on Asp and Asp.Net specially developed using (mainly advanced) applications with MS SQL or Oracle as a database were run in a Windows environment as a platform. Table 1 demonstrates the sorts of frameworks and their platform in the KAU.
 - ERP legacy frameworks as a bundled application that administers the workflow connected with the handling of distinctive assignments. It was running on ZOS with specially crafted (by regional standards improved) applications with DB2 as a database installed on IBM Mainframes Z196 as a platform. This is at present being moved to SAP frameworks.
 - An ERP SAP system that was a bundled application that regulates the workflow connected with the transforming of all managerial courses of action. It was running on zLinux with SAP bundled applications with DB2 as a database had installed IBM Mainframes Z196 as a platform.

- Academia systems running HP UNIX with SunGard higher education banner bundled applications with Oracle RAC as a database hosted on HP Superdome as a platform.

	Type of System	Platform
	ERP Legacy systems	Mainframes Z196
	ERP SAP	Mainframes Z196
	SunGard Higher Education Banner packaged applications	HP superdome
	KAU Portal and some other decision support systems	Windows environment

T
able 5.1:

Categories of the KAU -IT information systems

- **IT sophistication:**

The Vice Dean-KAU mentioned that *“The adoption of EAI is directly influenced by integration technologies and sufficiently sophisticated IT”*.

- **Personnel IT Knowledge:**

According to the majority of the KAU interviewees, the adoption of computer applications by any organisation is significantly affected by personnel IT knowledge. The Servers Department Manager - KAU mentioned that: *“IT people within KAU should have proper knowledge of IT capabilities so that they can easily evaluate their functionalities in relation to technologies.”*

In summary KAU interviewees agreed that the present IS architecture had not fulfilled the necessities of the KAU in this way, the issue was the absence of constant integration between distinct IS applications. Despite the fact that the group forms right now utilised by the KAU might be satisfactory for intermittent handling, they were not esteemed suitable for e-nature’s turf. The absence of integration had an immediate impact on KAU’s learners, staff, and workers in various ways. The absence of integration between the applications in the IS construction modelling along these lines constrained KAU from achieving the required level of academic and managerial administration. In reality, behind the fascination of the KAU website, islands of applications existed that reflected how

KAU's IS architecture had been haphazardly assembled as opposed to deliberately arranged inside a more extended vision. Given the new key accentuation, the KAU needed to proceed with a major project to incorporate all the core educational applications on the campus.

Due to this situation, KAU were confronted with many challenges regarding their efforts to use ICT. The EAI was intended to eliminate these challenges. Interviewees at KAU emphasised that these challenges in using technology should be considered. Similar challenges are also described in the literature (Martin, 2008; Claar *et al.*, 2014; Ahead, 2013; Shelley, 2008; Martín-Rodríguez *et al.*, 2014; Al-Qahtani *et al.*, 2013; Kamal *et al.*, 2009; Kruss *et al.*, 2015; Akbulut, 2002; Kamal *et al.*, 2003; Hanafi *et al.*, 2010; Mantzana and Themistocleous, 2005; Ramdani *et al.*, 2013; Wei-Hsi Hung *et al.*, 2015; Weerakkody and Jones, 2009; Aserey and Alshawi, 2013; Wei-Hsi Hung *et al.*, 2015; Kamal *et al.*, 2013; Mantzana *et al.* 2008; Bigdeli *et al.*, 2013; Themistocleous and Irani, 2002; Khoubati *et al.*, 2008; Kamal and Themistocleous, 2006; Sohimi *et al.*, 2011). These challenges should be considered when implementing integration technologies due to practical reasons as described by the interviewees and scenarios in the literature. The EAI was planned to confront these challenges to deal with technological issues.

- **Second theme: IT Supportive Factors**

The two factors, Data Security and Privacy and Evaluation Framework, in this theme will be illustrated as follows:-

- **Data Security and Privacy**

There were several data security and privacy problems from the perspective of all interviewees at KAU. The Servers Department Manager-KAU reported that: *“The KAU needs tools for security strike, hack assault forces, use of unapproved programming, and Internet protocol security risks and viruses”*.

The KAU major information security issues were:

- The KAU information incorporates a colossal number of records holding sensitive personal data
- The hack assault forces
- Students download indexes, movies, and photographs from the Internet
- Students are utilising USB drives or other storage media
- Students' use of unapproved programming
- Instant messaging security risks
- Wireless and voice over the Internet protocol security risks

- Around the clock access to managerial administrations and advanced library assets.
- Contributions to potential misbehavior
- The utilisation of ID cards makes a university a target
- **Evaluation Framework (EF):**

The Chief Administrator of Academic Programs-KAU reported that “*KAU is in need for a tool to assist decision-making during EAI adoption*”. He agreed that EF has to be considered as an essential factor in the adoption process.

All the interviewees at KAU reported that the IT supportive factors should be taken into consideration while designing any integration solution. The factors were referred to in the literature (Lam and Shankararaman, 2007; Themistocleous, 2002; Irani *et al.*, 2003; Kamal and Themistocleous, 2006; Kamal *et al.*, 2013). These factors are practical and have empirical evidence to support them and hence it is worth taking them into consideration when evaluating integration technologies.

- **Third theme: Organizational Factor**

Organizational factor covers the following sub-factors:-

- **Formalization:**

The interviewees at KAU acknowledged the significance of formalisation in the adoption purposes of EAI. The Application Department Manager-KAU said that: “*Formalisation alludes to the presence of clear methodology, standards and formal forms for doing organizational errands*”. In addition, according to The Chief Administrator of Academic Programs-KAU added “*the notable bureaucratic structure of the higher education sector may influence EAI reception*”.

- **Centralization**

All the interviewees at KAU emphasized the importance of a decision-making authority in an organization and how this authority should allow others in the hierarchy of authority to participate in making decisions. The Application Department Manager-KAU reported that: “*I think that EAI solution is usually decided by the top level management, and hence the speed of EAI adoption will be influenced by centralization*”.

- **Managerial capability**

KAU participants acknowledged the significance of the managerial capability factor for IT adoption. The factor represents the availability of personnel to take bold and effective decisions and create new ideas.

The Deanship of Information Technology, Vice Dean-KAU mentioned that: *“EAI adoption will be much easier and faster when personnel who have sufficient experience and capabilities to produce new ideas are available”*.

- **Student records**

KAU participants acknowledged the significance of the student records factor for EAI adoption. The Deanship of Information Technology, Vice Dean-KAU mentioned that: *"Student record contains files, documents, and personal information of a student. This record is typically maintained by the university, so it is considered as important factor in EAI adoption in HEIs"*. The Application Department Manager-KAU shares the same opinion and reported that *"Another factor has significance as Curriculum in the EAI adoption process in HEIs. This factor is the student record"*.

- **Curriculum**

KAU participants acknowledged the significance of the curriculum factor for EAI adoption in HEIs. The Deanship of Information Technology, Vice Dean-KAU mentioned that: *“The curriculum is one of the significant factors for EAI adoption since curriculum is considered as the foundation for an agreement among the student, instructor and institution”*.

Finally, KAU participants recommended adding another two sub factors, i.e. student records and curriculum. According to the empirical data, the interviewees believed that any revised study or plan should involve the organisational sub-factors including the formalization, centralization, managerial capability, student records and curriculum.

In conclusion, the KAU interviewees agreed that the organizational factors are significant and must be considered when designing any solution for integration. It is evident that these factors are practical and are referred to in the literature (Ebrahim, *et al.*, 2004; Hillison *et al.*, 2001; Ching-Yaw *et al.*, 2007; Massy, 2003; Bornman, 2004; Tsinidou *et al.* 2010; Kennedy, 2014; Grace, *et al.*, 2012; Krause, 2015; Temizer and Turkyilmaz, 2012; Anthony, 2012; Ramdani *et al.*, 2013; Aserey and Alshawi, 2013; Bigdeli *et al.*, 2013; Kamal and Themistocleous, 2006; Kamal *et al.*, 2013; Daggett, 1997; Neill, 2001; Themistocleous, 2002). Therefore, they must be taken into account when evaluating integration technologies.

- **Fourth Theme: Environmental Factors**

Environmental factors include internal and external pressures sub-factors.

- **Internal Pressure**

All participants from the three universities shared the view that internal pressure is an essential factor to take into account when planning EAI adoption at their universities. In fact, their opinions match not only with the proposed model but also with those factors that were reported in the literature.

▪ **Information Security**

The Quality Manager at KAU mentioned that: *“Internal pressure is an important factor and should be essential in initiating the adoption of EAI within our university”*. Moreover, the Deanship of Information Technology, Vice Dean-KAU said that: *“the managerial employee’s attitudes toward the system influence the EAI adoption process”*. He reported that: *“there are several Strategic, Technical, Managerial, Financial and Operational Problems affect the success of any system and should be manipulated as internal pressure”*.

According to the empirical data, the internal pressure sub-factors will be the instructor satisfaction, student satisfaction, university employees, and “Strategic, Technical, Managerial, Financial and Operational pressures”.

▪ **External Pressure**

Similarly as for the internal pressure factor, all the interviewees from the three universities pointed out that the external pressure factor is also a significant factor during EAI adoption at their universities. In fact, this coincides with the proposed model and with the factors reported in the literature.

The System Engineering Department Manager-KAU mentioned that: *“the community usage of the educational services will affect the adoption of EAI at our university”*. The Deanship of Information Technology, Vice Dean-KAU said that *“the external pressures such as ICT vendors, labour market, learning community, governmental regulation, and the external cooperation have to be considered in EAI adoption in HEIS”*

According to the empirical data, the external pressure sub- factors are ICT vendors, labour market, learning community, governmental regulation, and the external cooperation. Environmental Factors are practical and referred in the literature (Chen, 2003; Chen, 2009; Sun *et al.*, 2008 ; Catalunya, 2014; Ozkan and Koseler, 2009; Xiao and Wilkins, 2015; Temizer and Turkyilmaz, 2012; Bailie, 2015; Lu and Zhang, 2009; Rolando *et al.*, 2014; Lee *et al.*, 2011; Ramdani *et al.*, 2013; Bigdeli *et al.*, 2013; Ebrahim *et al.*, 2004; Themistocleous, 2002; Wei-Hsi Hung *et al.*, 2015; Khoubati *et al.*, 2008; Kamal *et al.*, 2013; Akbulut, 2002; Norris, 1999; Wei-Hsi Hung *et al.* 2015 and Aserey and Alshawi, 2013; Lu and Zhang, 2009; Yengin *et al.*, 2011; Croxton,

2014 ; Paechter *et al.*, 2010). Hence, they are very important and should be taken into consideration while designing any integration solution.

- **Fifth theme: Financial capability**

The Financial Capability factor is the last theme identified from the interviews. According to all the interviewees, there is a direct relationship between time and money and hence the financial capability is directly related to the adoption of EAI. Most institutes fail in this respect due to the unavailability of financial resources. Although all the three universities have understood the significance of EAI within their educational domain these universities do not have proper systems for estimating the cost and other finances that are essential for adoption purposes.

The Deanship of Information Technology, Vice Dean-KAU said that: *“The financial capability may influence EAI adoption in our university”*.

- **Return On Investment (ROI)**

The Director of Information Technology Centre-KFUPM reported that: *“Return on Investment study is important when adopting the EAI in HE institutions since it is a relatively new research area in higher education.”*

The Chief Administrator of E-Management Programs-KAU said that: *“Return on Investment is an important factor in the organization that intends to apply EAI adoption technology.”*. Moreover, the Deanship of Information Technology, Vice Dean KAU mentioned that: *“ROI is an important factor regarding the adoption of EAI in HE institutions because without investing in our organizations we cannot provide the excellence of the transition”*.

- **Cost:**

Cost is an important parameter that influences the adoption of EAI in HE institutions. Cost influences the adoption of integrated packages. The Deanship of Information Technology, Vice Dean-KAU reported that: *“Integration cost can be reduced significantly when integration is applied”*.

Although these institutes have proper grants and funding systems, they are lacking methods for determining the return on investment and this could become the biggest hurdle in implementing IS system improvement such as the expansion of IT and EAI. Thus, the cost directly influences the adoption of EAI in the universities. Institutes and universities belong to the higher education sector which requires IT integration to a greater extent compared to other organisations. The KAU has lacked practices in terms of integration

which has better IT standards but EAI adoption has not been achieved yet. The interviewees at the KAU agreed that the cost factor is very important and should be taken into consideration when designing any integrated solution because levels of financial capability greatly influence EAI adoption. As these factors are also referred to in the literature (Kamal *et al.*,2013; Akbulut, 2002; Simanaviciene *et al.*, 2015; Lo *et al.*, 2011; Rezaie *et al.*, 2012; Khoubati *et al.*, 2008; Irani *et al.*, 2003; Bigdeli *et al.*, 2013), it is evident that these factors must be taken into account when evaluating integration technologies as suggested by the literature and practical evidence.

3. KAU EAI Project Implementation

Because of studying the KAU application and the structured interview with DIT interviewers, the researcher can determine that the following applications have to be integrated. As illustrated in Table 5.3, these applications are:

- ERP SAP systems running on zLinux with SAP packaged applications with DB2 as a database hosted on IBM Mainframes Z196 as a platform
- Academia Systems running HP UNIX with SunGard Higher Education Banner packaged applications with Oracle RAC as a database hosted on HP Superdome as a platform
- The KAU Portal and some other decision support systems running on ASP and ASP.NET custom made (locally developed) applications with MS SQL or Oracle as a database hosted with a Windows environment as a platform.

As depicted in Figure 5.2 and Figure 5.3 each KAU institution taking part in the EAI project had its own standalone database. However, a centralised Foundation Program is required to serve the foundation students in all EAI projects. This solution needs to be fully integrated, centralised, and automated. The main purpose of this solution is to enable all the KAU institutions to use one solution, one database, and resources from one shared pool.

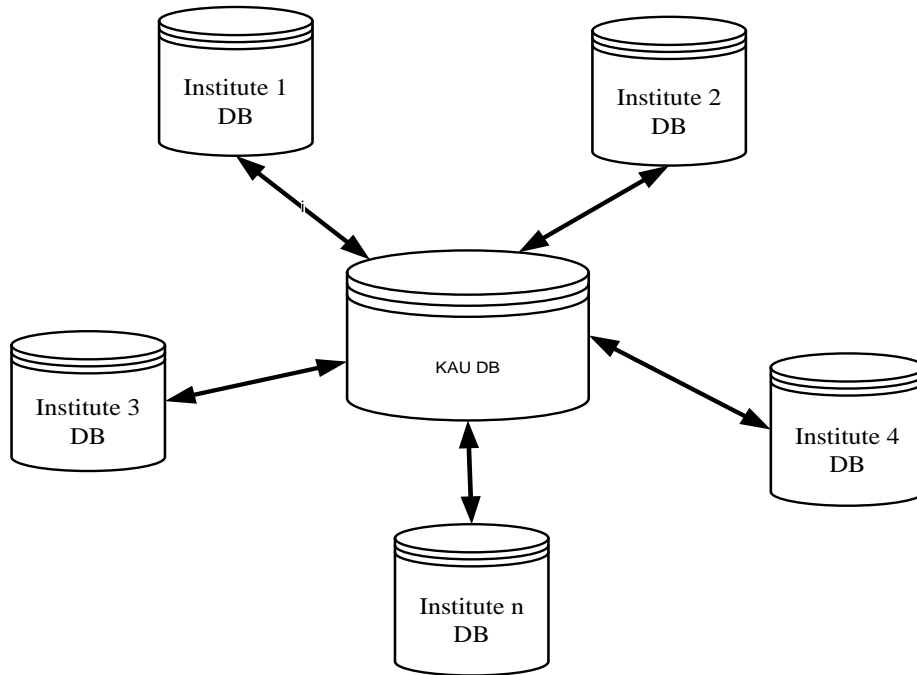


Figure 5.2: EAI DB solution structure

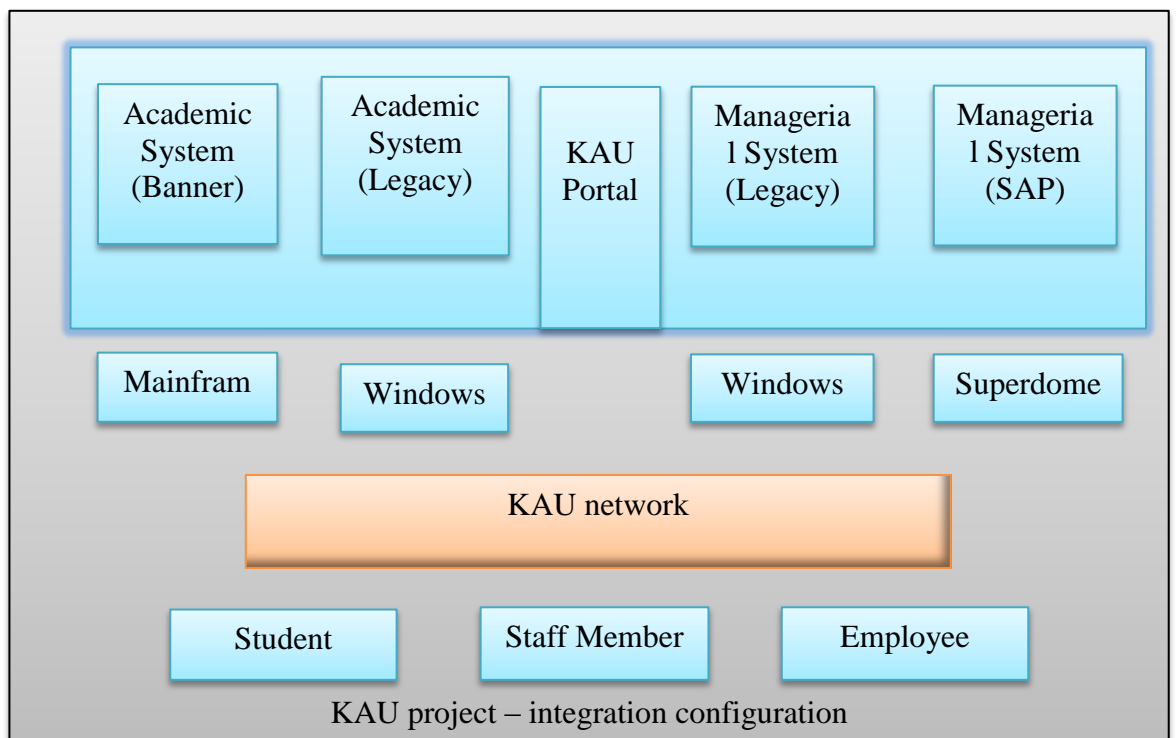


Figure 5.3 KAU as a single business unit – integration configurations

A centralised EAI solution must consider the following business areas:

Admission: The admission process is totally covered by the original institute Banner system, which is supposed to produce electronic files that contain the personal data for all

students admitted. The EAI solution must be capable to export/import the admission files from these entities. After this step, the data of students will be managed by EAI.

Scheduling: An important consideration is that preparing the class schedule for program(s) is totally managed by EAI. Thus, a single class schedule is prepared for all programs in all EAI project institutes using one shared pool of resources:

- Course catalogue
- Buildings and rooms
- Instructors
- Facilities

EAI enables students from different institutes to register for the same section with the possibility to restrict the registration in any section(s) for a specific institute's students.

Registration: All registration transactions for program students are covered by EAI DB, which is supposed to handle all registration requirements including registration setup, restrictions and module control.

Grading: The following grading areas are covered in EAI:

- Grading Modes definition
- Grade Entry and Grade Rolling
- GPA Calculation
- Academic Standing Rules and Calculation
- Student's Classification
- Data Migration for foundation year data to the Original Institute DB

Centralised Solution: A standalone Banner instance will be installed and implemented in each institute in the KAU project. The main idea of EAI is to have one integrated solution that serves the program in the six Banner instances. The centralized registration and grading transactions for the program will be implemented in one of the six instances, tentatively IAT instance. Many processes will be customized and installed to enable the institutes to migrate/transfer the data between the original institute DB and EAI; these processes will cover the following functional areas:

1. **Personal Data Transferring:** This phase consists of two processes:
 - Export students' personal data from the original institute DB
 - Import students' personal data to EAI DB
2. **Academic Data Transferring:** This phase consists of two processes:
 - Export students' academic data from EAI DB
 - Import students' personal data from the original institute DB

The following outcomes will result for the institution because of integration through using EAI technology:

- Reduced IT requirements because of a more beneficial EAI toolset. Utilizing EAI devices can decrease the starting budget and time expenses, and in addition, the ongoing support expenses of this task.
- Reduced managerial expenses through mechanization of all processes and automating the numerous forms that exist in the KAU divisions can wipe out a huge range of regulatory expenses.
- Reduced operational expenses through additional proficient processes and automating key methods will reduce the times for KAU business processes. This is can minimize the expenses from various perspectives.
- Higher person and staff fulfillment and faithfulness through new electronic administrations and programs and thus, EAI ventures are crucial for offering new electronic effective administrations. For instance, key online learner and staff “self-administration” operations could be carried out all the more effortlessly when utilizing EAI features.
- Better, faster, and effective decisions that aggregate all scholarly, managerial, and monetary data and making it accessible make decision making easier. Table 5 shows the information frameworks that will be integrated at the KAU.

No.	Type of System	Platform
1	ERP SAP frameworks running on zLinux with SAP bundled provisions with DB2 as a database had on IBM Mainframes Z196 as a stage.	Mainframes Z196
2	Academia systems running HP UNIX with SUNGARD Higher Education Banner bundled requisitions with Oracle RAC as a database had on HP superdome as a stage.	HP superdome
3	The KAU portal and some other choice emotionally supportive networks running on ASP and ASP.NET specially designed (provincially improved) provisions with MS SQL or Oracle as a database had on Windows environment as a natural platform.	Windows environment

Table 5.2: The KAU information systems that will be integrating

4. Summary of KAU case study Findings

This section presents the summary of findings for the EAI adoption process in higher education at KAU the following points can be noticed:

- The empirical findings illustrate that the proposed EAI adoption model (Figure 3.1) can be used in KSU. This is due to the case study having validated all the factors in the EAI adoption model depicted in figure 3.1.
- It is difficult to estimate the benefits of an integrated IT infrastructure due to lack of knowledge related to EAI.
- The empirical evidence provides important information and supports universities in decision-making to adopt EAI in higher education. It appears that the presented themes can be considered as influential factors for EAI adoption.
- In the KAU case study the empirical evidence indicates that external pressure sub-factors include ICT vendors, labour market, learning community, governmental regulation, and the external cooperation.
- Empirical evidence from KAU illustrates that the internal pressure sub-factors will be the: instructor satisfaction, student satisfaction, university employees, and “Strategic, Technical, Managerial, Financial and Operational pressures”.

As a result, the integration of the multiple information systems within KAU aims at combining all the needed systems. This formed and unified new system gives the users the impression of interacting with a single information system. It gives the users an integrated view to facilitate information access and reuse through the integration of the multiple information systems. As a conclusion, the KAU case study illustrated that validated factors besides the additional factors that were proposed, as mentioned earlier, should be considered when designing any solution for integration. It is evident that these factors are practical and are referred to in the literature.

KSU CASE STUDY

1. The Deanship of E-transactions and Communication (ETC)

As mentioned earlier in chapter four, the researcher held several interviews within KSU. It was not practicable to interview all the KSU participants. The Deanship of E-transactions and Communication (ETC) is responsible for all IT infrastructures in KSU. So, the researcher has interviewed senior employees whose opinion would count in EAI adoption within ETC as illustrated in figure 5.4.

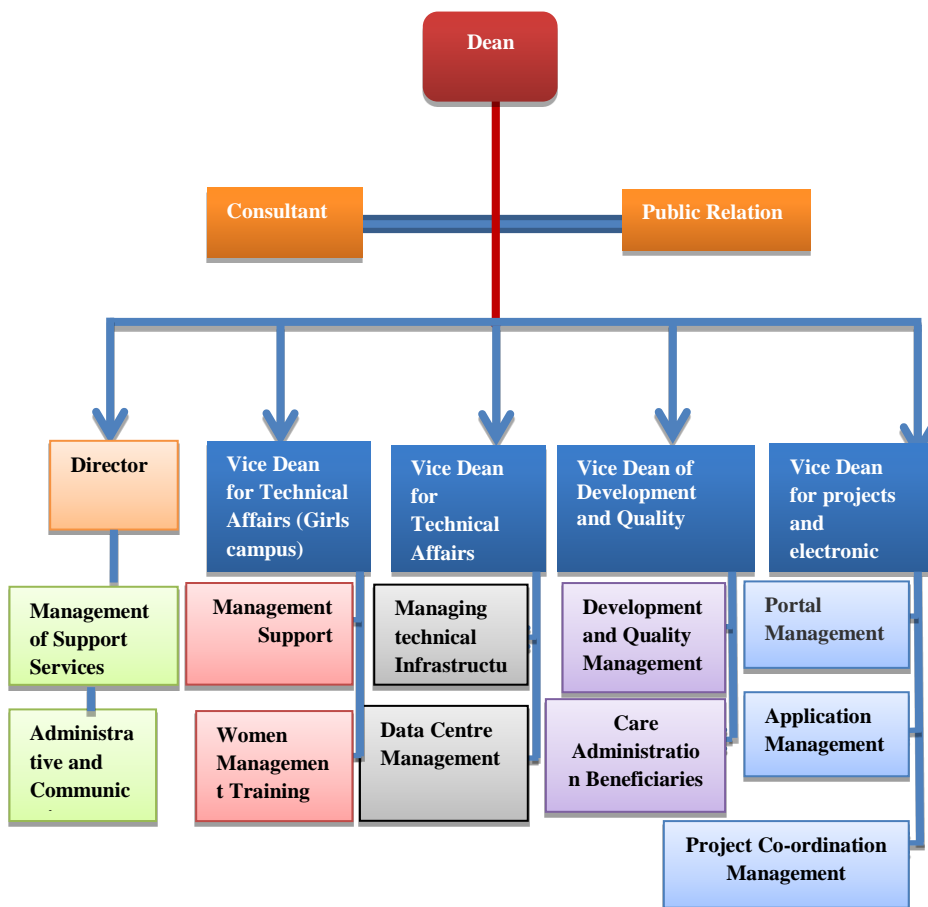


Figure 5.4: ETC organizational structure

The five themes are presented in the following sections.

2. KSU factor analysis

- **First theme Technological Factors**

This was the first theme that was obtained from the interview interpretation and includes the following sub-factors:

- **Technological Risk:** all KSU interviewees mentioned that technological risk has to be considered while integrating the HE applications. For example, the Director & Quality Dept. at KSU said: *“There is a Security breach in the current application systems”*.
- **IT Capabilities:** It consists of IT infrastructure, personnel IT knowledge and IT sophistication. All interviewees at the three universities have the similar point of view that IT capabilities is an important factor in the EAI adoption process in the HE domain. For example, the Vice Dean for Technical Affairs-KSU reported that: *“IT Capabilities factor should be considered as a very important factor in the EAI adoption process”*.

- **IT Infrastructure:**

All the interviewees within KSU mentioned that the IT infrastructure in HE institutions has to be considered as a factor that effects the adoption of EAI in HE institutions. KSU participants shared the same opinion. For example, regarding the current structure of KSU IT infrastructure, the Dean of E-Transaction and Communication-KSU reported that: *“KSU IT infrastructure is organised centrally. The Deanship of E-transactions and Communication (ETC) is responsible for all IT infrastructures in KSU-ETC”*. ICT Infrastructure Director-KSU talked about the integration problems: *“Basically we have an integration problem. The system does not respond efficiently to business processes and users. Critical business functions miss proper service levels. Moreover, the system has inadequate service management, Governance gaps, limitations, and Testing challenges”*. The head of Application Department-KSU spoke about IS within KSU: *“In ETC’s IS architecture, an added up to five separate IS requisitions underpinned the major operational needs of the KSU. These requisitions are recognised as central provisions in light of the fact that they served mission-discriminating business capacities of the KSU”*.

As demonstrated in Table 5.3 , according to the researcher’s observation and face to face interviews about the ETC’s IS architecture, which added up to five separate IS applications, it underpinned the major operational needs of the KSU. These applications were the core of IS within KSU in light of the fact that they served mission-critical business functions of the KSU as demonstrated in Table 6:

- E-Register framework

- ERP Legacy frameworks: a bundled application that administers the workflow connected with the handling of distinctive functions. It is running on SQL with SQL
- BlackBoard System
- MADAR application project.
- WEBSERVICE SYSTEM is the fundamental stones of building and advancing inside association business workflow

No.	Type of System	Platform
1	MADAR ERP SYSTEM	Oracle + Microsoft
2	E-REGISTER SYSTEM	Oracle + Microsoft
3	BlackBoard System	SQL
4	WEBSERVICE SYSTEM	Oracle + Microsoft
5	LEGACY SYSTEM	SQL

Table 5.3:
Categories
the KSU -

of

IT information systems

- **IT sophistication:**

The Dean of E-Transaction and Communication-KSU reported that “The majority of interviewees from KSU agreed that a sufficient level of IT sophistication is an important factor in EAI adoption”. Moreover, similar thoughts are reported by the Vice Dean for Technical Affairs - KSU and other IT individual interviewees within KSU.

- **Personnel IT Knowledge:**

The Consulting and Manager of Deanship-KSU mentioned that:

“The inadequate training in using IT increases the resistance to use the EAI technologies within KSU”.

In conclusion, the KSU interviewees agreed that the absence of IS application integration is responsible for the majority of university information problems and challenges confronted by the KSU with respect to ICT planning. The EAI was thought to overcome these challenges and thus, EAI was proposed to eliminate these challenges that faced KSU. The established applications have been incorporated in a ‘point- to-point’ where interfaces

are directly created between applications. On the other hand, a limitation of this approach is that as the amount of applications increases, the expense of developing and looking after the system as a whole becomes unmanageable and regularly brings about ‘spaghetti integration’. In EAI, this issue is addressed by the deployment of an integration broker that serves as a centre point for inter- applications communications. Similar challenges are also found in the literature (Martin, 2008; Claar *et al.*, 2014; Ahead, 2013; Shelley, 2008; Martín-Rodríguez *et al.*, 2014; Al-Qahtani *et al.*, 2013; Kamal *et al.*, 2009; Kruss *et al.* 2015; Akbulut, 2002; Kamal *et al.*, 2003; Hanafi *et al.*, 2010; Mantzana and Themistocleous, 2005; Ramdani *et al.*, 2013; Wei-Hsi Hung *et al.*, 2015; Weerakkody and Jones, 2009; Aserey and Alshawi, 2013; Wei-Hsi Hung *et al.*, 2015; Kamal *et al.*, 2013; Mantzana *et al.*, 2008; Bigdeli *et al.*, 2013; Themistocleous and Irani, 2002; Khoumbati *et al.*, 2008; Kamal and Themistocleous, 2006; Sohimi *et al.*, 2011). These challenges have to be addressed in the EAI adoption process according to the interviewees’ opinion and literature review in chapter two and in chapter three. The EAI is tackling all these challenges.

- **Second theme: IT Supportive Factors**

The two factors, Data Security and Privacy and Evaluation Framework, in this theme will be illustrated as follows:-

- **Data Security and Privacy**

From the perspective of KSU-ETC interviewees, the major information security issues can be resolved by developing systems administration and inter-networking. The Dean of E-Transaction and Communication-KSU said that: “*The KSU needs computerised devices for ensuring records and other data from the security strike (intrusion, interceptor, change, manufacture, and viruses)*”. They agreed that the major security issues are:

- The KSU information incorporates a colossal number of records holding sensitive personal data
- Any member with a properly arranged method can report inaccurate information
- By tasking particular clients, it is conceivable to increase individual data
- Tasks need to have their source checked
- Accepted data needs to be exact and transiently important
- Amount of mistake needs to be compelling.
- The hack assault forces.
- Creation, conveyance, and security of key data calls require secure administration.
- Students download indexes, motion pictures, and photographs from the Internet

- Students are utilising USB drives or other storage media
- Students' use of unapproved programming
- Instant messaging security risks
- Wireless and voice over the Internet protocol security risks
- Around the clock access to regulatory administrations and computerized library assets
- Contributions to potential misbehavior
- The utilization of ID cards makes the university an appealing target.

- **Evaluation Framework (EF):**

The KSU participants talked about the need for technological tools to evaluate IT applications since EF is an important factor in EAI adoption. The Director & Quality Dept.-KSU said: *"KSU needs a tool to evaluate and assist decision makers in IT selection process"*.

Finally, all KSU participants share the same point of view that the IT supportive factors should be taken into consideration in EAI adoption in HEIs. These factors were mentioned in the literature (Themistocleous, 2002; Lam and Shankararaman, 2007; Kamal *et al.*, 2013; Bigdeli, Kamal and de Cesare, 2013). These factors are practical and are supported by evidence in the literature and hence it is worth taking them into consideration when adopting EAI in HEIs.

- **Third theme: Organizational Factor**

The organizational factor covers the following sub-factors:-

- **Formalization:**

The interviewees at KSU acknowledged the significance of formalisation in the EAI adoption process. According to the ICT Infrastructure Director-KSU *"formalised procedures that make an organised environment might be suitable for frameworks arranging and data transforming"*.

- **Centralization**

All the interviewees at KSU emphasized the importance of a decision-making authority in an organization and how this authority allows others in the hierarchy of authority to participate in making decisions. The Dean of E-Transaction and Communication-KSU has a similar view; he said: *"different managerial hierarchical levels affect decision-making so the degree of centralization is very important and should be taken into consideration when designing any EAI solution"*.

- **Managerial capability**

- KSU participants acknowledged the significance of the managerial capability factor for IT adoption. The factor represents the availability of personnel to take bold and imaginative decisions when creating new ideas. The Dean of E-Transaction and Communication-KSU said that: *“managerial capability is a significant factor in EAI adoption process when managers with a technical background support new IT ideas or innovative proposals”*.

- **Student records**

KSU participants acknowledged the significance of the factor of student records for EAI adoption. The Dean of E-Transaction and Communication-KSU said that: *“Student record is very important and has to be secured since this record may be maintained in more than one location within university”*.

- **Curriculum**

KSU participants acknowledged the significance of the curriculum factor for EAI adoption in HEIs. The Dean of E-Transaction and Communication-KSU said that *“Curriculum identifies the fundamental components of the course and describes the expectations of the student’s grade, so it is an important factor in EAI adoption process”*.

Finally, KSU participants recommended adding another two sub factors, i.e. student records and curriculum. According to the empirical data, the interviewees believed that any revised study or plan should involve the organisational sub-factors including the formalization, centralization, managerial capability, student record and curriculum. It is evident that these factors are practical and are referred to in the literature (Ebrahim, *et al.*, 2004; Hillison *et al.*, 2001; Ching-Yaw *et al.*, 2007; Massy, 2003; Bornman, 2004; Tsinidou *et al.*, 2010; Kennedy, 2014; Grace, *et al.*, 2012; Krause, 2015; Temizer and Turkyilmaz, 2012; Anthony, 2012; Ramdani *et al.*, 2013; Aserey and Alshawi, 2013; Bigdeli *et al.*, 2013; Kamal and Themistocleous, 2006; Kamal *et al.*, 2013; Daggett, 1997; Neill, 2001; Themistocleous, 2002). Therefore, they must be taken into account when evaluating integration technologies.

- **Fourth Theme: Environmental Factor**

Environmental factors include the sub-factors of internal and external pressures.

- **Internal Pressure**

All participants from KSU have shared the view that internal pressure is an essential factor when planning the adoption of EAI at their universities. In fact, their opinions match not only with the proposed model but also with those factors that were reported in the literature. The Dean of E-Transaction and

Communication-KSU mentioned that: *"learner satisfaction is the most important factor and has to be considered in the evaluation process"*. He continued, *"Instructors' attitudes toward the system should positively influence student's satisfaction"*. According to the empirical data, the sub- factors of internal pressure will be the: instructor satisfaction, student satisfaction, university employees, and "Strategic, Technical, Managerial, Financial and Operational pressures".

- **External Pressure**

The KSU participants reported that the external pressure factor is an important factor during the EAI adoption at their university. The Head of Computer Section-Deanship of Admission and Registration-KSU Said that: *"KSU interacts with several external stakeholders such as, our community, labour market, governmental organisations and outside parts cooperation"*.

Finally, the Environmental Factors are important. In fact, this coincides with the proposed model and with the factors that reported in the literature (Chen, 2003; Chen (2009; Sun *et al.*, 2008 ; Catalunya, 2014; Ozkan and Koseler, 2009; Xiao and Wilkins, 2015; Temizer and Turkyilmaz, 2012; Bailie, 2015; Lu and Zhang, 2009; Rolando *et al.*, 2014; Lee *et al.*, 2011. Ramdani *et al.*, 2013; Bigdeli *et al.*, 2013; Ebrahim *et al.*, 2004; Themistocleous, 2002; Wei-Hsi Hung *et al.*, 2015; Khoumbati *et al.*, 2008; Kamal *et al.*, 2013; Akbulut, 2002; Norris, 1999; Wei-Hsi Hung *et al.*, 2015 and Aserey and Alshawi, 2013; Lu and Zhang, 2009; Yengin *et al.*, 2011; Croxton, 2014 ; Paechter *et al.*, 2010). Hence, they are very important and should be taken into consideration while designing any integration solution.

- **Fifth theme: Financial capability**

The Financial Capability factor is the last theme identified from the interviews. According to all interviewees, there is a direct relationship between time and money and hence financial capability is directly related to the adoption of EAI. Most institutes fail in this respect due to the unavailability of financial resources. Although all the three universities have understood the significance of EAI within their educational domain, these universities do not have proper systems for estimating the cost and other finances that are essential for the adoption purposes.

The Head of Computer Section- Deanship of Admission and Registration-KSU said that: *"The financial capability has to be one of the major factors that affect EAI adoption in our university"*.

- **Return On Investment (ROI)**

The Dean of E-Transaction and Communication-KSU said: *“Invest more in technology in education domain without a significant Return on Investment is a critical issue.”*

▪ **Cost:**

Cost is an important parameter that influences the adoption of EAI in HE institutions. Cost influences the adoption of integrated packages. The Director of Information Technology Centre-KFUPM said: *“Cost is an important parameter that influences the adoption of EAI in HE institutions”*. The Deanship of Information Technology, Vice Dean-KAU reported that: *“Integration cost can be reduced significantly when integration is applied”*.

In summary the KSU participants agreed that financial capability influenced the EAI adoption within KSU. They reported that any institutes belonging to the higher education sector requires IT integration to the greatest extent compared to other organisations. These universities lack practices in terms of integration. The interviewees at the universities agreed that the cost factor is very important and should be taken into consideration when designing any integration solution because levels of financial capability greatly influence EAI adoption. As these factors are also referred to in the literature (Kamal *et al.*, 2013; Akbulut, 2002; Simanaviciene *et al.*, 2015; Lo *et al.*, 2011; Rezaie *et al.*, 2012; Khoubati *et al.*, 2008; Irani *et al.*, 2003; Bigdeli *et al.*, 2013), it is evident that these factors must be taken into account when evaluating integration technologies because of evidence from the literature and practice.

3. KSU EAI Project Implementation

Because of studying the KSU application and the structured interviews with ETC interviewees, the researcher could determine that the following applications have to be integrated. As illustrated in Table 7, these applications are:

- E-REGISTER SYSTEM
- BlackBoard System
- MADAR is an ERP application Project developed in the KSU

As depicted in Figure 5.5 and Figure 5.6 the EAI project has its own standalone database. However, a centralised Foundation Program is required to serve the foundation students in the EAI project. This solution is required to be fully integrated, centralised, and automated. The main purpose of this solution is to enable all the KSU institutions to use one solution, one database, and one shared pool of resources.

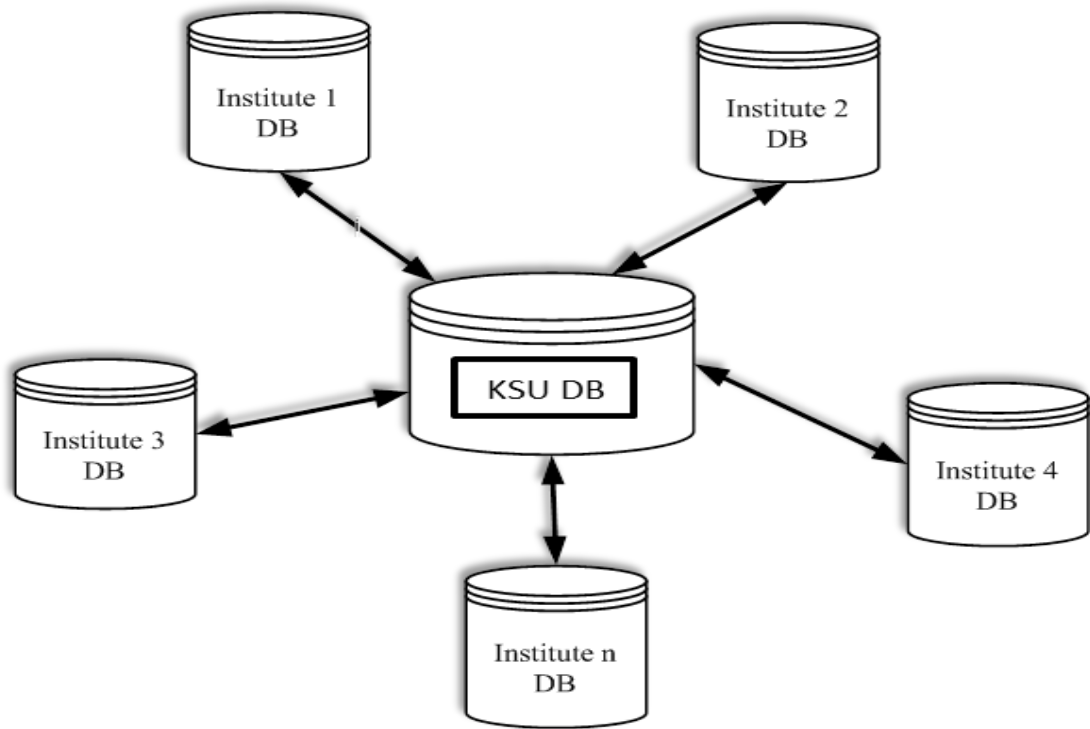


Figure 5.5: KSU - EAI DB solution structure

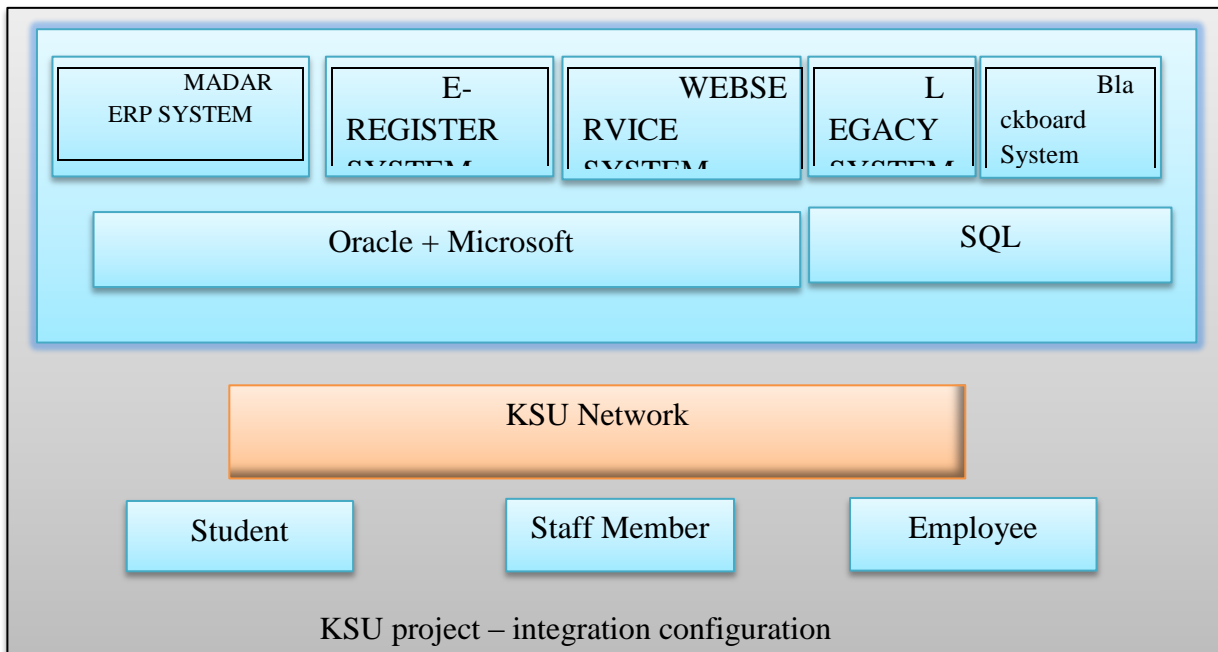


Figure 5.6: KSU as a single business unit – integration configuration

Like the other universities, the Centralised EAI Solution must be considered for the following business areas:

Admission: The admissions process will include electronic files for all students enrolled in the university and they must be dealt with through the EAI. This means that the data of students will be managed by EAI.

Scheduling: All the scheduling processes (class or educational programs) will be controlled and managed by EAI. Single class schedule is prepared for all programs in all EAI project institutes using one shared resources pool

Registration: The EAI will support students in all registration procedures for their selected programs handle the registrations process in a flexible and user-friendly manner.

Grading: All grading areas are covered in EAI as mentioned in the KAU previously.

Centralised Solution: The KSU proposed integrated EAI solution would be through the integration of a centralised solution by integrating the following systems:

- **E-Register System:** In this respect, the KSU began by using the scholastic draft framework (E-Register System), in the wake of signing an agreement with Adaptive Tech Soft (ATS). Under the immediate supervision of the Project Implementation Advisory Committee, with the pilot requisition period completed in the Community College in Riyadh, to verify that system fulfils the required objectives for the school staff information as a model for whatever remains of the school workforces. Besides, the genuine provision of the scholarly framework started in the same school and is nearing completion, which will make it ready for the following stages. Additionally, it is guaranteeing that there are particular phases of usage, with the goal that, scholars and working parts at the school and all its limbs inside and outside Riyadh can profit from the tremendous potential offered by the scholarly framework.
- BlackBoard System is a Learning management system (LMS) and is an extensive framework to administer studying. It is the focal centre of the instructive process on the Internet, where courses are delivered in electronic form to all clients of the framework. The KSU utilises the BlackBoard Slate is not difficult to utilise and you can access it at whatever time and anywhere. Learners can login to the framework and access the content of the courses, and conduct learning exercises, for example, taking part in various discussions, assessment exercises and examination sessions.
- MADAR is an ERP provision task advanced in the KSU. It is a task administration centre started by the KSU to supervise the execution stage of ERP in the KSU managing managerial and back programming of the university and additionally directs work for outer projects. In 2007, the KSU chose to implement the money

related, human resource and payroll, administrative interchanges, stock control, warehouse, and worker administration in this MADAR venture.

- In ETC’s IS construction modelling, there must be utilising the adding of components up to five separate IS requisitions that are providing the support to the major operational needs of the KSU. These provisions acknowledged the basic requisitions in the light of the fact that they served mission-critical business functions of the KSU as represented in Table 5.4

No.	Type of System	Platform
1	MADAR ERP SYSTEM	Oracle + Microsoft
2	E-REGISTER SYSTEM	Oracle + Microsoft
3	BlackBoard System	SQL

Table 5.4: The KSU-information systems that are going to integrate

4. Summary of KSU case study Findings

This section is a summary of the findings for the EAI adoption process at KAU and the following points can be noticed:

- The empirical findings illustrate that the proposed EAI adoption model (Figure 3.1) can be used in KSU. This is due to the case study having validated all the factors in the EAI adoption model as depicted in figure 3.1
- This validation of factors influencing EAI adoption through empirical research supports the literature findings for the factors as proposed in Figure 3.1.
- Similar to the KAU case study, the empirical evidence from KSU indicates that external pressure sub-factors include ICT vendors, labour market, learning community, governmental regulation, and external cooperation. Moreover, the empirical evidence illustrates that the internal pressure sub-factors will be instructor satisfaction, student satisfaction, university employees, and “Strategic, Technical, Managerial, Financial and Operational pressures”.
- All These factors are practical and are supported by the literature; hence it is worth taking them into consideration when adopting EAI in KSU.

KFUPM CASE STUDY

1. The Information Technology Centre (ITC)

As illustrated in chapter four, the researcher held several interviews at KFUPM with ITC employees since they are responsible for KFUPM IT infrastructures management within KFUPM. Therefore, the researcher has interviewed a number of selected employees who would be involved in EAI adoption within ITC. Figure 5.7 show the ETC organizational structure and KFUPM-IT infrastructures.

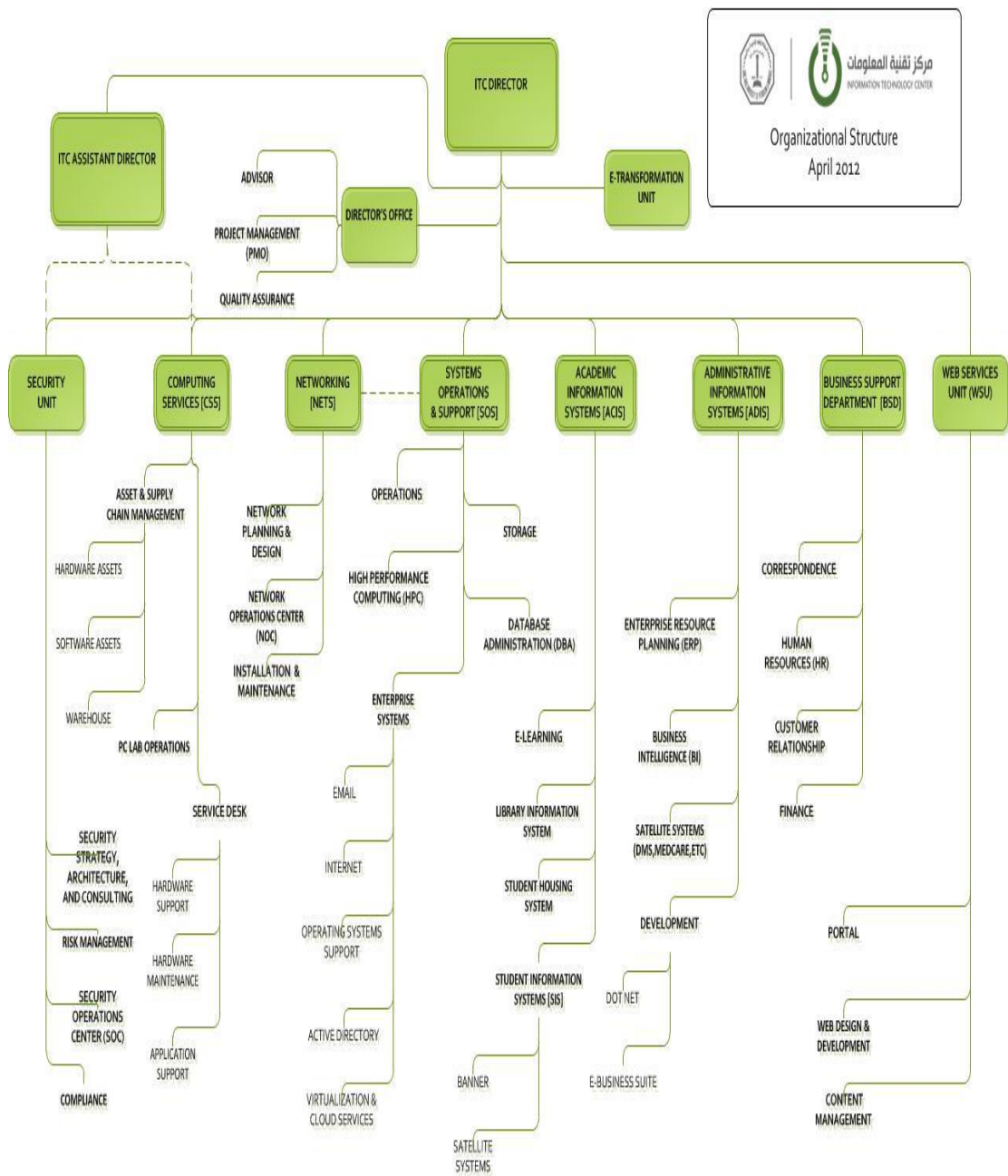


Figure 5.7: The organization of KFUPM-IT infrastructures

2. KFUPM factor analysis

Five main factors (themes) emerged from the KFUPM data.

- **First Theme: Technological Factors**

The Technological Factors were obtained from the interpretation of the interview data and the following sub-factors were identified:

- **Technological Risk:** The Technical Manager – KFUPM reported that: *“KFUPM needs to tackle several security problems such as Confidentiality, Integrity, Authentication and Non-repudiation”*
- **IT Capabilities:** As illustrated in literature review it consists of IT infrastructure, personnel IT knowledge and IT sophistication. All interviewees at KFUPM have the opinion that IT capabilities have to be considered to be a critical factor in EAI adoption in HEIs. For example, the Manager Administration Information System- KFUPM said that: *“All the IT capability factors have a very critical role in the EAI adoption in higher education sector”*.

- **IT Infrastructure:**

At KFUPM, the Director of Information Technology Centre-KFUPM said about the IT infrastructure that: *“The Information Technology Centre (ITC) is the department which is responsible for KFUPM IT infrastructures management”*. The Technical Manager said of the integration problems: *“We do not foresee the phasing out of any information systems due to EAI adoption. All our systems will be relevant in the post-EAI scenario”*. The Manager of Systems Operations and Support- KFUPM reported that IS within KFUPM: *“KFUPM has heterogeneous systems needing to access information from other systems. The DBA had to be contacted for access to a given application, which created a user with access to that application. This way, there were multiple users created an accessing problem”*.

According to the KFUPM interviewees and researcher observation, the ITC's-IS architecture consists of four different IS applications supporting the major operational needs of the KFUPM. These applications included core applications because they served mission-critical business functions of the KFUPM. The foundation is halfway reconciled and thus, the KFUPM has accompanied the intermediate mixture of frameworks and

integration which may include Oracle e-Business Systems that automates and midway administers the monetary, HR, payroll, projects, self-administration and research administrations. On the other hand, The Cogon's Business Intelligence System furnishes the users with functionality such as reports outfit clients with the data they have to make actuality-based choices. Similarly, dashboards help clients access, connect and customise content in a manner that backs how they settle on choices. Furthermore, analysing abilities give access to data from various points and viewpoints so that users can see and investigate it to settle down their education related choices. In addition to this, collaboration abilities incorporate specialised instruments and person-to-person communication to fuel the trade of thoughts throughout the choice making process. In the meanwhile, score carding abilities mechanise the grasping of administration and screening of business measurements so that users can pose as a viable rival them with their vital and operational targets. Furthermore, the Student Banner System furnishes the characteristics and handling abilities required for supervising learner data (affirmations, enrolment, and so forth). Thus, the BlackBoard framework furnishes complementary administration functions in order to provide course materials that incorporate content, complex mathematical statements, pictures, movies, and audio. This may also be helpful in evaluating people with tests and assignments and to communicate with people through dialogues, electronic mail, continuous talk sessions, and an intuitive whiteboard. Furthermore, it facilitates studying by utilising a searchable file, glossary, and picture database for every course. It encourages collaboration by supporting the development of scholar homepages and online presentations that may be used to share course content with different collaborators and organisations, record, support, and store grades, enable self-assessments through self-testing and progress monitoring. This further facilitates access to information that permits users to investigate the adequacy of their course. Four information systems in the KFUPM are shown in the Table 5.5.

No.	Type of System	Platform
1	Oracle e-Business Suite	Linux
2	IBM Cognos	Linux
3	Student Banner System	Linux
4	BlackBoard System	Linux

Table 5.5: Categories of the KFUPM-IT information systems

- ***IT sophistication:***

The KFUPM interviewees mentioned that an acceptable degree of IT sophistication has to be a factor in EAI adoption in their university. The Director of Information Technology Centre – KFUPM reported that "*the advancement of IT and its sophistications has to be one of vital element when adapting EAI in KFUPM*".

- ***Personnel IT Knowledge:***

KFUPM interviewees share the same opinion that, personnel IT knowledge must be considered as an essential factor during EAI adoption. The Manager of Project Management Office- KFUPM mentioned that: "*the IT training will minimize the level of the resistance during EAI adoption within KFUPM*".

Finally, the KFUPM interviewees mentioned that the absence of application integration is the reason for many problems. They also added that there is a need to implement solutions to overcome these problems to overcome non-integration between applications. So, the KFUPM needs to integrate all its applications at their campuses.

In conclusion, KFUPM are faced by many issues regarding efforts to use ICT. The EAI tackled these challenges that faced KFUPM. Participants at KFUPM stressed that these challenges have be considered. On the other hand, examples of these challenges are also found in the literature (Martin, 2008; Claar *et al.*, 2014; Ahead, 2013; Shelley, 2008; Martín-Rodríguez *et al.*, 2014; Al-Qahtani *et al.*, 2013; Kamal *et al.* 2009; Kruss *et al.*, 2015; Akbulut, 2002; Kamal *et al.*, 2003; Hanafi *et al.* 2010; Mantzana and Themistocleous, 2005; B. Ramdani *et al.* 2013; Wei-Hsi Hung *et al.*, 2015; Weerakkody and Jones, 2009; Aserey and Alshawi, 2013; Wei-Hsi Hung *et al.*, 2015; Kamal *et al.*, 2013; Mantzana *et al.* 2008; Bigdeli *et al.*, 2013; Themistocleous and Irani, 2002; Khoumbati *et al.*, 2008; Kamal and Themistocleous, 2006; Sohimi *et al.*, 2011). So, these challenges have to be taken into account when adopting EAI solutions. This is due to evidence as described by the interviewees and in the literature review.

- **Second theme IT Supportive Factors**

The two factors, data security and privacy and evaluation framework, in this theme will be illustrated as follows:-

- **Data Security and Privacy**

Framework should shield the classification, respectability, and accessibility of composed, spoken and workstation data. From the perspective of ITC interviewees the major information security issues are:

- Data being stolen

- Electronic mail might be captured and read
- Customer's visa numbers may be perused
- Login/password and different access data stolen
- Operating framework shutdown
- File system debasement
- User login data might be captured
- Unauthorised access
- Loss of message classifications or trustworthiness
- User identification.

- **Evaluation Framework (EF):**

All the KFUPM interviewees mentioned that this factor is very important during the EAI adoption process. The Technical Manger- KFUPM said that: *“Evaluation Framework should be considered since it is a tool to support decision-making for EAI adoption”*.

In summary, the KFUPM participants mentioned that the IT supportive factors should be taken into consideration while designing the EAI solution. This corresponds with findings of studies in the literature (Lam and Shankararaman, 2007; Themistocleous, 2002; Irani *et al.*, 2003; Kamal and Themistocleous, 2006; Kamal *et al.*, 2013). Due to practical evidence and evidence in the scholarly literature, these factors are worth taking into account in EAI adoption in HEIs.

- **Third theme: Organizational Factor**

The organizational factor covers the following sub-factors:-

- **Formalization:**

The Interviewees at KFUPM share the same point of view that formalization has to be considered in the adoption process of EAI within KFUPM. For example, the Manager of Project Management Office-KFUPM reported that: *“composed methodology and more formal environment will dispose of any ambiguities, and might expedite EAI selection”*.

- **Centralization**

The participants at KFUPM stressed the importance of the role of the hierarchy in decision-making in their university which allows others to participate. The Technical Manger- KFUPM said that: *“The degree of centralization factors should be taken into account when adopting integration technologies”*.

- **Managerial capability**

KFUPM interviewees acknowledged the importance of managerial capability issues for EAI adoption in their university because it represented the possibility of personnel to demonstrate their competencies, be creative, and be innovative. The Manager of the Project Management Office at KFUPM reported that: *“Managerial capability of a manager becomes an influencing decisive factor in the EAI adoption when a manager is able to identify the current problems of a system and can develop and evaluate alternative solutions to improve the IT capacity of an organisation”*.

- **Student records**

KFUPM participants acknowledged the significance of student records as a factor in EAI adoption. The Manager Project Management Office- KFUPM reported, that: *“Student record is an important factor influencing EAI adoption”*.

- **Curriculum**

KFUPM interviewees stressed the importance of the curriculum factor for EAI adoption in HEIs. The Manager Project Management Office- KFUPM reported that: *“Curriculum is a public document which is read by instructors, students and others, hence influencing EAI adoption”*. According to the empirical data, the KFUPM interviewees recommended adding another two sub-factors, which were student records and curriculum. As a conclusion, the KFUPM interviewees agreed that the organizational factors are important and must be considered when designing any solution for integration. It is evident that these factors are practical and are referred in the literature (Ebrahim, *et al.*, 2004; W. Hillison *et al.*, 2001; Ching-Yaw *et al.*, 2007; Massy, 2003; Bornman, 2004; M. Tsinidou *et al.* 2010; Kennedy, 2014; Grace, *et al.*, 2012; Krause, 2015; Temizer and Turkyilmaz, 2012; Anthony, 2012; B. Ramdani *et al.*, 2013; Aserey and Alshawi, 2013; Bigdeli *et al.*, 2013; Kamal and Themistocleous, 2006; Kamal *et al.*, 2013; Daggett, 1997; Neill, 2001; Themistocleous, 2002). Therefore, they must be taken into account when evaluating integration technologies.

- **Fourth Theme: Environmental Factors**

As mentioned in chapter two and chapter three, the environmental factors include internal and external pressures sub-factors.

- **Internal Pressure**

The interviewees at KFUPM shared the same opinion that internal pressure is a critical factor for the adoption process of the EAI at their university.

The Director, Information Technology Centre- KFUPM reported: *“In Higher Educational Institutions there are several internal pressure partners such as students and instructors who may or may not collaborate with the HE institutions”*.

Then he added: *“Students always demand for better educational services such as adding, deleting and/or postponing a course”*.

▪ **External Pressure**

The KFUPM interviewees reported that external pressure is an important factor when adopting EAI at their university. In fact, this coincides with the proposed model and with the factors that are reported in the literature. The Assistant Manager of Academic ITC- KFUPM reported that: *“pressures from labour market, government regulation, and ICT vendors are external and should be considered during the EAI adoption process”*.

Environmental Factors are practical and referred in the literature (Chen, 2003; Chen, 2009; Sun *et al.*, 2008 ; Catalunya, 2014; Ozkan and Koseler, 2009; Xiao and Wilkins, 2015; Temizer and Turkyilmaz, 2012; Bailie, 2015; Lu and Zhang, 2009; Rolando *et al.*, 2014; Lee *et al.* 2011.B. Ramdani *et al.*, 2013; Bigdeli *et al.*, 2013; Ebrahim *et al.*, 2004; Themistocleous, 2002; Wei-Hsi Hung *et al.*, 2015; Khoumbati *et al.*, 2008; Kamal *et al.*, 2013; Akbulut, 2002; Norris, 1999; Wei-Hsi Hung *et al.* 2015; Aserey and Alshawi, 2013; Lu and Zhang, 2009;Yengin *et al.*, 2011; Croxton 2014; Paechter *et al.*, 2010). Hence, they are very important and should be taken into consideration while designing any EAI solution in HEIs.

• **Fifth theme: Financial capability**

The Director of Information Technology Centre-KFUPM said that: *“The financial capability may influence EAI adoption in our university”*. The Dean of E-Transaction-KFUPM and Communication reported that: *“The institution’s available capital motivates the adoption of new technologies like EAI in HE institutions”*.

▪ **Return On Investment (ROI)**

The Director of Information Technology Centre-KFUPM reported that: *“Return on Investment study is important when adopting the EAI in HE institutions since it is a relatively new research area in higher education.”*

▪ **Cost**

Cost is an important parameter that influences the adoption of EAI in HE institutions. Cost influences the adoption of integrated packages. The Director of

Information Technology Centre-KFUPM said: “*Cost is an important parameter that influences the adoption of EAI in HE institutions*”.

In summary, the KFUPM has better IT standards but EAI adoption has not been achieved yet. The interviewees at KFUPM share the point of view that financial capability is an important factor and should be taken into consideration when implementing EAI solutions because levels of financial capability influence EAI adoption. As these factors also referred in the literature (Kamal *et al.*,2013; Akbulut, 2002; Simanaviciene *et al.*, 2015; Lo *et al.*, 2011; Rezaie *et al.*, 2012; Khoumbati *et al.*, 2008; Irani *et al.*, 2003; Bigdeli *et al.* 2013) it is evident that these factors must be taken into account when evaluating integration technologies because of the evidence from the literature and from practitioners.

3. KFUPM EAI Project Implementation

After studying the KFUPM application and the structured interview with ITC interviewees, it can be said that all ITC interviewees believe that in the near future all KFUPM application critical enterprise systems have to be integrated. These applications are as illustrated in Table 5.4 and are as follows:

- Oracle e-Business System automates and centrally manages financial, HR, payroll, projects, self-service and research services
- The Cognos Business Intelligence System provides users with the following capabilities:
 - o The Student Banner System provides the features and processing capabilities needed for managing student information (admissions, registration, etc.)
 - o The BlackBoard system which is a LMS

As depicted in figure 5.8 and figure 5.9 each of the KFUPM institutions in EAI project will have its own standalone database. However, a centralised Foundation Program is required to serve the foundation students in the EAI project. This solution is required to be fully integrated, centralised, and automated. The main purpose of this solution is to enable the all KFUPM institutions to use one solution, one database, and one shared resources pool.

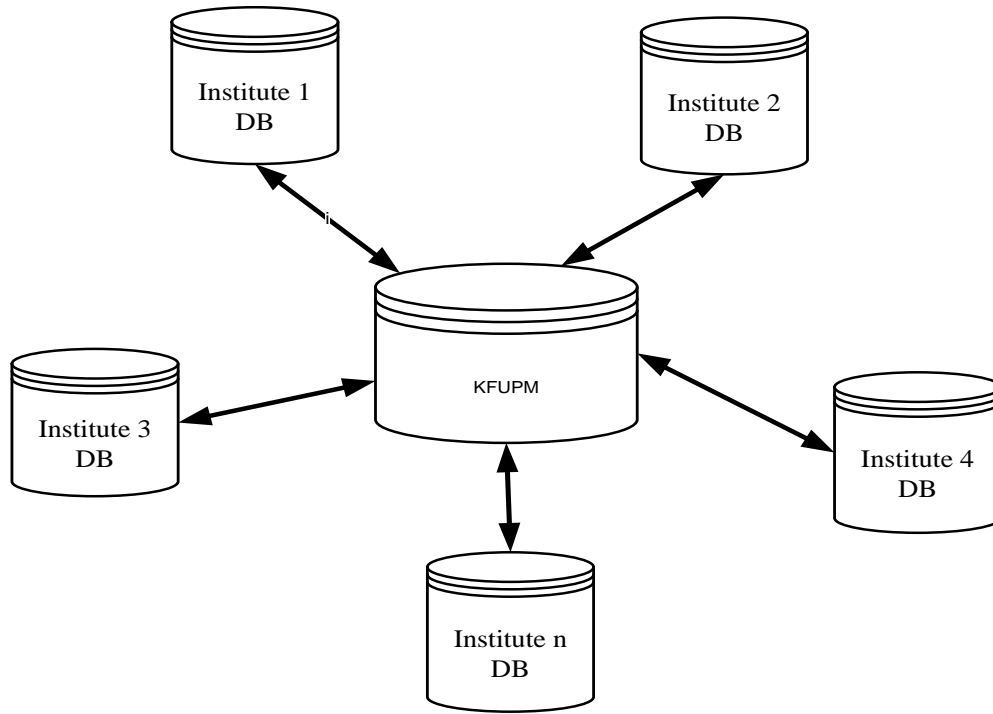


Figure 5.8: EAI DB solution structure

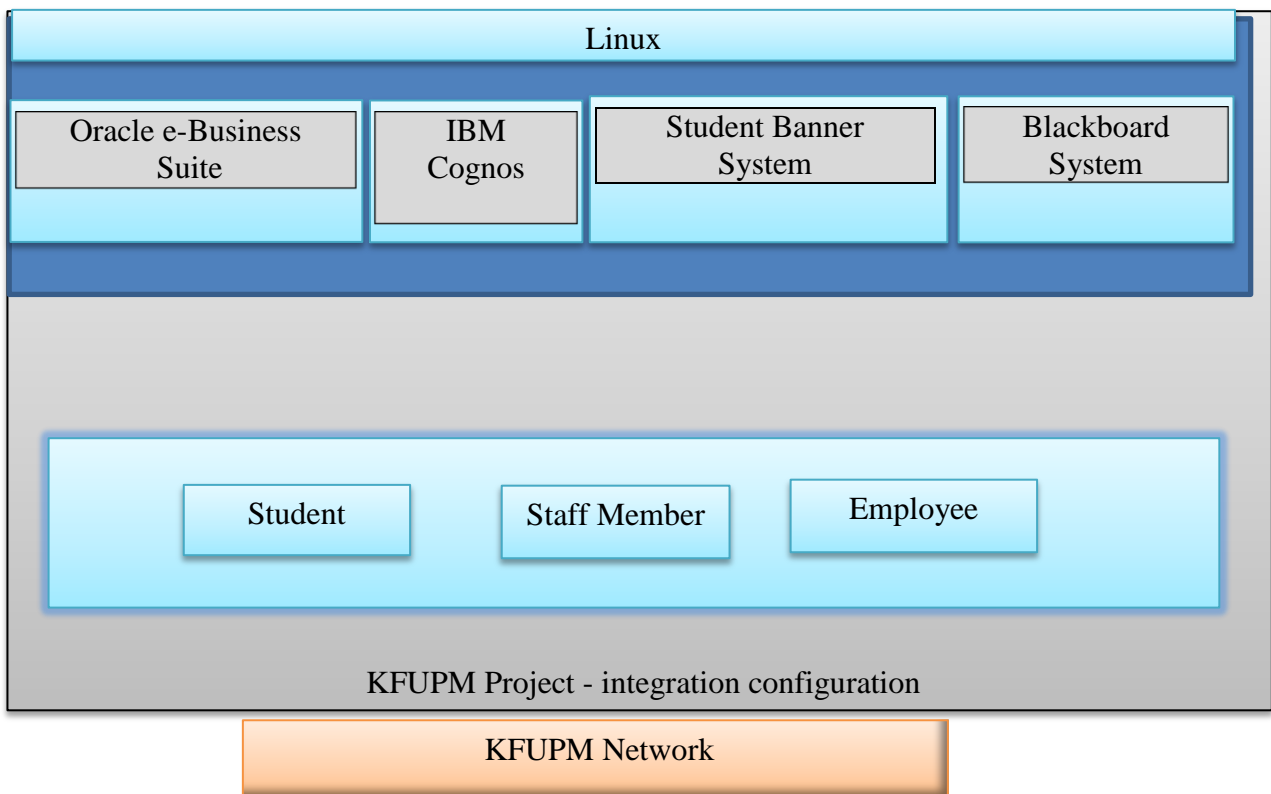


Figure 5.9: KFUPM as a single business unit – integration configurations

The centralised EAI solution must include the following:

Confirmation of methodology are much regulated an administered by utilising the Banner system. The admissions and records framework forms confirmations requisitions, keeps up

understudy scholarly records, gathers and circulates workforce participation archives, forms transcript and enrolment check demands, residency reclassifications and all methodologies of graduation petitions.

Booking of the class essentials, scholarly logbook due dates, and all planning data totally regulated and supervised by the EAI result. The scholastic date books will record terrifically critical dates for applying to the KFUPM, enlisting for classes, and due date dates for including and dropping classes, appealing to review a class, requesting of to finish a class on a pass/no pass groundwork, et cetera. Enrolment of procedures for the scholastic projects is incorporated when EAI reception is implemented. In addition, EAI DB expected to perform all enlistment necessities incorporating enrolment setup, confinements and control is recognised. Evaluating in instruction is the procedure of applying institutionalised estimations of changing levels of accomplishment in a course.

The accompanying reviewing regions are secured in EAI is as follows:

- Grading modes definition
- Grade entry and grade rolling
- GPA Calculation
- Academic standing rules and calculation
- Student’s classification
- Data migration for establishment year information to the original institute DB and this is presented in Table 5.6.

No.	Type of System	Platform
1	Oracle e-Business System automates and centrally manages our financial, HR, payroll, projects, self-service and research services	Linux
2	The Cognos Business Intelligence System	Linux
3	The Student Banner System provides the features and processing capabilities needed for managing student information (admissions, registration, etc.)	Linux
4	The Blackboard system	Linux

Table 5.6: The KFUPM information systems that will be integrated

4. Summary of KFUPM case study Findings

In summary of the findings about the EAI adoption practice process at KUFPM the following points can be noticed:

- The empirical findings illustrate that the proposed EAI adoption model (Figure 3.1) can be used in KSU. This is due to the case study having validated all the factors in the EAI adoption model which are shown in figure 3.1.
- The KAU and KSU case studies are similar in and the empirical evidence from KFUPM indicates that external pressure sub-factors include ICT vendors, labour market, learning community, governmental regulation, and external cooperation. Moreover, the empirical evidence shows that the internal pressure sub-factors are: instructor satisfaction, student satisfaction, university employees, and “Strategic, Technical, Managerial, Financial and Operational pressures”.
- KFUPM has better IT standards but EAI adoption has not been achieved yet.
- The empirical evidence provides important information and supports KFUPM in decision-making to adopt EAI in higher education.
- The appropriate selection of EAI solution integration technologies is influenced directly by the existing IT infrastructure.
- The empirical evidence from KFUPM showed that student and staff satisfaction and curriculum factors influence the decision making process for EAI evaluation and adoption.

As a result, the integration of KFUPM applications aims at combining all the needed systems. This well-formed and unified new system gives the users the impression of interacting with a single information system. It gives the users an integrated view to facilitate information access and reuse through the integration of the integrated information systems. Due to evidence from practitioners and from the literature, all these factors are worth taking into account in EAI adoption in HEIs.

5.4 Lessons learned from case studies

This section presents the lessons learned from the case study universities in Saudi Arabia when developing EAI adoption model in HEIs. The challenges addressed are similar to those faced by other organizations and include some unusual characteristics including both technical and management lessons learned. These lessons might be helpful to HEIs as well as to researchers, integrators and IT practitioners. These lessons are summarized below:

- A majority of the resistance to any enterprise-wide IT initiative is motivated by the perceived complexity and level of effort required for implementation. This situation found by the researcher in the three case studies (KAU, KSU, and KFUPM) in the data collection and data analysis phases. This resistance is compounded if the developers and/or program managers perceive that the standards to which they

must develop is in flux or is incomplete. To tackle this problem the HEIs have to attract skilled labor in EAI area or train their IT staff before implementing The EAI adoption model in HEIs.

- Empirical findings from KAU, KFUPM, and KSU, indicate that the lack of IT sophistication was an obstacle to the adoption of EAI and each university needed to evaluate the impact of EAI before proceeding to a global adoption. This is because the cost of EAI adoption is very high so analysis allows better understanding and contributes to better decision making.
- The high risk and the lack of reflective learning from the EAI cases influenced the decisions of KAU, KFUPM, and KSU to adopt EAI. A lack of sufficient knowledge of EAI is related to IT capabilities, since organisations could not understand the IT requirements of EAI.
- Empirical findings from KAU, KFUPM, and KSU indicate that HEIs require a substantial degree of technical capability to ensure smooth and productive adoption. This can be achieved through developing a technology roadmap that matches the HE innovation and the current technological setting in an institution.
- Empirical evidence illustrates that the integration process differs from one university to another due to the various software and hardware capabilities in each one, so the model cannot be generalized in this way.

5.5 Interpretive Phase Overview

The interpretive case study was carried out in conjunction with the explanatory case study. The interpretive phase performed a detailed case study on HE followed by analysis and adjustments in the design to the revised model and framework for EAI adoption in HE.

5.5.1 Background of this section

The practical issues and findings from the empirical evidence from the analysis of the case studies conducted at three Saudi universities indicated the need to modify the conceptual model proposed in chapter three. In this section, the conceptual model will be revised based on the empirical data. Decision-makers and researchers are offered a frame of references for the adoption and evaluation of EAI to satisfy the aim of this dissertation.

5.5.2 Overview of the revised conceptual model

There are no sufficient and suitable theoretical models for the adoption of EAI within the higher education field. In fact, the literature review presented in Chapter 2 highlighted this

point, and the empirical evidence found in this chapter echoed this finding. This research investigated the management concerns and recognised the factors influencing the adoption of EAI in higher education. Another contribution is that the procedures associated with the adoption and evaluation of EAI is better understood. This chapter analysed the empirical data used to develop the conceptual model presented in chapter three for the adoption of EAI in higher education. This chapter aims to consider the empirical data discussed in chapter three and proposes a revised conceptual model for EAI adoption in the higher education domain.

The following section summarizes the essential issues identified from the findings which were derived from the case studies to explain the revisions to the conceptual model. The conceptual model was revised for EAI adoption and to propose a framework to evaluate integration technologies. The conceptual model was modified by adding the new factors that were derived from empirical evidence. These factors are the student records and curriculum as part of the organisational factors. Internal pressures sub-factors namely, instructor satisfaction, student satisfaction, university employees and Strategic, Technical, Managerial, Financial, and Operational Problems (STMFOP) were added as well. Moreover, the labour market, ICT vendors, government regulation and external co-operation were considered as external pressures sub-factors. This forms a framework to support the evaluation of EAI packages. The framework to assess the integration technologies proposed in the current chapter was modified. As mentioned earlier, these modifications were derived from empirical data and were organised within three new evaluation criteria: connectivity integration layer, security and manageability. A novel conceptual model was proposed in this chapter for the adoption and evaluation of the EAI technology. Higher education institutions can use such a model to support decision-making when adopting EAI.

5.5.3 The Main Findings of the Case Studies

The main findings are drawn to allow other researchers to relate their experiences to the presented evidence by describing the perspectives of the case studies. This dissertation will not propose prescriptive guidelines for EAI adoption and evaluation but offers an explanation of the concept of EAI adoption. Parameters extracted from the empirical data through structured interviews, observations, and written documents are identified as factors to be considered during the adoption of EAI by the three universities. The key findings that were derived from the empirical data can be summarized as:

- The three universities revealed that they will adopt EAI for many reasons such as, the Strategic, Technical, Managerial, Financial and Operational Problems (STMFOP). In addition to the students, staff, and managerial employees, these factors will be considered as internal pressures on EAI adoption. These factors were not included in the proposed conceptual model in the previous chapter and hence, the model was modified to reflect these new empirical findings.
- Empirical data indicated that ICT vendor, ICT producers, the labour market, educational external co-operation, and government regulations represent external pressures on EAI adoption.
- In all cases, the insufficient IT sophistication was an obstacle to EAI adoption. Moreover, each university had to evaluate the impact of adopting EAI on many applications including integrated IT infrastructure before deciding to proceed to a wider adoption. The cost of EAI adoption is very high and therefore, analysis offers better understanding and supports decision making. The decisions by universities to adopt EAI are influenced by high risk and unavailability of adoption case studies. In addition, organizations could not recognize the IT capabilities of EAI because of insufficient knowledge of the benefits of integrated applications. IT sophistication, personnel IT knowledge, and IT infrastructure are the sub-factors of IT capabilities that were not included in the proposed conceptual model. However, the cases under study illustrated the need and the importance of these sub-factors to be added in the revised conceptual model.
- The analysis showed the importance of the evaluation framework and the associated data security and privacy for the evaluation of integration technologies within the universities. The interviewees believed that their decisions to adopt EAI would be influenced by such a framework. These two parameters influence EAI adoption and were included as factors in the proposed conceptual model.
- The three universities decided to develop a global integrated IT infrastructure after implementing the corresponding pilot projects. Then a decision was taken in a comprehensive EAI adoption due to the benefits derived from implementing the pilot projects. EAI benefits, barriers, costs and the technological solution were assessed before making that decision.

This evidence established the grounds for modifying the proposed conceptual model. Figure 5.4 summarizes these modifications as derived from the case studies. Table 5.7 summarises the main findings.

5.5.4 Themed analysis for the Interpretive Phase

The empirical research presented in the previous section has been carried out to develop a revised conceptual model, specifically for EAI, as shown in Figure 5.4. The figure illustrates that the adoption of EAI is influenced by the technological and social aspects. These two basic aspects are classified into five basic factors namely: Technological, IT Supportive, Organisational, Financial Capability and Environmental Factors. These factors will be analysed in the following paragraphs. The internal pressures sub-factors are university employees and STMFOP while external pressures sub-factors are the labour market, ICT vendors, government regulation and external co-operation. Furthermore, internal and external pressures sub-factors, which were listed in the previous section, were added.

- **Technological Factors (TFs)**

Technology factors are considered to be the main and vital factors that affect the decision to adopt EAI in the HE domain. HEIs require a substantial degree of technical capability to ensure smooth and productive adoption. This can be achieved through matching the HE innovation with the current technological setting of an institution. A number of cases show that some factors will affect the adoption of TFs as follows:

- **Technological Risk (TR):** The risk associated with the new technology that will integrate the HE applications is considered to be an important factor. At a university, the degree of TR is high. Using public networks together with university databases can considerably increase TR.
- **IT Capabilities:** including IT infrastructure, personnel's IT knowledge and IT sophistication of an enterprise (Alonso *et al.*, 2004):
 - IT Infrastructure: To provide better educational services and to improve the decision making process, the IT infrastructure in HE institutions should be considered to be a significant factor that effects the adoption of EAI.
 - IT Sophistication: HE requires a high level of IT sophistication for integration. Thus, the adoption of EAI is directly influenced by the level of IT sophistication for EAI and integration technologies.

- Personnel IT Knowledge: One of the most important factors in the adoption of any new computer applications by any organization is the skills of the personnel. Lack of skills and inadequate training constrains the introduction of new technologies.

- **IT Supportive Factors (SF)**

- **Data Security and Privacy (DS & P):** Any access to student and staff information or data in a distributed database of an HEI must be considered seriously. Two significant questions are raised: who has access to this information and how unauthorized users are to be prevented from accessing these data. The technology is threatened by potential unauthorized access. Any HEI should take into consideration the processes that address security and privacy issues with high importance. For these reasons, DS & P represents an important factor during the EAI adoption process within the HE environment.

- **Evaluation Framework (EF):** integration technologies are combined to integrate an IT infrastructure to create a framework as a tool to support decision-making for EAI adoption. For higher education, EF assists decision-making to adopt EAI in the HE environment and in selecting appropriate EAI technologies and tools. It is considered to be a factor that influences the adoption of EAI in the HE area. This framework can be used in parallel with the evaluation of integration technologies to assist in decision-making. It contributes to reducing the confusion surrounding the integration marketplace because it offers a better understanding of how each EAI package is applicable. Hence, the more appropriate EAI packages for adoption by HEIs will be indicated.

- **Organizational Factor (OF)**

It is a source of structures, processes and attributes that constrain or facilitate the adoption of any application. The role of top management, financial readiness, degree of centralization, formalization, quality of human resources, amount of slack resources available internally, and size of organization are several dimensions of the organizational context which can influence the implementation process of e-government (Kamal and Themistocleous, 2006; Kamal, Hackney and Ali, 2013; Bigdeli, Kamal and de Cesare, 2013). This factor covers the following parameters:

- **Formalization:** It involves clear procedures, norms and formal processes to carry out organizational tasks. Systems planning and information processing may use a structured environment that is created by highly formalized processes. EAI adoption can be facilitated and any ambiguities will be eliminated when written procedures and a formal environment are implemented.
- **Centralization:** This is the degree of power or decision-making authority in an organization. It encompasses participation in decision-making and the hierarchy of authority.
- **Managerial capability:** It is one of the significant factors for IT adoption and refers to the personnel who are available to take bold and effective decisions to produce new ideas.
- **Student Record:** It provides essential data obtained from the approved application and includes data relating to the progression records: the administration of student records such as change of course, serious disciplinary cases and any other information.
- **Curriculum:** Materials that prepare students to contribute to their study programs. A curriculum is prescriptive and contains the syllabus to specify the topics and the achievable grades.

- **Environmental Factors (EFs)**

This is the area in which an organization conducts and influences its members. An organization's adoption of EAI could be driven by the actions of competitors and it may establish connections with other organizations for better collaboration. These factors include:

- **Internal Pressure (IP):** Pressures such as technical and managerial ones inside an organization. This factor is essential in initiating the adoption of EAI in an organization. There are several internal pressure factors in HEIs, such as collaboration of students and instructors with the institution and the demand for better educational services by students. This factor was implemented in the process of adoption of EAI in HEIs.
- **Student Satisfaction (SS):** A factor that has to be considered in the EAI adoption in HEIs.
- **Instructor Satisfaction (IS):** IS indicates active and positive attitudes of instructors to motivate students (Mantzana and Themistocleous, 2005).

- **STMFOP:** This refers to the Strategic, Technical, Managerial, Financial and Operational Problems (STMFOP) factors. It was shown to be relevant by the opinions of the case studies' interviewees. All of the interviewees considered this factor to be a very important factor that affects the new EAI model in the HE domain.
- **University IT employees:** IT-related employees' factor represents a vital role in the success of the implementation of the proposed system when applying our new EAI model in the educational domain.
- **External Pressure (EP):** This refers to pressure from other parties outside the organization. For instance, an organization may be pushed to search for new ways to enhance its efficiency by increased competition. Better collaboration is expected when an organization interacts with several stakeholders including governmental organizations. Better services, such as instant query response, data security and availability of data, wherever it is required, are demanded by citizens. This factor can be considered when the development of the EAI model is tackled.
- **Labour Market:** It is very important that the educational institutions should tailor new programs to respond to labour market shortages. This can be achieved through linking the output of educational institutions' programs to labour-market needs. ICT vendors' service helps HEIs to decide what they need, evaluate which is the best option, suggest a mutually acceptable contract and ensure that it is delivered at the agreed time. Procuring the appropriate software, hardware and services makes a successful business. The ICTs vendors should be:
 - a) Providing efficient, appropriate and timely ICTs services
 - b) Actively maintaining quality and cost level
 - c) Bringing major technology innovations
 - d) Offering technical content that is diverse

USAID ICT Procurement Guide for Customs (2011) mentioned that the ICT procurement is challenging for a number of reasons:

- a) Technical content is diverse and difficult to define
- b) ICT components are dependent on an organization's business processes
- c) ICT and associated methodologies change rapidly
- d) ICT contracts usually entail a substantial mix of professional and intellectual services as well as hardware and software
- e) Successful procurement usually entails organizational change management.

- f) ICT costs do not start and end with the cost of a personal computer. It includes hardware and infrastructure, software, Internet access, training, other support and consumables and eventual replacements of hardware.
- **Government Regulations:** The government plays a significant role in regulating, funding, and monitoring higher education (Norris *et al.*, 2008). Hence, the government is an important external pressure factor that affects higher education, especially in developing countries like Saudi Arabia, and is considered to be a factor when developing the revised EAI conceptual model.
 - **Learning Community (LC):** more sophisticated and advanced information technologies would be adopted when the community is served by larger educational institutions compared to smaller institutions. LC would be a key factor in influencing EAI adoption in HEIs due to interactions to enhance learning achievement particularly within the learning community using a web-based e-learning system. Users' satisfaction will be improved by assessment feedback when an e-learning system provides more or diversified assessment tools and methods. According to the opinions of the participants at the three universities, we investigated and found out that the current web-based e-learning systems are not fully utilised by the learners due to non-integrated systems. Interactions with the learning community can enhance learning achievement. This finding coincides with Nusselein (2003) and Pircher and Pausits (2011) who stated that e-Learning satisfaction is significantly influenced by interaction with others and multiple assessments as environmental variables. Users' satisfaction will increase when various assessment tools and methods are provided by the e-learning system. Feedback from assessments indicated that satisfaction improved when more learners interact with one another (Qureshi, 2005). The higher learning satisfaction explained by Raghupathi and Tan (2002) as properly designed interaction mechanisms in e-learning environments that improve frequency, quality, and instant interactions. E-Learner satisfaction is considerably impacted by various and multiple assessments (Sultan, 2010).
 - **Educational External Co-operation:** This includes:
 1. Scholarships and academic co-operation worldwide enhances quality in higher education
 2. A joint study program enhances the quality of higher education and vocational education and training

3. Promoting teaching and research on international, Islamic, and Arabian integration
4. Building co-operation between Saudi Arabia and neighboring regions
5. Capacity-building and regional integration in higher education

This factor is so important that it should be considered when designing the new revised conceptual model.

- **Financial capability (FC)**

When organization capital is allocated and is available for adopting technology, EAI adoption will be highly influenced by the FC factor. Any organization that has available resources can afford costly innovations and explore new ideas in advance of the actual need. The effective FC factors are:

- **Return on Investment (ROI):** It is an important factor in the application of EAI adoption technology. HEIs are reluctant to invest without significant ROI. This can be attributed to:
 - a. Lack of skilled staff or opposition to adoption of new technologies
 - b. Lack of understanding and knowledge of EAI in the HE organization
 - c. HE organizations have been very slow or even unprepared for technological transformations
 - d. Low allocated IT budgets in the HEIs will prevent the transition to EAI
- **Cost** of adoption of EAI is a significant factor. Therefore, a cost benefit analysis is performed before taking any important decision regarding the investment in the adoption of EAI.

Aspect	Factors	Sub-Factors	Items
Technical aspect	Technological	Technological Risk IT Capabilities	IT infrastructure Personal IT knowledge IT Sophistications
	IT supportive	Data Security & Privacy Evaluation Framework	
Social Aspect	Organizational	Formalisation Centralisation Managerial capability Student record factor. Curriculum factor	
	Environmental	Internal Pressure	Instructor satisfaction Student satisfaction University employees STMFAP (Strategic, Technical, Managerial, Financial and Operational pressures)
		External Pressure	ICT vendor labour market learning community, Governmental regulation, External cooperation.
	Financial Capabilities	Return of Investment (ROI) Cost	

Table 5.7: summary of the main findings

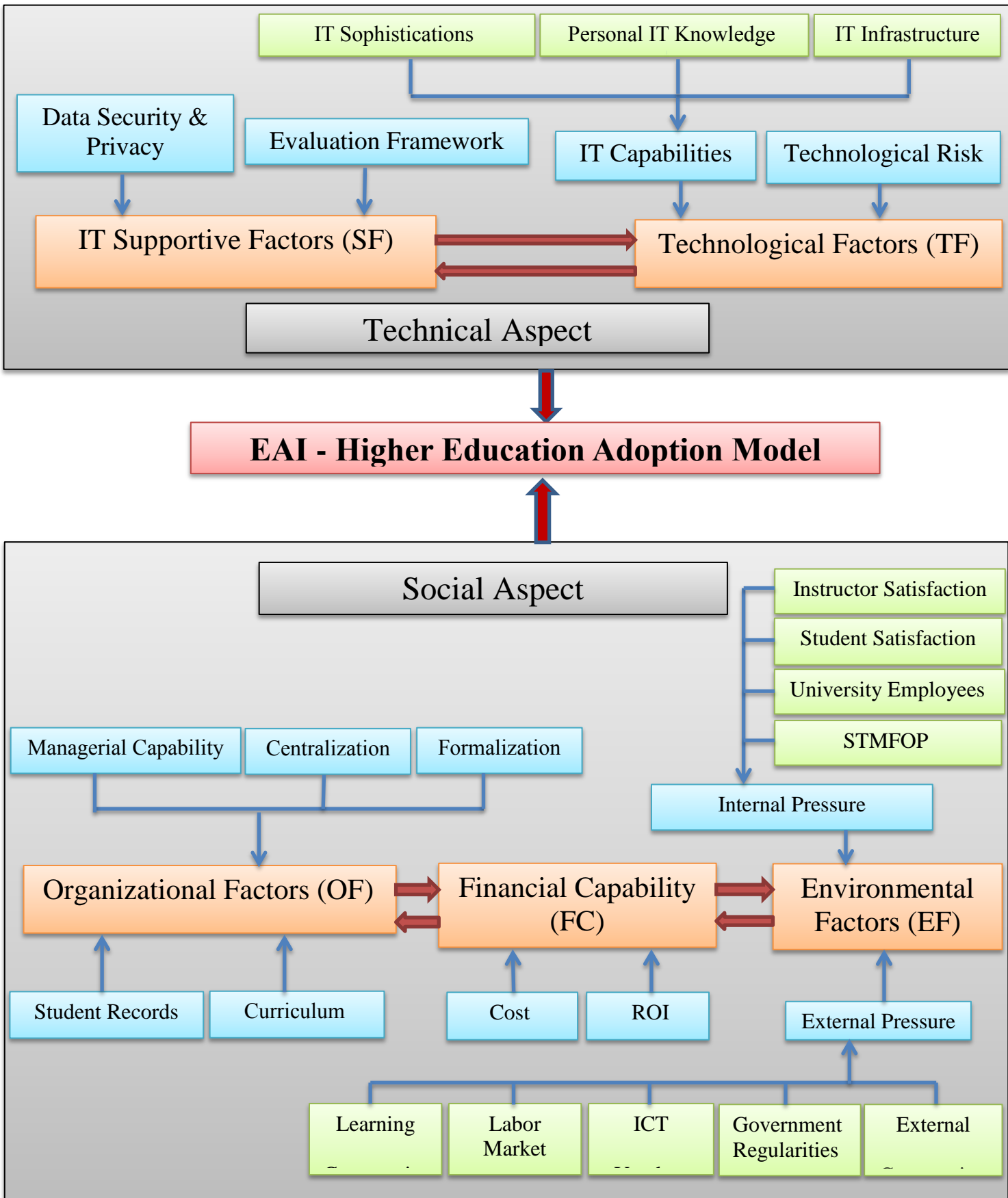


Figure 5.10: The revised conceptual EAI model in HE

5.6 Summary

The three phases of the study were summarized and discussed in the findings. Then the EAI revised model for the HE domain was designed based on these findings. The presented case studies in the exploratory phase of the research were implemented to provide a thorough understanding of the HE environment.

The thesis is summarized and conclusions will be drawn based on both the literature and empirical research carried out in this chapter.

The factors that influence EAI adoption and evaluation and the development of a proposed model are identified, justified and transferred into a frame of reference. The conceptual model proposed in Chapter 2 is revised to reflect these identified factors. Empirical data and its analysis play an important role in the modification process of the conceptual model. In addition to the factors introduced in the conceptual model (see Figure 5.4), empirical evidence suggests that new factors should be considered when adopting and evaluating EAI. The factors of the proposed revised model are classified into five basic factors, namely: technological, IT supportive, organisational, financial capability and environmental factors. The additional sub-factors in the revised conceptual model are related to these five factors. The new factors and sub-factors that were deduced from the empirical research and influence EAI adoption in higher education are:

- a) The student records and curriculum were added to the organizational factors
- b) The internal pressures sub-factors: instructor satisfaction, student satisfaction, university employees and STMFOP (strategic, technical, managerial, financial, and operational problems)
- c) The addition of the Labour Market, ICT Vendors, Government Regulations, and External Co-operation as external pressures sub-factors

The factors of the revised conceptual model are now better understood by adding these new sub-factors. These sub-factors contribute positively to decision-making during the EAI adoption and evaluation process.

A novel conceptual model as presented in Figure 5.4 can be justified by:

- The literature review presented in Chapter 2 illustrated the lack of any theoretical models for EAI adoption and evaluation in higher education area. Hence, this model can be considered as a first attempt to explore and understand the adoption and evaluation of EAI in this field.
- A comprehensive set of factors that affect EAI adoption in higher education are included in the model. Moreover, the model incorporates factors influencing EAI

adoption in other areas that were identified previously by separate studies. As illustrated in chapter two, an extensive literature review of factors affecting the adoption of EAI in several areas such as healthcare sector, banking system, manufacturing sector, local government, stock market, supply chain, information system lifecycle, and public sector organizations, have been reported.

- Also, a wide review of relevant areas that support the adoption of EAI in the higher education environment was performed. A consistent model for EAI adoption and evaluation in higher education was developed by implementing these factors.
- Moreover, the empirical evidence supports the integration process through the EAI adoption conceptual model in higher education that has been proposed
- The conceptual model assists decision-making and supports higher education institutions and allows researchers to understand and analyze EAI adoption in this area.

The adoption of inter-organizational information systems will benefit from the concepts of the proposed model because these systems typically focus on integrated technologies and infrastructures.

6 CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

Enterprise Application Integration (EAI) adoption in HEIs can only really take place if a structure that is given to the existing problem has been developed with an understanding of the educational process. As a final conclusion, a successful EAI adoption is accepted when EAI adoption is done correctly, that is when all the HEIs' applications are integrated and information is exchanged at the exact time when it is required and feedback is acknowledged and incorporated into the educational development process.

HEIs require a flexible IT infrastructure to adapt easily to the continuous changes in their environment so that competitive advantages may be gained between them.

This research concentrated on constructing a new model of EAI adoption in HEIs. The theoretical literature showed that there is an absence of a theoretical model for the adoption of EAI in HE, which is not surprising since it is relatively new research area and there have been a limited number of studies of EAI adoption in the HE sector. As a result, the author has studied, analyzed, and critically evaluated several previous studies to check the coherence of this study. So, the implementation of EAI in the HEIs is considered to be a new field of research. Hence, the lack of well-established theoretical and conceptual models means that factors which influence the decision making process for EAI adoption have to be identified. The exploratory research indicated how applications are being currently integrated in HEIs. On the other hand, the explanatory research offered an explanation of how and in which business areas EAI was particularly involved. An interpretive study was devised to incorporate the EAI's common and HE-specific influential factors through EAI model development. The author found that EAI in HE could be implemented by bringing together various technical and social aspects. Sub-factors contained within these aspects were adopted in a novel EAI evaluation model for HE. A novel revised conceptual model was developed by investigating more factors that affect the adoption of EAI and this model meets one of the aims of this dissertation. Then the EAI conceptual model was empirically analysed and modified. The qualitative research approach was used to provide the research process with a well-developed framework. Empirical research methodology was followed and a case study protocol was developed to provide an understanding of the trends of EAI adoption in HE. Three case studies' perspectives were analysed and used to describe social and technological perceptions during the adoption of EAI. Empirical evidence derived from the three cases suggested

modifying the conceptual model by adding a number of factors and sub-factors as internal and external pressures to the conceptual model. These findings can be considered as a novel contribution and hence the EAI conceptual model for HE was revised.

These factors and sub-factors contribute to better decision-making during the process of EAI adoption and evaluation. The EAI conceptual model for HE can be used as a frame of reference during EAI adoption in HEIs.

The main conclusions of this thesis will be presented by beginning with a brief introduction to the progressive achievements of aims and to what extent objectives were met. This is followed by stating the main contributions and limitations of this study and recommending further research possibilities and future studies.

6.2 Fulfillment of aims and objectives

A few aims and objectives were set out at the beginning of the research. They have to be examined to check how well they have been met. Objectives will be tested to discover to what extent they have been achieved and what their contributions are to the essential aims of the research. The objective: 'To capture the significant EAI adoption factors that can affect in EAI adoption in higher education by conducting a literature search', was met in a number of ways. Firstly, by establishing, through the literature review which of these common factors influencing EAI were potentially significant. Secondly, by discovering that various EAI factors affect the EAI adoption process in HE. Many of these factors affected various EAI applications which were designed to eventually meet the same purpose. The other objective: 'To produce a theoretical framework of EAI adoption in HEIs' was met by allowing the construction of a theoretical framework to capture and combine these factors in the development of the EAI model. Relevant aspects were merged and efforts were concentrated on understanding EAI adoption in HE development. This contributed to a better understanding of the EAI factors and their roles in the EAI adoption development process in HE from a theoretical viewpoint. The empirical research started after a preliminary theoretical model was produced by investigating various methodologies. This objective contributes significantly to close the present gaps in the literature when using theories from various EAI adoptions in different business areas. The next objective was partly 'To examine and assess factors influencing EAI adoption in the higher education sector through empirical research to explore and define the new adoption factors of the HEIs.' This objective was met by performing interviews with experts in HEIs and conducting thorough case studies in three universities. This contributed to a better understanding of the current practical EAI factors of adoption development in HE and

revealed new EAI adoption factors in HEIs. This helped to define the EAI adoption factors in the HE sector by understanding the perspectives of HEIs and their commitments to the educational process. This is related to the aim of understanding the EAI model development process in HEIs. The third objective was: ‘To develop and propose an innovative model for EAI adoption in HE’. The outcome of this objective was the final construction of the new model for EAI adoption in HEIs. The aim of this research was met because the model took into consideration EAI methodologies and was able to encapsulate and integrate the HEI’s applications more distinctively through using EAI. This ultimately led to fulfilling the final objective: ‘To test and evaluate the model within the practical environment and provide a novel contribution to the field of EAI adoption.’ This objective was approached through conducting case studies in three universities: KAU, KFUPM and KSU. These case studies examined the perceived benefit by the proposed EAI adoption model. This led to an exploration of the efficiency of the EAI adoption model. The importance of the aim of this research can be understood by incorporating EAI adoption factors. This was achieved by including the factors that commonly influence EAI adoption for HE in the development of the proposed model. Attention was paid to the required interaction between the factors influencing EAI adoption in HE through proposing a model which encapsulated and integrated all the HEIs’ systems in the empirical research.

6.3 Main Theoretical and Practical Findings of this Thesis

The main theoretical and practical findings derived from the theses presented in this dissertation are:

1. Theoretical

The literature review showed an absence of a theoretical model for the adoption of EAI in HE. So, the implementation of EAI in the HEIs is considered to be a new field of research. Hence, the lack of well-established theoretical and conceptual models means that factors which influence the decision making process for EAI adoption should be identified.

- A novel conceptual model for the adoption and evaluation of EAI was proposed and empirically established. The proposed revised model includes five basic classified factors: Technological, IT Supportive, Organizational, Financial Capability and Environmental Factors.

2. *Practical*

- The new EAI conceptual model in HE can be used as a tool for decision-making to support HEIs and allow researchers to apprehend and analyze EAI adoption in a new area such as HE.
- At the three universities, the lack of IT sophistication was an obstacle to the adoption of EAI and each university needed to evaluate the impact (benefits, barriers, costs, integrated IT infrastructure etc.) of EAI before proceeding to a global adoption.
- The cost of EAI adoption is normally very high. Hence, analysis allows better understanding and contributes to better decision making. Moreover, the high risk and the lack of reflective learning in EAI cases influenced the decisions of universities about the adoption of EAI.
- A lack of sufficient knowledge of EAI is related mainly to its IT capabilities, since organizations did not understand fully the IT capabilities of EAI. IT sophistication, personal IT knowledge, and IT infrastructure are the sub-factors of the IT capabilities that were not included in the proposed conceptual model. However, the case studies illustrated the need and the importance for these factors to be considered. Therefore, the model was modified accordingly.

6.4 The beneficiaries of this research

The beneficiaries of the EAI adoption model in this research are:

1. **The university staff:** the academic staff of a university such as professors, lecturers, and/or researchers who deal with and implement the EAI adoption model.
2. **The university students:** students in HEIs in both public and private sector institutions are directly targeted when the EAI adoption model for HEIs is used.
3. **HE policy makers:** all levels in the HE decision/policy making departments and especially at the national level.
4. **The community:** members of the community who may be in non-governmental and private organizations which are interested in university issues.
5. **Researchers:** all the people who are interested in the research area of EAI especially in HE

6.5 Research Contribution

The contributions of this research come from all the parts of this thesis from the contextual information presented in Chapters 1, 2 and 3, to the empirical research methodology reported in Chapter 4, through the data collection and data analysis of the three case studies that are illustrated in Chapters 4 and 5 and, finally, the development of an EAI adoption model for HEIs presented in Chapters 5 and 6. The work presented in this research makes a novel contribution to the area of EAI adoption in the HEIs. The contributions of this research are summarized below:

- **Contribution 1:** Novelty in investigating, validating and identifying additional factors for EAI adoption in HEIs as follows:
 1. The addition of internal pressure sub-factors namely: the university employees and STMFOP (strategic, technical, managerial, financial, and operational problems, Table 5.7 , Figure 5.10).
 2. The addition of the labour market, ICT vendors, government regulations, and external co-operation as external pressure sub-factors (Table 5.7 and Figure 5.10; Fulfilment of research objective 1).

These new factors were discovered from empirical evidence as factors and sub-factors influencing EAI adoption in higher education and in particular at the three universities. These new factors support the evaluation process of decision makers and researchers to better understand the impact of such technology.

- **Contribution 2:** A novel way of identifying, investigating, and validating additional factors influential for EAI in HE achieved through investigating, validating and identifying new factors relating to EAI adoption in the HE domain. These new factors include student records, curriculum, student satisfaction and instructor satisfaction, as indicated in Tables 3.1 and 5.7, Figures 3.1 and 5.11 (Fulfillment of research objective 2).

In effect, the factors of the revised EAI adoption model are much clearer after presenting these sub-factors. Moreover, they contribute to clear and enhanced decision-making during the process of EAI adoption and evaluation in HEIs.

Contribution 3: New aspects of EAI adoption, technical and social, have been identified (Figures 3.1, 5.11 and Tables 3.1, 5.7).

Contribution 4: A Novel Model for EAI Adoption in HE.

The fulfillment of the aim of this research, i.e. the aforesaid contributions led to a novel model for EAI adoption in HEIs (Figures 3.1, 5.11 and Tables 3.1, 5.7). This model

provides HEIs' decision makers and others a clear guideline while adopting EAI at their universities.

The most important contribution of this dissertation is the development of a comprehensive novel model for EAI adoption in HE (Figure 5.10). The modifications to the conceptual model (Figure 3.1) were imposed by empirical data as presented and analysed in Chapter 5. Empirical evidence suggests that apart from the factors reported in the conceptual model (Figure 3.1), new factors should be considered when adopting and evaluating EAI. A number of influential factors have been constructed from the empirical data from the three universities and identified as factors that were taken into consideration during the adoption of EAI. The three universities reported the new factors that were derived from empirical evidence as factors and sub-factors that influence EAI adoption in higher education. The novelty of the EAI adoption model focuses on the following:

- The absence of theoretical models for EAI adoption and evaluation in the higher education field as indicated in the literature review in Chapter 2. Therefore, this model is one of the first attempts to investigate and understand the adoption and evaluation of EAI within this field.
- The model consists of a comprehensive set of factors that influence EAI adoption in higher education as indicated in Chapter 3. In addition, it incorporates factors influencing the adoption of EAI in other areas. These factors were identified separately in previous studies of other areas. As illustrated in Chapter 2, an extensive literature review of factors affecting the adoption of EAI has been proposed in several areas such as healthcare sector, banking system, manufacturing sector, local government, stock market, supply chain, information system lifecycle, and public sector organizations.
- Moreover, a wide review of relevant areas that support the adoption of EAI in the higher education environment was performed. These factors were used for the development of a consistent model for the adoption and evaluation of EAI in higher education. The inter-organizational information systems can be adopted by utilizing the perceptions of the proposed model.

6.6 Limitations

Some objectives have not been extensively met as first predicted. This can be considered to be a limitation in the research.

Chapter 4 showed that the qualitative data gathering techniques were used and justified to collect the required data. These techniques allow generalization of soft and rich contextual

data, which can provide details about human behavior, emotion, and personality characteristics that quantitative studies cannot match. However, these techniques have weaknesses; a number of them being encountered during reported research process. Data collection and analysis of qualitative data have proven time consuming in this thesis. In addition, the author has recognized a number of issues regarding the use of qualitative research techniques including:

- Due to its subjective nature, there will always be elements of bias inherent in qualitative data analysis. Hence, it was difficult to interpret events from the subjects' point of view.
- Qualitative approaches are criticized for not considering theoretical elements. Hence the relationship between theory and research might be believed as weak and unstructured. However, in this research a conceptual model was developed by proposing factors that influence EAI adoption and building a framework for evaluating integration technologies to partially address this concern. In fact the qualitative data gathering is amorphous in the sense of lacking theory and structure. The suitability of well established theory is appreciated and acknowledged as an appropriate research methodology for EAI adoption investigation.
- The university case studies are relatively few so that the qualitative research cannot be generalized. However, increasing the number of case studies would not have increased its external validity.

6.7 Further Research

In future research, the proposed conceptual model could be examined to investigate the impact of EAI adoption in the HE domain. Moreover, at each stage of the adoption process it would be advantageous to map the identified factors influencing EAI adoption. Furthermore, it would be beneficial to identify the causal relationship between EAI adoption decisions of the HEIs and the factors of the model at each stage of the adoption process that influence the overall performance. It would be beneficial to study further the factors that influence the adoption of EAI. As an example, it would be informative to study the importance of each factor, the level of its influence and the relative significant of the factors. This would improve analysis in the higher education area and contribute to better decision-making in this domain. In addition, it could be suggested to transform the proposed conceptual EAI model into a large-scale survey questionnaire, rather than continuing with an interpretivist epistemology. The existence of the conceptual EAI model supports the possibility of this suggestion. An extensive

survey would create an opportunity to find a generic meaning to the aspects related to the proposed conceptual EAI model.

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8 Appendix A

8.1 Appendix A1: King Abdulaziz University

King Abdulaziz University carries the name of the establisher of Saudi Arabia- God bless him. This university was established in 1387 H / 1967 G as a national university aiming at spreading higher education in the western area of Saudi Arabia. This dream has come true through the continuous efforts of the loyal citizens of this country. The members of the initiating committee had the chance to meet King Faisal Bin Abdulaziz –God bless him- and His Majesty showed all support for this idea. The establishing committee was formed headed by King Faisal- God bless him and his highness the Minister of Education at that time Sheikh Hasan Bin Abdullah Al - Sheikh. The university started its first year in (1388h- 1968g) by inaugurating the preparation study program with a few number of students(68 male students and 30 female students,) and directly the year after, the university inaugurated its first college (the College of Economics and Management,) then in the following year the college of Arts and Human Sciences was established. After the honored resolution of the Council of Ministers was issued in (1394h - 1974g) by including the university in the government, the national university was changed into a government university and another decision was issued at the same time by including the College of Shareah and the College of Higher Education that were already established in 1369h-1949g in Mekka in King Abdulaziz University. These two colleges followed Omm AL-Qora University after it was established. The adoption of the government to this young university and the continuous support was of great effect on changing King Abdulaziz University to a modern university with a number of students that now amounts to 82152 male and female students. The university also occupies a distinguished place among higher education institutions in the Kingdom.

King Abdulaziz University includes two separate campuses according to Islamic regulations one for males and another for females. Each of these campuses is provided with all cultural, recreational and athletic facilities, in addition to a big library equipped the most up to date technology to serve students and the teaching staff. Within four decades, the university becomes one of the outstanding higher education institutions on the local and international level. This university offers educational programs for preparing the graduates to do jobs that cope with the changing needs of the community. After being established, the university included branches for other universities like Teeba University in Al-Madina Al-Monawarah which became an independent university in (1424h - 2003g) ,

the branch of Tabouk University and Jasan University which were also became independent universities, the North Borders University and Araar and Rafha colleges. The university witnessed much development in quality and quantity since it was established until it becomes one of the distinguished universities in terms of the number of students, the number of scientific and theoretical fields of study and the exclusiveness of certain specializations such as Seas Sciences, Geology, Nuclear Engineering, Medical Engineering, Meteorology and Aviation and Mineralization. King Abdulaziz University is considered a pioneer in offering higher education to the Saudi girl and the female and male sections were inaugurated in the same year. The University not only has the regular students program but it also has the external program to make it easy for all students to get higher education. It also established the Deanship of Distant Teaching to cope with the development in learning and teaching technology.

The Minister of Higher Education presides over the University Council which includes in its membership HE the Director of the university, The Deputies of the university, the deans of colleges and the independent deanships.

Constitute the basic values of a key ingredient in the dominant culture university , and the university is adopting it's one of the most important and the main pillars in the process of the preparation of the Strategic Plan of the second university , where control Behaviour and overall performance for all categories of workers , parts, organizational units , and whenever the consolidation of these values And a commitment to the more elevated content of those measures of individual and collective performance and the institutional framework of the university in the implementation of the objectives And strategies of the Strategic Plan and its programs and initiatives , and is the most important core values are as follows:

- Efficient and effective management and proper use of resources.
- Quality and continuous improvement and a commitment to the accreditation standards of institutional and academic career.
- Intellectual creativity and innovation applied.
- A member of the faculty and university employees as capital support.
- The student is the focus of the university.
- Positive and stimulating environment for learning, work and scientific research.
- The quality of the educational process and interactive between the parties.
- E-learning and distance education and the consolidation of applications.
- Society and its development.
- Flexibility and transparency.

- The public interest and citizenship of the priorities of teamwork.
- Work ethic and scientific research.
- Individual initiative and the spirit of teamwork and positive dialogue.
- Competitiveness and leadership in the areas of higher education.
- Excellence and appreciation and reward.
- Cooperation and exchange of expertise locally and globally.
- Information and new technologies associated with them.
- High morale and love of the university.
- Intimacy, communication and social interaction, the concept of a single family.
- Mission of King Abdulaziz University

To enrich society through cultural prominence, scientific acumen, and pioneering research:

University's Vision

- A beacon of knowledge: Islamic values and time-honoured academic traditions.
 - The integration of professionalism and excellence.
 - Increased leadership in development: Innovation, diversity and continuous academic research into community service activities.
- University Long Term Goal (1440 h).

The university will become a leader in:

- Developing standards of assessment for student performance.
- High-quality research and development programs.
- Cultural contributions.
- Garnering the trust of society and the corporate world.
- Optimal investment of university resources and capabilities

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8.2 Appendix A2: King Saud University history

Establishing Saudi Arabia's first university was a response to the educational and professional needs of a young nation. Abdulaziz Al-Saud, proclaimed the King in 1932, and began laying the foundations for modernizing his country and establishing an educational system. In 1953, Saud, the eldest son of Abdulaziz, acceded to the throne upon his father's death. He would soon institute the Council of Ministers and establish the Ministry Education.

Prince Fahd, who would eventually become the Saudi King himself, assumed the office of the first Ministry of Education, and following the first session of the Council of Ministers, he announce, "We will shortly establish the first Saudi University, this is a foregone conclusion. This university will be one of the most prominent houses of culture and sciences and will be worthy of our country where the light of Islamic faith and civilization has emanated." The Kingdom's first institute of higher education, King Saud University, was subsequently opened in Riyadh in 1957.

Prince Fahd was committed to promoting higher education, and once said, "I am interested, before anything else, in supporting higher and vocational education in this country in order to add a new and illustrious chapter to our glorious history. Establishing a Saudi university with all its colleges, institutes and laboratories, built according to the highest of standards, is my immediate concern."

In 1957, according to the dictates of the Royal Decree No. 17, Prince Fahd announced the founding of King Saud University, established in order to, "Disseminate and promote knowledge in Our Kingdom for widening the base of scientific and literary study, and for keeping abreast with other nations in the arts and sciences and for contributing with them discovery and invention", in addition to reviving Islamic civilization and articulate its benefits and glories, along with its ambitions to nurture the young virtuously and to guarantee their healthy minds and ethics." KSU: A History of Success Students began studying in the College of Arts in the 1957-58 academic years. Since that time, KSU has gone through many stages of developments, and its administrative organization has developed and adapted according to the diverse needs and expanding role of the nation.

A great many of changes would take place in the coming years, such as the establishing of new colleges and opening of new branches throughout the Kingdom. Below is a collection of some of the most significant changes and developments to take place at King Saud University since its founding in 1957:

- Between 1958 and 1960, three colleges are established: the College of Sciences, the College of Business (now the College of Public Administration) and the College of Pharmacy.
- Royal Decree No. 112 grants King Saud University independent status with its own budget; the University was now responsible for higher education, promoting scholarly research and advancing the sciences and arts in the country. The Minister of Education was to be Rector of King Saud University, while the administrative positions of Vice Rector and Secretary General were established and each college and institute was required to have a dean, a vice dean, and a university council. (1961)
- The College of Agriculture is established; in the same year, control over the Colleges of Engineering and Education, having been under the Ministry of Education in cooperation with UNESCO, is assumed by the University (1965)
- The name King Saud University is changed to the University of Riyadh (1967)
- The College of Medicine (1969)
- Arabic Language Institute for non-Arabic speakers, as well as the Deanships of Admission and Registration and Students Affairs and Libraries (1974)
- The College of Dentistry and the College of Applied Medical Sciences are added to the Riyadh campus and the launching of the Abha campus with the College of Education (1976)
- The Graduate College assumes role of supervising and organizing all graduate programs in the various departments of the University (1978)
- The College of Medicine at Abha (1980)
- A branch in Qassim opens with the Colleges of Agriculture, Veterinary Medicine, and Economics and Administration (1981)
- Celebrating its 25th anniversary, the University of Riyadh goes back to its original name of King Saud University at the orders of King Khalid bin Abdulaziz. The Deanship of Community Service and Continuing Education replaces the Center for Community Service and King Khalid University Hospital (KKUH) is formally opened (1982)
- The Colleges of Computer and Information Science Sciences and Architecture and Planning (1984)
- The Institute of Languages and Translation (1991), but becomes the College of Languages and Translation (1995)

- The Council of Higher Education approves the creation of the Center for Consulting and Research, which would eventually be renamed the King Abdullah Center for Consulting and Research (1996)
- King Saud University Community College in Jazan and the College of Sciences at the Qassim campus (1997)
- King Khalid University is accorded university status in southwest Saudi Arabia. The branch of Imam Islamic University becomes an independent university. After unified regulations for graduate studies are established for Saudi universities, the Graduate College becomes the Deanship of Graduate Studies, while the Deanship of Academic Research is established in accordance with the dictates of the System of Academic Research (1998).
- The College of Medicine is established at the Qassim campus, and the Deanship of Community Service and Continuing Education was turned into the College of Applied Studies and Community Service (2000)
- The Community College in Riyadh (2001)
- The College of Science at Al-Jouf is established, and the College of Engineering is opened at Qassim, which becomes an independent university. Community colleges are approved for Al-Majma'ah, Al-Aflaj, and Al-Qurayyat (2003)

Mission:

To provide students with a quality education, conduct valuable research, serve the national and international societies and contribute to Saudi Arabia's knowledge society through learning, creativity, the use of current and developing technologies and effective international partnership.

- **Vision:**

To be a world-class university and a leader in developing Saudi Arabia's knowledge society

- **Values:**

Based on our Islamic and traditional cultural values, we strive for:

- **Quality and Excellence:**

We hold our values according to extremely high standards, honoring lofty ambitions and the pursuit of excellence through a commitment to the rigorous intellectual standards in teaching, learning and innovation.

- **Leadership and Teamwork:**

We are committed to promoting individual and institutional leadership roles, which drive social development, professionalism, responsibility, and innovation. Collaboration and cooperation are recognized as necessary means of attaining excellence.

- **Freedom of Inquiry:**

Rigorous and honest intellectual exploration is fundamental to our academic traditions, and reflected in every facet of scholarship at King Saud University.

- **Fairness and Integrity:**

We abide by the principles of social justice, equal opportunity and cultural diversity, holding members of our community to the highest standards of honesty, respect, and professional ethics.

- **Transparency and Accountability:**

We are committed to openly placing our scholarly ideas and works for society and scholars to judge. In our pursuit of excellence, we hold everybody in our community accountable for respecting and upholding our values in all forms of their scholarly activities.

- **Lifelong Learning:**

We are committed to lifelong learning inside and outside the KSU community, ensuring continued intellectual growth and welfare of society.

Strategic Objectives

- Maintain a distinctive faculty possessing the highest credentials and abilities;
- Provide graduate students with the best education and opportunities that will enhance their knowledge, skills and relevant experience;
- Establish excellence in all fields of scholarship and research;
- Building bridges locally, nationally and internationally;
- Provide a supportive learning environment for faculty, staff and students;
- Ensuring a sustainable environment for the pursuit of excellence;
- Establishing flexibility and accountability.

www.ksu.edu.sa/en

8.3 Appendix A3: King Fahd University of Petroleum & Minerals (KFUPM)

KFUPM HISTORY & Philosophy

King Fahd University of Petroleum & Minerals (KFUPM) were officially established by Royal Decree on 5 Jumada 1, 1383 (23 September, 1963). The first students were admitted a year later, on 23 September, 1964, when 67 young men enrolled in what was then named the College of Petroleum and Minerals (CPM). Since that time, the University enrollment has grown to a level that is expected to exceed 8,000 by the 2009 academic year.

Several significant events have marked the University's growth. In 1971, at the first graduation ceremony, four men received their baccalaureate degrees in engineering. In 1975, the College of Petroleum and Minerals became the University of Petroleum and Minerals, a change both in name and academic status. In 1986, the University was renamed: The King Fahd University of Petroleum and Minerals. As a result of the vast growth of KFUPM, 18,563 degrees were awarded including 1,821 Master's and 86 Ph.D. degree by the end of the 2004/2005 academic year.

The rapid growth of KFUPM is related to the rapid economic and technical development of the Kingdom. It also reflects the rising expectations of the people of Saudi Arabia, the expanding opportunities for the country's young men, and the increasing importance of the Kingdom as a major source of the world's energy.

The vast petroleum and mineral resources of the Kingdom pose a complex and exciting challenge for scientific, technical, and management education. To meet this challenge, the University has adopted advanced training in the fields of science, engineering, and management as one of its goals in order to promote leadership and service in the Kingdom's petroleum and mineral industries. The University also furthers knowledge through research in these fields. In addition, because it derives a distinctive character from its being a technological university in the land of Islam, the University is unreservedly committed to deepening and broadening the faith of its Muslim students and to instilling in them an appreciation of the major contributions of their people to the world of mathematics and science. All areas of KFUPM - facilities, faculty, students, and programs - are directed to the attainment of these goals.

The process of reaching the desired outcomes involved extensive iterative thinking. The process started with a careful situational analysis taking into account the previous efforts in the first KFUPM Strategic plan, relevant data about the University, input from the

main stakeholders, results from focus group meetings and workshops, and comparison with several strategic plans of other international and regional institutions. As a result, the Steering Committee identified the key strategic issues and the main ingredients for the vision and mission statements. After analyzing the current situation and assessing current KFUPM ambitions, the strategic goals and strategies related to them were formulated. This process involved extensive re-evaluation and genuine feedback from the University Administration, the Executive Committee for the strategic plan, the International Advisory Board (IAB), and KFUPM stakeholders.

Vision

To be a preeminent institution known for its globally competitive graduates and cutting edge research and leadership in energy discoveries. Teaching and Research are the main two core functions of KFUPM. The vision is ambitiously drafted to reflect the aspired outcomes of both. Global Competitiveness of graduates requires that they are prepared with high knowledge, sharp skills, real ethics and instilled leadership. Carrying cutting-edge research in all its fields will enable KFUPM to make scholarly impact and contribute to national needs. In addition, as KFUPM is focusing in its research and technology development on energy and its related fields, it aims to achieve leadership in this challenging area. In all of these ambitious stands, KFUPM strives to be a preeminent institution worldwide.

Mission

To make a difference within the Kingdom of Saudi Arabia and beyond in the fields of sciences, engineering and business; we are committed to:

- Graduating leaders who are knowledgeable, skillful, and productive members of society.
- Creating new knowledge that makes a scholarly impact, provides innovative solutions, and contributes to the national economy.
- Engaging our society, alumni, and partners, in valuable endeavors.

While the mission of almost every higher education institution is centered around the three key components of teaching, research, and community service, KFUPM is committed to make a difference in all what it does. This distinct contribution is to be witnessed in the Kingdom of Saudi Arabia and beyond, keeping its focus on the fields of sciences, engineering and business. KFUPM's mission highlights the main characteristics of its graduates which should make them ahead of their peers. Research will make a difference only when it is creative and innovative. While addressing global trend and making a scholarly impact in research, KFUPM is giving essential local needs the

appropriate attention. Finally, KFUPM believes that engagement with the society is an opportunity to partner with its key stakeholders, contribute to the prosperity and intellectuality of the community, and enrich the experience of KFUPM community

Values

Guided by the Islamic principles, these values form the foundation upon which KFUPM builds its reputation and success:

- Integrity: Adhere to ethical and professional code of conduct that encapsulates honesty, sincerity and trustworthiness
- Fairness: Deal fairly and humanely with all people, respecting justice and individual rights and freedom
- Transparency: Deal in a transparent manner in matters of education, performance and progress of faculty, staff and students
- Passion: Conduct our work with enthusiasm and engage actively and positively with our partners and collaborators
- Inclusiveness: Attract and develop employees and students of different nationalities seeking to promote cultural diversity through inclusion of a broad range of people and perspectives
- Care: Provide support to our Community and looking after their growth and needs in a motivating work environment
- Discipline: Focus on a disciplined behavior, interaction and approach to our professional work
- Creativity: Encourage and entertain creative ideas and solutions in teaching, learning, and research, placing it at the forefront of our focus and initiatives.

<http://www.kfupm.edu.sa/default.aspx>

9 APPENDIX B

9.1 Appendix B1: Interview Agenda

BACKGROUND OF THE UNIVERSITY

No.	Question	Answer
1	How many IT employees are employed by your university?	
2	How many colleges does your university have	
3	Does your university have other branches	
4	If yes, please specify how many branches your university operates	
5	How many students do you have in the university (approximately)	
6	How many academic staff members do you have in the university (approximately)	
7	How many managerial employees do you have in the university (approximately)	

8. What are the key businesses of your university?
9. How is your IT infrastructure organized? Is there any central integrated infrastructure or does each subsidiary (or department) have its own infrastructure?
10. Is there any integration Problem within your university?
11. Could you please tell us about the background of your university Integration Problem?
12. How many information systems are there in your university? Please specify types of system
13. (e.g. packaged, custom, e-business), platform (e.g. AS/400), numbers:

No.	Type of System	Platform

14. What problems do you have before adopting an Enterprise Application Integration (EAI) solution (e.g. data accuracy)? Please explain:

FIRST THEME: TECHNOLOGICAL FACTORS

1. How important are the following Technological sub-factors?

i. Technological Risk :

ii. IT Capabilities

a) IT Infrastructure

i. What does the overall picture of the integrated IT infrastructure look like?

Please draw a figure of the overall EAI solution:

ii. Could you please specify how many information systems will be phased out due to EAI adoption in your university, together with the type and platform?

No.	Type of System	Platform

iii. What types of systems will you integrate?

No.	Type of System	Platform

b) Personal IT knowledge

c) IT Sophistications

2. From your opinion, Is there extra sub-factors?

SECOND THEME: IT SUPPORTIVE FACTORS

1. How important are the following IT supportive sub-factors?

i. Data Security & Privacy

ii. State the current data security problem?

iii. Evaluation Framework

2. From your opinion, Is there extra sub-factors?

THIRD THEME: ORGANIZATIONAL FACTORS

1. How important are the following organizational sub-factors?

i. Formalisation

ii. Centralisation

- iii. Managerial capability
2. From your opinion, Is there extra sub-factors?

Fourth Theme: Environmental Factors

1. How important are the following Environmental sub-factors?
 - i. Internal Pressure
 - Who are the partners that considered as External Pressure for the systems involved?
 - ii. External Pressure
 - Who are the partners that considered as External Pressure for the systems involved?
2. From your opinion, Is there extra sub-factors?

FIFTH THEME: FINANCIAL CAPABILITIES FACTORS

1. How important are the following Financial Capabilities sub-factors?
 - i. Return of Investment (ROI)
 - ii. Cost
2. From your opinion, Is there extra sub-factors?

9.2 Appendix B2: Participant information sheet



Brunel Business School

Research Ethics

Participant Information Sheet

Enterprise Application Integration in Higher Education

Dear Participant,

I am a PhD student at Brunel Business School, Brunel University in the UK. I am undertaking a research project on Enterprise Application Integration in Higher Education. This research is one of the requirements for the Award of a PhD degree in Information System Management at Brunel University. This research introduces a framework model to assess the effect of using EAI in higher education institutions in Saudi Arabia. It examines the critical factors that have impact on higher education.

As part of this research, I am interested in your opinion. Therefore it is important that you give an accurate and honest response to all the questions. Your participation is absolutely voluntary and your cooperation is critical to the success of my PhD research.

The interview agenda will take around 40-45 minutes of your time. Your responses will remain confidential and anonymous, and will be used for research purposes and might be published but without mention of your organization's name (i.e. data will be protected and secured; your identity will not be identifiable from the published results). If you have any

concerns regarding the ethical elements of the results, please contact me on Naseir.Aserey@brunel.ac.uk.

Thank you in advance for your cooperation.

Naseir Aserey

Brunel Business School

Brunel University

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Do you agree to take part in this study? Yes No