

De Montfort University

**A Framework for University Admission in Saudi Arabia (UASA):
Current and Potential Position**

By

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Dedication

This thesis is dedicated to my family who have supported me whole heartedly throughout the duration of my research.

Abstract

The motivation for this research is to improve the quality of university admission systems in Saudi Arabia under the rapid changes in information technology (IT), including decision support systems [DSS]. This is achieved by introducing elements of DSS and knowledge management techniques, rationalizing the decision-making process, and, consequently, attaining the optimum exploitation of the available resources to achieve agreed targets.

This research aims to explain the role of DSS in improving the efficiency of university admission systems in Saudi Arabia. In addition, it is concerned with: **a)** describing the existing system for admission in Saudi universities; **b)** testing the existing system for admission to Saudi universities using a set of commonly agreed indicators for monitoring the admission of students enrolled in universities, with a view to improving the overall process of admission and consequently enhancing the existing educational national system in Saudi universities; and **c)** the development of a framework for designing a proposed admission system in the universities of Saudi Arabia.

An empirical study was conducted based on a survey carried out with a sample of employees in the admissions departments in some selected Saudi Universities in order to evaluate the current admission systems. In addition, a survey carried out with a sample of students in some selected Saudi Universities in order to evaluate the proposed admission system.

This research revealed that the current systems for admission in Saudi universities are flexible and easy to use and update, but not suitable because it is not comprehensive for admission in all universities and wastes time, effort and money. Therefore, it needs to be developed into one central system. For the purposes of the optimum exploitation of the available resources (such as: qualified people, modern equipment, money and so on) in Saudi universities it is necessary to improve the admission systems by applying DSS. Thus, applying the e-admission system will help to improve the current admission systems in Saudi universities to be one central admission system.

In order to develop the effectiveness of the current systems for admission to Saudi universities it is necessary to apply DSS appropriately and this is dependent on modern IT. In addition, to improve the current University admission systems in Saudi Arabia it is necessary to make its database more comprehensive of all Saudi universities, more integrated with other related databases, and more relevant to all Saudi universities. Furthermore, to meet the necessary requirements to implement this requires an advanced database, a relevant feedback system, qualified people and a good models base.

The researcher has proposed a framework for the admission system for all Saudi universities in order to develop the admission process within those universities. As the current systems of admission in all Saudi universities is not comprehensive and no longer relevant, it is necessary to apply the proposed system for admission as soon as possible. This will help in improving the efficiency of the admission system in Saudi universities. With the proposed system, students are only required to submit one application form which covers all universities instead of submitting several application forms to several universities. Through this process, they will be offered only one place at one university at any given time. This will save effort and time, and reduce cost.

Publications

A paper has been published entitled: Managing Admission in Saudi Universities: A System Approach.

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List of Abbreviations

AIS	Accounting Information System
ANN'S	Artificial Neural Networks
DM	Data Mining
DSS	Decision Support Systems
EC	Expert Choice
EDSS	Educational Decision Support System
EMIS	Education Management Information System
ERP	Enterprise Resource Planning
GA	Genetic Algorithm
ICT	Information and Communication Technologies
IEEE	The Institute of Electrical and Electronics Engineers
NSS	Negotiation Support Systems
IP	Internet Protocol
IT	Information Technology
KPI	Key Performance Indicators
KSA	Kingdom of Saudi Arabia
MCA	Multi-Classification Analysis
MCDM	Multi Criteria Decision Models
MQA	Malaysian Qualifications Agency
NWFP	North-West Frontier Province
OOKB	Object-oriented Knowledge Base
RPD	Recognition-Primed Decision
SD	System Dynamics
UASA	Universities Admission in Saudi Arabia
UCAS	the Universities and Colleges Admission Service
UK	United Kingdom
UNESCO	the United Nations Educational, Scientific and Cultural Organization
URE	United Arab Emirates
VPN	Virtual Private Network

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Chapter 1

Introduction

Objectives:

- To present the general framework of the study, literature review, the problem, and the hypothesis.
- To present the research questions, objectives, importance, methodology, and structure.
- To present the research contributions and limitations.

1.1 Background and motivation

The use of knowledge management in industry encourages serious thoughts about transferring their capabilities in academic domains. Consequently, it is necessary to depend on all the required knowledge in any field in academic domains, especially Information Technology (IT), to help develop universities' performance. For this reason, the universities in the Kingdom of Saudi Arabia (KSA) must not only understand the importance of the situation, but they must be ready for the introduction to knowledge management operations to ensure they are able to apply knowledge management in the field of education.

IT develops rapidly and provides policy and decision makers with a huge range of information regarding the processing and analysing that is required to assist them in the decision making process. The education system in the KSA faces new challenges that need to be overcome in order for its objectives to be met. These objectives include improving quality, efficiency and relevance on the one hand and providing users with the ever-changing needs of the local economy and regional labour markets on the other (for example, see: Maroun et al., 2008).

In order to meet these objectives, a comprehensive educational Decision Support System (DSS) needs to be established and institutionalised throughout the entire education system. This system needs to be officially constructed and designed to collect, maintain and provide relevant, reliable and renewable information in order to implement the right educational policies, planning and decision-making processes in all the education institutions in the KSA.

The motivation for this research is to improve the quality of the admissions system in the universities in Saudi Arabia in light of the ever increasing and rapid changes in IT and incorporate DSS to rationalise the decision-making processes. Thus, attaining the optimum exploitation of the

available resources for Saudi universities (such as qualified people, modern equipment, finance and so on), and consequently, to achieve the Saudi universities agreed targets.

1.2 Previous studies

There have been many studies conducted on the role of decision support systems to promote the adequacy of student admission systems. For example, Eliman (1991) proposes a DSS for developing university student admission policies, as the university decision makers and the DSS components need be determined. According to Eliman (1991), the DSS consists of three modelling components which are shown as:

- a) an academic performance test model that contains a multi-classification analysis and cohort analysis;
- b) models to evaluate the prospective secondary school graduates and request for graduates from university that depend on demographic growth and decreasing analysis; and
- c) a student allocation model which uses a linear programming model for student allocation.

The models provide Data Mining (DM) by using an iterative and flexible link approach to the DSS models. After having a three-year experimental period, the DSS, according to Eliman (1991), has received a positive response from the university's decision makers.

Sanyal (1995), investigates the relationship between computerised information systems and the need to increase university management efficiency. The study proposes that an information system should be designed to contribute to the integration of procedures and files which is based on one-time data entry into centralised common files that are set up to obtain all the available information on a university-wide basis. In addition, it should also adequately provide quantities of organised and detailed information on which the university administrators can base their plans and make their decisions.

On the other hand, the system should supply historical information to establish and support information system models and reflect the university approaches for management. In this way, it will support the traditional reporting requirements of the university (Sanyal, 1995). Rather than

proposing a DSS model, Sanyal (1995) established the profession of the university management system with guidelines to create harmony between IT and a DSS model.

The issue of gender in education needs to be acknowledged. In his study, Hamdan (2005) explores the role of women in education in Saudi Arabia. According to this study, the historical, social, economic and political circumstances of Saudi Arabia are an important aspect to fathoming a woman's rank in the Saudi community. The exclusion of women from public life which exists in modern Saudi Arabia is one of the most controversial debates, not only among Muslims but also globally, as the Saudi society is subjected to continued inspection and scrutiny internationally. In recent years, women have been allowed to study most of the same subjects as their male counterparts, except those that might lead to them having to mix with men (Hamdan, 2005). In 1980, the number of female graduates exceeded the number of male graduates in the humanities sector.

IT in DSS was presented in Mansmann and Scholl's (2007) model. They proposed that decision-making in the academic planning field should have the capacity to analyse huge volumes of data originating from several systems. Furthermore, the deans and department chairs need to make sure that these modern professionalisms and programs are adequately determined in relation to new technological applications developed from electrical engineering, computer science and computer engineering (Mansmann and Scholl, 2007).

The management of the academic workload is mainly interested in distributing teaching resources to ensure that the university's educational framework is efficient; for instance, in terms of teaching workload, faculties, courses, admission policies and degrees, etc. (Mansmann and Scholl, 2007). Mansmann and Scholl (2007) provided a methodology for estimating educational capacity and planning its distribution and deployment. Implemented as a DSS, this would facilitate the simulation and evaluation of many suggestions and scenarios and enable the system to acquire input data from trusted sources and transfer it to an independent data store.

A graphical client front-end makes sure that adequate outcome aspects are provided to the decision-makers by uncovering important data properties and dependencies (Mansmann and Scholl, 2007). The study details the main points pertaining to the application of the system with respect to supporting the decisions utility for the policy makers and provides results that increase procedures planning and give more insight and depth to the data (Mansmann and Scholl, 2007).

Getting ready for their research within quality, Garcia, Cascales and Lamata (2009) used the insights of the Spanish National Agency for Accreditation and Quality Assessment to estimate each of institutions through its Evaluating Programme. The study is interested in the external estimating stage for qualifications in the field of industrial engineering and, more specifically, on the framework and structure of the database for a DSS on the higher education's rankings. Moreover, the criteria weight and the linguistic labels definition used in the external evaluation stages are confirmed (García-Cascales and Lamata, 2009).

Similar to Garcia-Cascales and Lamata (2009), Bresfelean et al. (2009) believe that, due to the increasing competition in all higher education environments, it is essential for universities to possess up-to-date information and communication technologies (ICT) systems to carry out the functions and procedures necessary to deliver a high standard of quality education. Universities need to ensure they are using more accurately gathered data and improved tools to collect and direct information management in order to influence managerial decision making processes in a positive way. The gathered data can be used to measure quality, perform analyses and diagnoses, estimate dependencies on the levels and practices of syllabus and curriculum, and provide appropriate replacements to the decision-making process.

Bresfelean et al. (2009) argue that data mining and decision support systems are technologies that are both well suited to provide decision support in higher education environments by producing and presenting information and knowledge that would enhance the quality of educational processes and management, including admissions system (Bresfelean et al., 2009). Dahlan and Yahaya (2010) ensure a particular measurement of quality through KPI; they explore the factors that shape the basis of a DSS which directly caters for efficient resource management, thus contributing to a system dynamics (SD) model.

Dahlan and Yahaya (2010) are of the view that managing academic resources is a multifaceted administrative issue. They argue that the admissions capacity for a degree program is determined based on the number of lecturers, total number of enrolled students and the available facilities in the university. The formula used is the lecturer-to-student ratio. Dahlan and Yahaya (2010) suggest that actions should be taken by universities towards harmonising the educational capacity based on the KPIs of academic activities, as this would guarantee the systematic and strategic management of academic resources.

Bhatti and Adnan's (2010) study presents a challenge to the Education Management Information System (EMIS) (Bhatti, Adnan, 2010). This offers an EMIS that not only intends to collect statistical information from the schools, by people, models, methods, procedures, processes, rules and regulations, it also relates to the emerging computer technology. It makes sure that all functions work together to provide timely and dependable data to education leaders, decisions makers, planners and managers to ensure they perform their tasks efficiently, and ultimately realise their goals and objectives.

Computer technology provides technical support to the EMIS by providing the proper people with the most useful information at the relevant time, thus enabling them to make the most suitable decisions whilst planning and controlling in the perfect way, taking the needs of the institution into consideration.

One of the related studies on DSS is offered by Vohra and Dais (2011) who showed how the mechanisms of a DSS for developing student admissions policies in a higher education institute or at universities helps to overcome the pitfalls experienced by many higher education institutions (Vohra and Das, 2011). Moreover, many other studies have mentioned that IT (including DSS) is a beneficial tool which can provide many benefits to and uses in the field of education, such as with the admission systems. Each study covered one or more purpose. Nevertheless, the current study attempts to cover more than one purpose relating to admissions systems in the field of higher education, by also improving the application process for the universities in the Kingdom of Saudi Arabia.

The study aims to propose a new framework for the admissions process for Saudi universities, which is designed to save effort, time and reduce costs. The proposed admission system in the KSA is a unique system because it includes two sub-systems; namely, one for male students and another for female students. Furthermore, the current study attempts consider some factors, such as a student grades (GPA, GAT and SAAT), requests, sex, region and nationality, amongst others.

1.3 Problem statement

The existing admissions systems in Saudi universities are problematic and need to be improved. For example, with the current admissions systems it is difficult to achieve a fair distribution of students among all universities according to their grades. This is because the individual Saudi

universities have different admission systems. In addition, these systems are not comprehensive apropos of all universities and are not appropriate for use in all universities. The current admission systems let students apply to more than one university in one single application. Hence, by doing so, resources, including time, effort and money, are wasted for both students and universities alike (see, for example: UNESCO IBE, 2007; The World Bank, 2008; Ministry of Education, 2005 and Wikipedia, 2011).

Accordingly, these systems need to develop and to change from decentralised systems into one, single and centralised system. With the proposed system, students are only required to submit one application form that covers all universities. With the current admission systems, students apply to multiple universities in Saudi Arabia. Therefore, they can be accepted into more than one university. This can lead to missed opportunities for other students who may then lose a place which has been allocated to another student who has applied for and been accepted on a course at another university.

Through the new system, students are offered only one place at one university at any given time. However, in order to implement this an appropriate DSS is required; this will improve the current admission systems in Saudi universities and ultimately, will result in the attainment of the optimum use of the available resources and the achievement of targets in the field of education in the KSA. This, in turn, will reduce the amount of effort, time and money attributed to the admissions process.

In addition, changes to the educational environment in Saudi Arabia, changes to its educational policies, economic needs, practical needs, and so on, continue to occur. In addition, the number of universities has increased, the number of students, both male and female has increased and the associated costs of the admission process have also increased.

In view of the above, this study proposes an integrated admission system, based on a specifically designed DSS, which can be implemented nationally in all Saudi government universities and eliminate the variations, thus making a standard and fair admissions process for all students. The proposal considers many factors, such as grades, geographic location, application request, gender etc.) and assigns a new grade and major to each student who applies to any university. This will lead to the attainment of the optimum use of available

resources and the achievement of targets in the education field in the kingdom of Saudi Arabia. This will save effort and money, and reduce time.

Due to the challenges and problems facing the current admission systems in the KSA, this system needs to improve. Improving the current admission systems in the KSA requires establishing a new admission system, based on DSS, which is formally structured and designed to collect, maintain and supply relevant, reliable and timely information to guide educational policy, planning, and the decision-making process.

Because the student introduces many requests to more than one university, the current admission systems in Saudi universities give him or her acceptance in more than one university. Doing so leads to wasting many opportunities for other students. The proposed system accepts only one application from each student that will allow them to apply to all universities. On the other hand, it helps the universities by having one centralized system for receiving the students' applications.

1.4 Contributions

The research contributions are as follows:

A set of commonly agreed indicators were used to test and monitor the existing admissions system for students enrolled in Saudi universities. Therefore, it is necessary to suggest a central admission system for two branches, one for males and the other one for females. A new system was proposed with the aim of improving the overall admissions process by saving time, effort and money and consequently, enhancing the management and functionality of the existing national education system in Saudi universities.

A framework for a new admissions system was built for Saudi universities. The system will be integrated and comprehensive for all students within the KSA (either Saudi or non-Saudi) and will help to improve the efficiency of the admissions process for Saudi universities. This system will save time, cost and effort for parents, students and admission systems administrators. With the proposed system, students are only required to submit one application form which covers all universities, rather than having to submit several application forms to several universities, as with the current systems. Through this process, they will be offered only one place at one university at any given time. Thus, the admissions process will be managed by one central system and

eliminate the need for several admission systems being required for each individual university in Saudi.

The new admission system will be, as previously mentioned, one central system for two branches, a male branch and a female branch. Each branch has a different policy, budget, regulations and opportunities. This will be different from other admission systems in other countries, since the environment and traditions in the KSA are different.

A prototype for the central admission system in Saudi universities was built and this was used to test the framework. The prototype was designed to help to improve the efficiency of the admissions system in the Saudi universities, and to save time, effort and cost for parents, students, admission systems administrators and government as the Saudi government pays a monthly amount for Saudi students.

With the current admission systems in Saudi universities (either male branch or female branch), it is difficult to achieve a fair acceptance of students among all universities according to their grades. This is due to Saudi universities' having different admission systems. In addition, these systems are not comprehensive, apropos of all universities and are not proper to all universities. The current admission systems let students apply to more than one college and get acceptance in more than one college in the same time. Then, they will choose one college and enroll in it. At the same time, they will bar the acceptance in other colleges for at least one or two years. This reduces the admission opportunities of other students. Doing so, resources, including time, effort, and money are wasted for students and universities. As such, the installation of a DSS is highly recommended in order to improve the efficiency and performance of admission to Saudi universities. This requires establishing a central and unified admission system for all Saudi universities. The proposed system will give students a chance to apply to all universities nearly by one application form, instead of applying more than one application form, and get acceptance in only one university. This will, of course, save time, effort and money for users (students, parents and administrators).

This system will improve the quality of the admission system in the Saudi universities. Also, it will lead to optimum use of available resources and achievement of targets in the field of education in the KSA. Thus, the return of investment in the proposed system will

be high, especially in the long term.

1.5 Research objectives and its importance

The research aims to achieve three objectives, as follows:

- To describe the current admission systems in Saudi universities in order to determine its advantages and disadvantages;
- To test the existing admission systems in Saudi universities by using a set of commonly agreed indicators for monitoring the admissions processes of students enrolled in universities in order to improve the overall process of admission, and consequently to enhance the existing Saudi Higher Education; and
- To develop and design a proposed new system for admission to universities in the Kingdom of Saudi Arabia.

Therefore, the importance of this research lies in the necessity for improving the quality of the admissions system in Saudi universities and implementing a relevant and appropriate DSS, thus enabling them to keep up-to-date and support the rapidly developing changes in IT and rationalise the decision-making process. The importance of this research is based on the culture where it will be implemented. It is intended to exploit the best of the sources of available and help raise the plane of educational institutions that have not previously operated at this level, to ensure that all their aims and objectives are accomplished.

1.6 Research questions

This research tried to answer the following questions:

- a. What is the best way to develop the existing admissions systems in Saudi universities?
- b. How can a new framework be developed to meet the new requirements?
- c. How can a new framework be evaluated?

In the terms of the research problem, this research is based on the following hypotheses:

- The shortcomings of the current admissions rule in the Saudi Universities leads to problems that the students face when trying to secure a place at university.
- The implementation of a set of commonly agreed indicators for monitoring the admissions process of students enrolled in Saudi universities leads to an improvement in the overall

process of admission and consequently enhances the existing educational national system in Saudi universities.

- Applying a central admissions system to Saudi universities will improve the efficiency of the admission process and consequently, will enhance national capabilities in the field of education.

1.7 Research methodology

This research was conducted on the following:

- A theoretical study was conducted on the role of DSS in improving the efficiency of the admissions system in Saudi Arabia. This was done by revising, discussing and analysing the existing research that are presented in the literature and are related to the above-mentioned subject. Thus, the theoretical study is designed to achieve the first objective of this research.
- An empirical study was conducted based on a survey carried out with a sample of employees in the admissions departments in some selected Saudi Universities. The main aim of the empirical study was to achieve the second and third objectives of this research. The researcher depended on the SPSS programme for data analysis.

1.8 Research limitations

The research limitations are:

- This research is concentrated on the relationship between using DSS and improving the efficiency of the admissions system in the universities of Saudi Arabia.
- The research will be applied to only three universities in Riyadh city; two are governmental universities and the third is a private university.

1.9 Thesis structure

The thesis is organised and structured into 8 chapters as follows:

Chapter 1:

This chapter provides the general framework of the study, the literature review, the problem and the hypothesis. The research questions, its objectives, its importance, its methodology and structure are then explained. Finally, the limitations of the research, expected contributions and difficulties are presented.

Chapter 2:

In this chapter, the nature of decision support systems (DSS) is explained. Chapter Two presents some definitions that are related to DSS. Then, the relationship between Artificial Intelligence and DSS are presented. It also presents some applications that are related to a DSS. Finally, it presents important adjuncts to the DSS.

Chapter 3:

This chapter explains the nature of the admission process in Saudi universities and presents the problems facing this process. It starts by presenting background information about the KSA and its education system, and then illustrates the general profile of the admission system in Saudi Universities whilst explaining the main problems associated with this system. It also presents an outline of the higher education system in the Kingdom of Saudi Arabia.

This chapter also presents a theoretical background regarding the chapter's subject. Then, some application areas of a DSS are presented. Following this, some of the benefits of using a DSS for university admission systems processes are discussed. In addition, some of the restrictions relating to the utilisation of DSS in universities are also outlined.

Chapter 4:

This chapter explains the research methodology for the current study; it begins with a discussion around the research objectives and its hypotheses. Chapter Four presents the research approach, either quantitative or qualitative, along with a detailed description of the study sample (sampling frame, sample size and sampling technique) and the research instruments.

The two survey instruments, including a questionnaire and an interview, are explained, along with a breakdown of the pilot study. The reliability of the questionnaire is also described in this chapter. The administration of the instruments for the main study is described. Finally, the chapter explains the data analysis tools that are used. For more details, please see Chapter Four.

Chapter 5:

In this chapter, the data is obtained from the empirical survey by questionnaires and interviews and the results are presented. The chapter describes the research sample in Riyadh City according to the respondents' demographic information. Chapter Five also presents the data obtained from the empirical survey by the use of interviews. The results include general information about the interviewees, followed by data about the admission systems in Saudi universities. Finally, the results are discussed and the hypotheses are tested.

Chapter 6:

In this chapter, the researcher presents a framework for designing, implementing and evaluating a proposed admission system for the universities of Saudi Arabia (UASA). Chapter Six also describes the main features of the current and proposed admission systems in Saudi universities, describing in detail the main elements of the proposed system. In addition, it presents an evaluation of the proposed system benefits and damages. The proposed programmes are presented as print screens.

Chapter 7:

In Chapter Seven the researcher presents a critical review of the admissions system in SAU. Following this, it presents the features and requirements of the admission system in SAU. Finally, it presents the admissions process for the universities in Saudi Arabia (UASA).

Chapter 8:

In this chapter the researcher presents the summary, conclusions and recommendations for future research and the contributions from this research, in order to achieve the research objectives.

1.10 Main concepts

Framework: the admissions system and all its components.

Comprehensiveness: the admissions system includes everything required for the different aspects for admission as easy utilisation by the users, practicality for both the users and

administrators, all the data required for the administration process and all governmental Saudi universities, etc.

Relevance: the admission system is related to the affairs of the contemporary students and administrators, as well as easy use and update, since it is based upon advanced IT methods.

1.10 Scenarios

Scenario 1: A student who is interested in pursuing law goes online to check for the proximity and requirements of the colleges of law in the KSA. After deciding the colleges, he wishes to apply to, he then enters the official website of the Ministry of Higher education of the KSA. The student logs into the website using his personal ID and given password, follows the given instructions and fills in his grades and requests for the colleges he decided upon earlier within his stage (stage 1, stage 2 or stage3). After reviewing his data carefully, he then submits it to the admissions office to be reviewed and assessed.

The admissions office, after reviewing and matching his grades with his requests, sends him a report that shows which requests he is eligible for. If he, indeed, is accepted into his college of choice, he then just waits for further instructions from the given college, e.g. interviews. If, on the other hand, he is not accepted into his college of choice, he has the option of choosing a single college - as his last resort - from a select few, based on his grades and administrative region.

Scenario 2: In the old admission systems, medical colleges with an average of 500 available seats each, get an average of 1500 applications. The same students make approximately half of these applications, i.e. the same student applies to every medical college within the Kingdom. In doing so, this blocks the opportunity for the other half of the applications to be accepted. This dilemma is prevented in the new admission system, since each student will be allowed one application form and will only get accepted the college most deserving of his or her capabilities.

Scenario 3: In the new admission system, student X would like to apply for a place at medical college but would prefer to attend a college in his or her district. The student is

unsure if the application will be accepted, so starts by applying to his local medical college and then fills up other medical colleges by order of proximity, all in the same application form. Using the old admission systems, this student would have to literally apply to each individual medical college inside and outside his district (a process which could take a number of days, or even weeks) in order to apply to every medical college within the KSA to ascertain entry to a medical college. This means the proposed admission system will save time, effort and reduce cost.

Chapter 2

Review of Decision Support Systems (DSS)

Objectives:

- Present the theoretical background regarding DSS.
- Present the relationship between artificial intelligence and DSS.
- Present the importance of DSS.
- Present some areas in which DSS can be applied.
- Present some of the benefits DSS can offer to universities.
- Present some of the limitations of using DSS in universities.

2.1 Introduction

Decision Support Systems (DSS) is an interactive computerized system which collects and presents data from a wide range of resources, and it is typically used for business purposes. DSS applications are systems and subsystems that help decision-makers in different fields make decisions based on data that is picked from a wide range of sources.

One important aspect in establishing a DSS is that it can be associated with an integrated system. It has been the primary impetus of the research to find evidence that can practically and theoretically support the creation of DSS literacy in new and untried environments. The DSS can help in designing, implementing and institutionalising models for the student journey that cover all the requirements of universities, from admission, choice of major, evaluation of the system, teaching staff, students' abilities and potential, through the process of supplying a DSS that can serve the multiple needs of universities, its academic staff and the student body. DSS applications are not single data resources, but link completed resources in order to meet targets in several fields. The main aim of this research is to develop a framework which will help develop the admission process in Saudi universities.

The goal of the researcher is to be part of a team that brings to universities an administration system that is world class standard. It was important for the researcher to review the literature from developing countries, as this would contain similarities to what is required for implementing the technology in this particular target area. The researcher was also interested in the many

varieties of different applications that are available to improve the university administrators' abilities to serve the students and staff. To this end, the DSS should be complete and any additions to it should be transparent. Yet no single system or prototype investigated for the purposes of this study has covered all these criteria. However, most of the studies have noted the importance of matching the existing systems with each individual university's needs.

2.2 Theoretical background of DSS

DSS are a particular class of computerised information system that provide the ability to make decisions on organisational activities. DSS are designed to be an interactive software-based system which is intended to help decision-makers compile useful information from databases, personal knowledge and/or business models to identify and help to solve problems and make decisions (Broun, 2012). DSS provide useful information for making semi-structured and unstructured decisions for decision-makers at all management levels (top management, middle management and lower management) (Khan and Khan, 2011). So, DSS can enable universities to gain a sustainable competitive advantage by moving beyond the customer's satisfaction (students) and creating a positive change in the surrounding environment (saving time and effort, and reducing cost). They can improve practical academic programs (admission system programs for example), increase confidence and improve the quality of education.

DSS can aid human cognitive shortages by processing many sources of information, supplying suitable access to knowledge and supporting the process of making decisions. They can provide choices from well-defined alternatives (Castro-Schez et al., 2005). Therefore, a DSS can help decision-makers in rationalising their decisions by saving time and effort, and reducing cost. These systems can also provide decision-makers with useful information and models.

DSS support higher management levels in solving less structured problems related to activities in the near to distant future. They can be model or data-driven. DSS use data which reflect both the organisation and the environment, and deliver key performance indicators, visuals and drill-downs of aggregate figures. DSS increase the control, competitiveness and capability of the organisation, enabling it to make decisions in a futuristic manner (for example see: Druzdzal and Flynn, 1999). These systems will play an important role in the admission process of universities. Therefore, the researcher selected these systems for improving the efficiency and the performance of the admission system in Saudi universities.

To use a DSS properly, several groups, or roles, must be involved. These roles mainly include: model builder, managerial designer and technical designer (see for example: Bidgoli, 2014). In addition, a DSS needs to establish an integrated database to provide users with the required information and techniques in order to support them in the decision-making process.

DSS are interactive computer-based systems which are used to help decision makers use data and models, identify and solve problems and make good decisions. It unites the human skills involved in the decision-making process with the strength and capability of IT to provide decision-makers with effective management tools for handling huge volumes of information, flexible reporting, analytical and modelling capabilities and a variety of visual procedures for presenting alternatives.

The DSS plays an important role in several fields including the field of higher education. The DSS should provide suitable support to decision makers in university environments, by generating and presenting relevant and useful information for making decisions for managing admission to higher education.

In order to improve higher education, it is necessary to develop the admission system which lies at the heart of it. The university decision makers' demands and the DSS components are described in order to help improve admission systems. For improving the admission systems to higher education it is necessary to apply an excellent program based on DSS. The DSS components should support policies of admitting students to higher education. An intelligent DSS significantly helps the field of higher education. Therefore, this chapter will explain the relationship between DSS and the admission systems in universities.

Despite the enormous number of empirical investigations of the effects of DSS on decision outputs, few investigations have carried out longitudinal studies to assess DSS effectiveness in the field of university admission systems. For example, (Barr and Sharda, 1997) propose that the effects of DSS on decision outcomes develop over time. Their study evaluates whether improvements in decision quality, typically associated with DSS, were primarily due to developmental effects. Using an add-on and take-away design, the study examines whether the use of DSS contributes to decision quality after managers have become familiar with tasks. It also evaluates the activities of decision-makers after eliminating the DSS. Results indicated that although DSS contributed to the quality of decisions after managers became familiar with tasks, improved decision making by DSS-aided decision makers may be due to dependence on the DSS,

rather than better conceptual understanding of the problem. The implication of these results for the design and implementation of DSS are discussed.

Hung, et al (2007) identified the way in which the value of decision support systems (DSS) is assessed, as a very important research issue. The researchers adopted user fulfilment and decision achievement to evaluate DSS success. However, in some cases, the use of DSS isn't driven by practical considerations. Instead, DSS adoption may be prompted by a need to eliminate decision errors or decrease decision cost, indicating that regret avoidance might be a useful criterion for DSS success. This exploratory study goes beyond prior research on DSS evaluation by proposing regret avoidance as an extra measure of DSS success. Experimental studies involving the use of DSS for stock investment, show that DSS use significantly decreases regret as well as instances of low user satisfaction. Thus, besides decision-making performance and user satisfaction, regret reduction is essential for evaluating the effectiveness of DSS (Hung et al., 2007).

Michael L., et al (2007) used a laboratory experiment to investigate the effect of DSS use on the decision maker's error styles and decision quality. The DSS used in the experiments is the widely-used Expert Choice (EC) application from the Analytic Hierarchy Process. EC is decision-making software that is based on multi-criteria decision making. Perhaps surprisingly, the experiments do not generally support for the implicit supposition that the use of a DSS, such as EC, improves decision quality. Rather, the researchers find that, whereas a DSS can help decision makers develop a better understanding of the essence of problems and can decrease logical error, especially if there is high information load, it is also susceptible to machine errors. This study showed several cases, where the occasional errors might outweigh the advantages of using a DSS, resulting in lower quality decisions (Williams et al., 2007).

An empirical investigation was carried out to investigate the effect of users' experience of working with DSS experience on the effectiveness of their problem solving. The results showed that individuals who had recently begun to use the DSS, were confused by the set of functions provided by the system and did not have an effective plan for making use of the DSS, whilst those who had previous experience of the system exhibited a more focused and efficient problem-solving approach. The findings suggested that problem-solving strategies relied significantly on the user's level of experience with the system (Lee, Wagner and Shin, 2008).

Employee empowerment is an important factor which might be affected by the use of DSS. The factors related to employee empowerment were investigated in a research study involving employees within the Tehran Education Organization. The research was carried out using descriptive surveys. Samples of 230 participants were selected according to the Morgan table. Information was gathered using a questionnaire created by the researchers. The results showed a positive relationship between empowerment and motivational elements, such as increased staff honesty, confidence and employee development, and increasing information and improved teamwork. In addition, other positive effects were seen, such as strengthening communication, increasing skills, increasing the efficiency of partnerships, improved employee experiences, and optimising work flow and procedures (Haghighi, Alimohammadi and Sarmad, 2011).

A study by Yazdani, Yaghoubi and Giri examined factors affecting employee empowerment in the Sistan and Baluchestan University in Iran and introduced strategies to improve it. The research investigates the effective approaches to achieving employee empowerment, the factors affecting it, and the scale on which it can be deployed. The study investigates job enrichment, delegation and performance-based rewards; it also investigates participative management, employee participation, a suggestion system and the role of teamwork in goal-setting as important paths to empowerment. Finally, these results were used to propose a model for employee empowerment (Yazdani, Yaghoubi and Giri, 2011).

In their paper, Alnajjar and Al-Zoubi aimed to identify the level of both DSS applications and empowerment in Jordanian Universities, as well as analysing the impact of decision support systems on empowerment. The study advances a conceptual frame containing two roles which simulate the study model. The target population of the study comprised all faculty members in the Colleges of Economics and Business in the Jordanian Universities (state and private). A random sampling was achieved with equal numbers of public universities (5) and private ones (5). Out of the 150 surveys which were issued, 142 were actually included in the analysis. Based on previous studies, 38 different issues were investigated in order to meet the study objectives. The results showed that DSS generators had a very important effect, with a significance of $P \leq 0.05$, on organisational empowerment in Jordanian universities. The study found that DSS generators had a statistically significant effect on personal and collective empowerment in Jordanian universities (Alnajjar and Al-Zoubi, 2012).

A few studies have investigated different aspects of the relationship between DSS and university admission systems. Each study covered one or more sides of this relationship. However, the current study aims to investigate this issue from various viewpoints, with a number of different goals, in order to improve the admission process when applying for a course of study in the universities in the Kingdom of Saudi Arabia. The current study aims to evaluate the admission system in Saudi universities before and after a program based on DSS is applied. In addition, a framework will be developed for designing a future admission system for Saudi universities. This will lead to an improvement in the quality of education in Saudi universities.

2.3 Artificial intelligence and DSS development

Artificial Intelligence focuses on constructing a person or animal with the aid of science, engineering and IT. However, the successful achievement of this objective, is heavily dependent on the applied learning system. Although the notion of a DSS as a resource for querying and analysis goes back to the 1960s, it was not until the 1990s that data storage was universally available and adopted (Baranovic, Madunic and Mekterovic, 2003). The fundamental objective of all the literature reviewed, embraces the concept of decision making by improving the DSS with various alternative architectures, such as neural networks and finely tuned algorithms, and applying them with high accuracy across all decision-making platforms.

Despite their large number and potential for improving organisational decision making, multi-criteria decision models and decision support systems (MCDM DSS) are not adequately applied and used. The developed MCDM theories currently used are well-known and are generally accepted almost without criticism (Chungyong, 1999). However, there are two main reasons behind these systems being unable to adequately meet the necessary requirements, namely unforeseen technological advances and breakthroughs in software development. The necessity for institutions to invest in the hardware and software necessary for operating a DSS is undeniable, and over time there have been great advances in this field; however, the hope, desire and need for better systems is driving serious research in this area. This leaves institutions fearful that systems will become obsolete before they are implemented. In a time when funding is under great pressure, it is necessary to carry out studies that prove the benefits of the DSS and its adjoining systems.

Therefore, a DSS for resource management is becoming an important tool used for complex administrative tasks carried out by institutions in various fields, such as education. These

activities include resource planning, evaluation of competing strategies and decision making. The DSS most suitable for resource distribution and making decisions are more data centric for data retrieval and data analysis activity. For strategic planning purposes, a model centric oriented DSS is more favourable as it offers suggested actions based on simulations performed, which enable universities to maximize or optimize their resources (Dahlan and Yahaya, 2010).

Encheva and Tumin (2008) presented a novel prototype of a knowledge learning system capable of learning from experience and receiving knowledge. The suggested learning system contains artificial neural networks which are known as ANN's, and an object-oriented knowledge base. It also proposed a genetic algorithm (GA) and fuzzy inference engine. Simulation results confirm the feasibility of this system. However, the author concluded that much effort is necessary to improve the performance of the system proposed in his research. The concept is very interesting and intriguing. However, as an educator trying to establish a strong DSS base in an institution, these types of ground breaking concepts are not yet 'workable'. Field laboratory experimentation and intense research are invaluable, but beta trials in online situations are not feasible until the research and development provides applications which are suitable for professional use (Encheva and Tumin, 2008).

Encheva and Tumin (2008) paper proposed the application of many-valued logic for the process of selecting and recommending learning objects to be included in a subject. They implemented a prototype of a decision support system using three-tiers of web application server architecture (Encheva and Tumin, 2008). The Apache web server is used for the presentation layer, Python for a logic layer, and the SQLite (structure query language) database engine for the data layer (Limayem and Chelbi, 1997) and (Butler et al., 2006). This is a critical concept for learning object ranking by applying algorithms which make decisions on the best subject choice for a learner. This is one of the tools most needed for the situation in which universities in Saudi Arabia find themselves. Based on both this approach and the traditional way of decision making way, there is also a procedure which recommends the best choice of subject to m learner preferences to a particular learner. A learning object ranking example is discussed to demonstrate the method of implementation based on multi-agent framework (Pukkhem and Vatanawood, 2009).

The capability of learning from experience is of critical importance in developing multi-element systems supplying dynamic team decision making. Then experience acquisition and adaptation are tightly connected to learning. For example, instance-based learning (Gonzalez, Lerch and

Lebiere, 2003) is particularly proper to experience integrity and the Recognition-Primed Decision (RPD) model highly locates on the availability and correct recognition of past experiences. It introduces a hierarchical learning approach which aims to support hierarchical group decision making as the decision makers at a low standard only have a one side view of the whole picture. To further understand such a hierarchical learning concept a learning component within the R-CAST (RPD-enabled Collaborative Agents for Simulating Teamwork) agent architecture, with lower-level learners using the Log it Boost algorithm with decision stumps (Chen et al, 2006) and (Hanratty et al., 2007) was implemented. The boosting-based learning elements were used in their experiments to identify experience cases. The results refer that hierarchical learning can hugely improve suitable decision while lower-rank decision makers have little information that can be applied. In most cases business needs drove the innovation (Chen et al, 2006).

Accordingly, artificial intelligence helped in developing a DSS in the field of the decision-making process for several purposes because both artificial intelligence and DSS are related.

2.4 Academic DSS applications

The business applications of a DSS can be used for academic applications in several fields. Dahlan and Yahaya (2010) studied the determining factors fundamental to a decision support system which takes a supply and demand approach to an academic program and directly aids the efficient management of resources. They constructed a system dynamics (SD) model for the purpose of evaluating strategies and generating forecasts (Dahlan and Yahaya, 2010). The proposed model is based on the academic program structure of Malaysia University of Science and Technology. The academic program structure, however, follows the trend of other higher education institutions. The simulation of resource management decision making is carried out through executing a system dynamics model which primarily takes into account supply and demand issues, higher education trends as well as the policies set forward by the Malaysian Qualifications Agency (MQA) and the University (Dahlan and Yahaya, 2010). This model can be applied to solve many problems which related to academic capacity planning since it (Dahlan, Yahaya and 2010):

- a) permits management to explore changes in the academic source management processes before implementing any policy changes;
- b) computes the necessary changes to the number of admission or teaching resources for supporting a certain scenario, such as a reduction in funding; and

- c) gives insights on the likely impact of funding, academic policy or management decisions on quality as well as academic resources.

Luis et al (2004) presented a new 3-level classification model for tracking analysis on e-learning platforms. The approach is taken of adopting a 3-level model for a new data management system that permits the execution of information support and smart tutoring as well as a decision support system. In this way, the system improves learning efficiency and overcomes the loss of face-to-face communication in previous e-learning systems (Luís, Simões and Horta, 2004). The authors concluded that the e-learning platforms for data management systems should not be built to only have reference to the operational database systems. It is mandatory to transform the acquired operational data into structured data, based on appropriate metadata models, store it in a data warehousing system and implement the multilevel model for tracking analysis (Luís, Simões and Horta, 2004). The generalised use of e-learning platforms, both for distance learning scenarios and on campus, improve the dissemination of information among users, although at the cost of face-to-face contact between student and tutor.

Education Management Information Systems (EMIS) are not only used to collect statistics from schools through various methods. They are also used to collect statistics on rules, people, models and regulations. An EMIS is also able to link to the new computer technology so that all the functions to work together, in order to provide comprehensive, integrated, relevant, reliable and modern data to education advisors, decisions makers, planners and managers. This enables them to meet targets and perform their responsibilities efficiently (Bhatti and Adnan, 2010). Both of these are critical points for any administrator trying to establish an operational DSS.

Computer technology provides technical support to the Education Management Information Systems by providing the right people with accurate information in good time so that they can make planning and monitoring decisions which are in the best interests of the organization (Bhatti and Adnan, 2010). Bhatti and Adnan (2010) concentrated on accumulating reality-based data. They carried out a study based on a descriptive type of research in which data is collected through observations, discussions and questionnaires, rather than through any kind of experiment (Bhatti and Adnan, 2010).

The objective of the above study was to examine the trend in utilising the power of IT to meet challenges regarding the integration, timeliness and reliability of the data. This study was carried

out in Pakistan, which has many similarities to Saudi Arabia. Therefore, this report was important to the researcher with respect to formulating strategies for the current study. Bhatti and Adnan's study was significant in that they paid specific attention to the development and growth in IT, especially in the management of timely and reliable data production, data integration, data sharing and efficient data utilisation. All this is required for the successful development and working of an education management information system for efficient planning and decision making. Their analysis reveals that the current EMIS infrastructure is slow and inefficient (Bhatti and Adnan, 2010). This finding is consistent with the local situation in Saudi Arabia. Education Management Information Systems (EMIS) are playing an important role in planning, decision making and monitoring of schools, but considerable limitations and challenges exist across EMIS cells in terms of the use of IT in education management and decision making (Bhatti and Adnan, 2010). This study indicated that the internet was under-utilised by educationalists and that more efficient use of these resources in an educational network is required for a national EMIS. The idea of using the internet to its full extent leads us to the concept of utilising available resources.

2.5 DSS negotiation application

One important application of the DSS is in the field of negotiation. This does not refer to what is normally thought of as the concept of negotiation, although there are many DSS systems used in negotiation, such as in the settlement of divorce cases. A negotiation support in a business application can be a supply, production and delivery system which must negotiate logistic factors when coming to the necessary decisions. Negotiation support through DSS has grown in importance with applications for many and varied purposes. Researchers are engaged in studying related issues from various fields such as machine learning, social sciences and game theory. It is also being applied in other fields, such as agent technology, economics, psychology and negotiation support systems (Lao and Zhong, 2010).

The main objective of the research described in (Bellucci and Zeleznikow, 1998) is to build negotiation support tools to develop the most up-to-date versions of smart negotiation support systems. They point out that when the system based on agent-based systems and reasoning as well as machine learning and argumentation, it does not give the domain enough depth to retrieve optimal solutions (Gonzalez, Lerch and Lebiere, 2003). Therefore, they recommend mathematical ways of finding these solutions, such as fuzzy set and probability theories. They have built four systems and applied it to Australian family law (including divorce law).

It is necessary to determine which cases are involved in a negotiation. In some ways, it is important to consider whether the cases are dependent, semi-dependent or independent. Thus, it is imperative to focus on the relationships between cases to establish the best method of obtaining a satisfactory settlement (Bellucci and Zeleznikow, 1998). However, there are difficulties in describing these relationships, because of the subjectivity of the parameters and the interrelation of factors. The researcher was not convinced that their work can be independently verified because of the skewed nature of the input.

This study examined the facilities for interactive and active learning by using the joint gains Negotiation Support Systems (NSS) from a web site. The Joint Gains is a web-based facility for carrying out interactive negotiations, and is used to solve negotiation problems online. It has been successfully applied in a Lake-River regulation policy problem. They foresee that potential users of the proposed site could include experts and students in e-business. Moreover, it could be useful for the training of professionals involved in environmental and political decision making. These aims are taken into account when choosing the examples and cases presented in the material. For instance, the problem of the commons provides insights into the challenges of environmental decision making, and the 'buyer-seller' case in this study features a problem emerging frequently, in one form or another, between customers and their suppliers in e-business and supply paths (Ehtamo, Hamalainen and Koskinen, 2004).

One way of introducing Negotiation Support Systems (NSS) to real-life applications is that researchers carry out their use in role-playing procedures and then present the changing role process to real participators. The researchers want to make their methods close to real-life situations by using the NSSs with real limitations. Therefore, this study's e-learning samples contain theory sections developed with proper references to the literature, as well as quizzes, assignments and case studies. They are developed with multimedia projects, such as video clips, animations and colourful graphics, where necessary. Facilities are provided for interactive and active learning using the joint gains NSS (Ehtamo, Hamalainen and Koskinen, 2004). The Joint Gains has been successfully applied to the problem of water resource management in a Lake-River regulation policy (Ehtamo, Hamalainen and Koskinen, 2004).

Negotiation is an important part of commodity trading and business. It can be defined as the process in which two or more parties conduct talks so as to reach a trading agreement. Traditional negotiations focus on humans who, based on their specific interests, negotiate and finally reach a

conclusion which is agreeable to all parties. E-commerce has become an important part of the national economy, as well as social information (Bellucci and Zeleznikow, 1998). With the development of e-commerce and globalisation, the complexity of negotiations has increased and people have to react to market changes more quickly. This kind of negotiation has the features of a long period before reaching agreement and a slow response to environmental change. Therefore, the traditional human-based negotiation has not adapted well to the global e-commerce market (Lao and Zhong, 2010).

E-commerce oriented automatic negotiation systems have aroused great interest, and technology is driving and continually evolving the study of automatic negotiation. The maturity of semantic web and ontology technology solves the problem of multi-agents in the interaction process (Hanratty et al., 2007). Also, the huge potential demand for applications in the e-commerce market is attracting technicians and engineers into deeper study of automatic negotiation. The automated negotiation system is realised using agent technology. Agent technology simulates the actual behaviour of individuals using a computer program which makes use of artificial intelligence. Using agents instead of supply or demand to negotiate will greatly improve the efficiency of remote business operations. In the complex and uncertain environment of e-commerce, a good negotiation system not only saves time but also achieves a good deal (Hanratty et al., 2007). Therefore, the application of DSS to negotiation is useful in the field of decision-making.

2.6 Application areas for DSSs in universities

The need for quality education in universities, in countries such as Saudi Arabia, is addressed through several key factors, including organisation and resources, students and their support, teaching and learning, curriculum, funding, research and management and quality control policies (Ashworth and Harvey, 1994). Therefore, the realisation of quality education in a particular university depends on its ability to maintain balance across all of the key factors. This is often influenced by temporal changes in internal and external educational policies in universities. The system of admitting students to universities is considered as one of the main factors which affect the quality of the education process. Thus, it is necessary to improve these systems. This can be done by using an excellent programs based on DSS.

Academic decision making is usually supported by means of IT to supply options for explorative analysis. Many different methods are utilised in a DSS for resource management, such as methods

which depended on network models and databases. The DSS also depends on the approach taken to linear or integer programming.

DSSs have been heavily used in higher education management since the 1990s to facilitate resource allocation, performance assessment, course scheduling, admissions policy, advising, student profile evolution and strategic planning. A DSS for resource management is becoming an important tool for complex institutional administrative tasks, such as resource planning, evaluation of different strategies and generating forecasts (Dahlan and Yahaya, 2010). Therefore, DSSs are considered to be a good tool for improving the performance of the admission systems in universities. Accordingly, universities should apply programmes which use DSS, in order to improve the performance of their admission systems.

The process of creating a DSS for higher education would involve developing proper academic analytical tools for collecting, synthesising and examining appropriate data for effective decision making. For example, an efficient management information system (such as a DSS), would carry out the following activities (Bresfelean et al., 2009):

- supervise current educational activity, i.e. the sources and processes that involve students, teaching and auxiliary curriculums, syllabus, staff and all administrative services;
- collect data on education and research processes; - develop a cooperative environment, record performance and examine objectives are achieved;
- present important information to monitor performance, and suggest alternatives; and
- offer feedback for continual development.

Therefore, some areas in which a DSS can be applied in universities include: admission systems, resource allocation, education quality, performance assessment, course scheduling and other educational activities that would rationalise the decision-making activities in this field.

2.7 Benefits of DSS in universities

Decision Support Systems are computer-based systems that are designed to be used interactively by decision makers and other staff members, who control the sequence of interaction as well as the operations performed. They offer benefits in several fields, (for example see: Power, 2003; Power, 2002 and Mansmann, Scholl, 2005):

- Can facilitate and support specific decision-making activities and/or decision processes;

- Can support decision makers at any level in a university. They are NOT intended to replace decision makers;
- Are designed for frequent use. Particularly, DSS may be used traditionally or used as needed for ad hoc decision support tasks;
- Provide specific capabilities that support one or more tasks related to decision-making, such as data analysis; identification and design of alternatives; choice of alternatives and decision implementation;
- May be independent systems that collect or replicate data from other information systems OR subsystems of a larger, more integrated information system; and
- Are intended to improve the accuracy, timeliness, quality and overall effectiveness of a particular decision or a set of linked decisions.

This means that DSSs are designed specifically to facilitate decision making processes. A DSS should support rather than automate decision making and should be able to respond quickly to the changing needs of decision makers.

DSS can be used for managing the use of educational capacity in universities, as described by Bidgoli (2014). Bidgoli (2014) showed that the application of a DSS by policy-makers has led to an important increase in speed in planning activities, increased overall awareness of the implicit methodology and overall led to a more efficient academic administration (Bidgoli, 2014).

Other benefits of DSS to universities are that it (for example see: Agbo and Ogai, 2013 and Holsapple and Whinston, 2005, p. 99);

- improves personal efficiency and facilitates interpersonal communication;
- speeds up the process of decision making and problem solving in an organisation;
- increases organisational control and promotes learning or training;
- encourages exploration and discovery on the part of the decision maker;
- generates new evidence in support of a decision and solves semi-structured and unstructured problems;
- creates a competitive advantage;
- uncovers new activities to think about the problem space;
- helps automate managerial processes, supports managers at all levels, whether individuals or teams, generates creative thoughts to increase the quality and intelligence of choices.

Therefore, introducing a DSS to universities will provide them with a number of benefits and advantages. It will help them in several fields, including the admission system. Managers in universities, for example, need computerised decision support systems and supporting technologies to do their jobs better and to promote their individual efficiency. Thus, a DSS can help decision makers rationalise their decisions. These systems will play an important role in the admission process in universities as they can improve the efficiency and the performance of admission systems. Therefore, the researcher selected these systems to develop the admission systems in Saudi universities.

2.8 Limitations of DSS in universities

Although there are many benefits to be gained from using a DSS, three significant problems are encountered when sourcing a suitable DSS. These problems are (for example see: Holsapple and Whinston, 2005, Power and Kaparathi, 2002 and Anonymous, 2005):

- a) Difficulty in learning to use the DSS – many of the available systems are too complex for users to learn and use successfully within a short period of time. This is, of course, counter-intuitive to the notion that a DSS is meant to be easy for managers to use.
- b) Inability to examine the logic of the system:
 - A university that has a DSS wants it to operate transparently. When training users to use a DSS, it is hoped that students can see and understand how the system operates. However, it is hard to understand what is going on unless you can understand the logic behind the decisions recommended by the system.
 - Need to customise – it is hoped that students would be able to not only see how the system works, but also be able to alter assumptions, customise it, make changes and observe the effects.
- c) Cost – given a small budget to support the purchase of software for teaching purposes, this would require a system that is free or at least inexpensive.

A DSS can create advantages for universities and bring positive benefits. However, building and using a DSS can cause negative outcomes in some situations. Therefore, before universities invest

in a DSS, they must consider the advantages and disadvantages of the decision support system, in order to ensure they get value from their investment. However, by introducing a DSS to their institution, universities will then have a decision-making system which will enable them to gain a sustainable competitive advantage. Benefits include moving beyond customer satisfaction and bringing positive change to the surrounding environment, delivering practical academic programs, building confidence and improving the quality of education.

2.9 The importance of DSS

When approaching this project, the researcher realised that in order to properly run a DSS for an educational institution, certain associated programs, including the diagnostics, would be necessary for assessing the process.

2.9.1 Assessing the process

It is easy to see from the accumulated literature that the accuracy of the science is still being questioned. Much of this comes from a lack of knowledge, as well as lack of maintenance of the existing data systems. This important point is related to the author's own goals. The alignment of IT with business processes and strategy is still an important area of consideration in many institutes. Educational organisations are no exception, with low alignment maturity being reported (see, for example Albrecht, 2004 and Silvius and de Waal, 2010).

Silvius and de Waal (2010) carried out a study which investigated the business and information technology alignment maturity of training sector and the Dutch Vocational Education. A survey was undertaken to evaluate the alignment maturity standards in organisations as a baseline for development. In the study, the following questions were posed (Yousefi and Modiri, 2011):

- Can alignment in the educational sector be problematic and low, as was shown in earlier studies?
- If alignment in the education sector is problematic and low, is it due to lack of ambition or lack of ability?
- Do different educational institutions have different standards of alignment?

Some authors think that alignment maturity is low and problematic in the particular context of higher education training institutions for Dutch vocational education. Since the role played by IT in these institutions is extending into instructional applications, the demand for a cooperative

relationship between the education and IT departments becomes important. This study investigated the maturity of alignment between the educational institutes and the IT department, taking into account the specialist information structure in these institutions. In order to plan development for growth in maturity, the study assessed both the recent (as-is) standard of alignment and the desired (to-be) standard (Albrecht, 2004) and (Silvius and de Waal, 2010).

Another important factor is the complexity of these systems. Eliminating unnecessary complexity or simplifying systems to become more responsive is always a point to consider. Software complexity is a well-known paradigm within software engineering and one which has led to the development of many methods claiming to be able to identify and measure the complexity of software. Different kinds of complexity have been defined and described in an attempt to examine productivity, maintain effort, dependence and testing. Software complexity has an important impact on the time and cost of software maintenance and development. In recent years, many efforts have been made to control and examine the complexity of software and through this paper, it demonstrates the complexity which depend on The Institute of Electrical and Electronics Engineers (IEEE) requirement engineering document and impact in reducing the complexity of integrated design software (Yousefi and Modiri, 2011).

2.9.2 Assessing the procedure

Applications and their security are a grave concern to any institution that is responsible for private data and the integrity of their own system. Generally, trust in the field of information system can be considered as an abstract mapping of a subset of human confidence. That the choice of subset and the reasons for confidence are explained based on applications and their corresponding conditions. Thus, confidence in information systems a belief that can be described or quantified. System trust is subjective and objective, and occurs by consensus (Modiri, Farahi and Ketabi, 2011).

Another grave concern is fraud in online exams, which are just as public as traditional exams and are considered to be a major educational problem. This is because of the low likelihood of uncovering and identifying fraud in online exams. This is a topic that will surely be a challenge in the university environment.

The framework for holding online examinations (Modiri, Farahi and Ketabi, 2011):

- Use of 360° cameras with capability of taking Internet Protocol (IP)

- Installing special secure software for examinations
- Linkage to main server using a Virtual Private Network (VPN)
- Determining a username and password for every exam
- Asking the examinations questions on a step by step basis
- Specifying a time limit for answering each question

The most viable DSS is the one which satisfies the specific requirements of an institution, and will not be the one which comes as a complete package, but rather one that evolves with the requirements of the institution and the advances in technology.

2.10 Conclusion

This chapter has described the nature of Decision Support Systems (DSS). It began by presenting definitions related to DSS, followed by a description of the relationship between Artificial Intelligence (AI) and DSS. It presented applications that are related to DSS, as well as important additions to the DSS. This chapter also explained the theoretical background of DSS, as well as some areas in which DSS can be applied. The benefits that DSS can offer universities were discussed, particularly with respect to the admission process. Finally, some of the limitations of using a DSS in universities were discussed.

From this discussion, it is clear that DSS are important tools for supporting the process of decision-making in several fields, including education. It is, therefore, necessary to develop, implement, assess, maintain and upgrade the DSS to enable it to adequately support the decision-making process. Considering the present and future importance of DSS it could be used to improve the efficiency and performance of university admission systems. Therefore, the relationship between DSS and the improvement of university admission systems will be discussed in the following chapter.

Chapter 3

Admission Process in Universities in Other Countries

Objectives:

- Provide an overview of the Saudi education system.
- Present an overview of the Saudi higher education system.
- Describe the existing admissions systems in universities in Saudi Arabia.
- Outline the admissions systems and processes in universities in other countries.

3.1 Introduction

This chapter presents an outline of the admissions process in universities in other countries. It, also, explains the nature of the admissions process in Saudi universities and presents the problems that are prevalent in this process. In addition, it provides an outline of the higher education system in the Kingdom of Saudi Arabia.

The higher education system in the KSA is primarily implemented via the jurisdiction of the Higher Education Ministry. The Higher Education Ministry is in charge of the policy funding and development of the higher education sector. Saudi Arabia began to focus on higher education in the early 1970s when the country entered into a new era of rapid development and required a highly educated and skilled workforce to support the Saudi market in operating its increasingly developing sophisticated economy.

Broadly speaking, all applicants wishing to apply to higher education in Saudi Arabia are required to successfully complete their secondary education and obtain a General Secondary Education Certificate. Entries to specific programmes are dependent on the stream of secondary education completed, the scores obtained in the General Secondary Education Certificate and their performance and results achieved on aptitude tests (Qudrat Tests) and proficiency tests (Tahseeli tests).

3.2 Background to the education system in the Kingdom of Saudi Arabia (KSA):

The KSA was established in 1932. It was a poor country with a small educational programme comprising 12 schools and only 700 students. This situation changed in 1938, directly after substantial amounts of oil was found in Saudi Arabia. By 1950 there were 365 schools educating 42,000 students (Zhang, Durresi and Barolli, 2011).

The Ministry of Education was established in 1954; unfortunately, however, at this point in time education was offered to male students only and there were no schools offering education for female students. In 1957 the government acknowledged the need to open a university in Saudi Arabia to educate its students, rather than sending them abroad to further their education. It was then that the King Saud University was established and inaugurated in Riyadh, the capital of Saudi Arabia.

Later in 1959, King Saud investigated the issue of women's education in Saudi Arabia and requested favour from religious scholars to support the introduction of an education programme for girls. The first school for girls opened its doors in Riyadh in 1960 (Al Rawaf and Simmons, 1991) and to the present day, the education system in Saudi provides schools which separate boys and girls at all educational levels.

Elementary through to secondary education in Saudi Arabia is free to all students, irrespective of whether they are Saudi or non-Saudi. However, higher education is offered exclusively to Saudi citizens and the students are paid salaries to support them throughout their journey in higher education. Even though students were paid to get into schools and institutions, the literacy standard remained low in Saudi Arabia, particularly among women. Overall, the standard of literacy was evaluated at 78.8%, being 84.7% for males and 70.8% females in 2003 (Central Intelligence Agency).

After King Saud University was established in 1957 another six universities were established in Saudi Arabia over of the next 20 years, as detailed below (Alamri, 2011):

- The Islamic University was established in 1961;
- King Fahd University for Petroleum and Minerals was established in 1963;
- King Abdul-Aziz University was established in 1967;
- Um Al-Qura University was established in 1967;
- Imam Muhammad Bin Saud Islamic University was established in 1974; and

- King Faisal University was established in 1975 (universities websites).

As the number of the universities increased to seven, it was necessary to establish the Ministry of Higher Education in Saudi Arabia and subsequently, the Ministry of Education governed higher education. The purpose of this establishment was to govern the higher education institutions in Saudi Arabia exclusively. Some of the Ministry's responsibilities were (Alamri, 2011):

- to propose the establishment of higher educational institutions and grant them the authority to offer special programmes in accordance with the country's demands;
- to generate and supply management services for the universities and colleges in the Kingdom;
- to promote the standard of coordination and communication between organisations of higher learning and coordinate with other governmental ministries and institutes, according to the desires and demands in higher education; and
- to present the government outside the Kingdom in all cultural affairs and educational via many cultural and educational offices distributed over 32 countries.

The Ministry of Higher Education is the authority in charge of directing university education in accordance with the adopted policy. It observes the advances of university education in all fields, coordinating in universities, particularly in the field of scientific sectors and degrees, motivates research and forms regulations and rules for compliance by all organisations of higher learning (Alamri, 2011).

Higher education in Saudi Arabia has experienced considerable development during the last ten years. The higher education system, which depends on diversification, has expanded to contain (Kingdom of Saudi Arabia, Ministry of Education, 2005):

- 23 government universities;
- 37 colleges and institutes for health;
- 12 technical colleges;
- 18 primary teacher's colleges for men;
- 80 primary teacher's colleges for women; and
- 33 private universities and colleges.

Although private institutions have only appeared in the Kingdom during the last decade, a substantial number of private institutions now provide higher education. Moreover, this number is increasing consistently. Higher education in the KSA faces challenges imposed by social and economic elements, which are commonly experienced worldwide. Thus, to the present, every system comes with its own specific demands and challenges that need to be satisfied within their own context.

In Saudi Arabia, higher education is affected by three important challenges; namely, quality measures, a limited number of places and the depletion of resources. Some criteria have been began to reduce the pressure experienced in Saudi higher education; this includes the setting up of private colleges, the introduction of new post-secondary diploma courses and the establishment of a higher education fund. However, appropriate financial restructuring and organisational procedures are being neglected through these processes.

This article presents the Saudi higher education system from a critical perspective. It provides a complete overview of the system's developments, describes the challenges arising from the reaction to these developments, and provides suggestions for further improvements and development (Alkhazim, 2003).

3.3 Higher education in the Kingdom of Saudi Arabia (KSA)

The admission system for the universities in Saudi Arabia has some distinct features. Each year, Saudi universities are inundated with a huge number of applications from students who have completed their secondary school education and desire to further their education and major in a specific field. For example, in 2010 more than 120,000 students were allocated places in Saudi universities (UNESCO IBE, 2007; The World Bank, 2008; Kingdom of Saudi Arabia, Ministry of Education, 2005 and Wikipedia, 2011). There are no undergraduate fees and as such, university places are accessible to the majority of school leavers. In addition, students receive a monthly bursary of approximately 200 euros per month, which makes studying at university particularly appealing and achievable.

The traditions and customs of Saudi Arabian society have an impact on higher education; in particular, family issues remain strong and most families will encourage their sons to continue with their education by studying at university in specific majors. It is preferable for males to study

in the medical, pharmaceutical and dentistry fields. Failing this, the other most commonly preferred subjects include engineering and IT.

There are, however, some government universities, such as King Saud University, which do not accept the final grades of secondary school students to determine their field of study. Instead, these students are required to study basic maths and computer skills in the 'preparatory year' and based on their results, the university determines the eligibility of the student for the major that he or she wishes to study. This approach creates significant differences among the government universities and creates extra overheads for the students and their families in terms of financing this additional year of study (for examples, see: The World Bank, 2008; Kingdom of Saudi Arabia, Ministry of Education, 2005 and Wikipedia, 2011).

Another issue is the existence of private universities that grant admission to students more easily than the government universities. Regulated by the Ministry of Higher Education, these universities exist in many cities in the KSA. However, there is a strong feeling that the study programmes offered by these universities are easier; thus, many students who struggle in government universities switch to private universities. However, there are generally no transfers from private universities to government universities. This would support the view that different scaling and criteria is used to measure the qualifications of the students for a specific major. In fact, private universities mostly accept students who have the financial capabilities and the determination to get a particular major (for examples, see: The World Bank, 2008, Kingdom of Saudi Arabia, Ministry of Education, 2005 and Wikipedia, 2011).

Yet another problem is the number of foreign students in Saudi Arabia who do not speak Arabic but graduate from school and have adapted to different education systems, such as the International Education System (IES), which is only available in private schools. With this system, the required programmes and the scale for the grades is not the same as in other places. In Saudi Arabia, private education is considered to be one of the supporting elements of government education at all levels.

The General Department for Private Education at the Education Ministry supervises private schools for both boys and girls. The government supplies private schools with free textbooks and annual financial support and employs and pays for a specialists and qualified managers in every private school (UNESCO IBE, 2007). According to UNESCO, 6.4% of students enrolled on

general courses attend private schools and 70.3% of students enrolled onto technical and vocational programmes attend private schools. Thus, in secondary education, 13.4% of students enrolled onto general courses are in private schools and 61.6% of students enrolled onto technical and vocational courses are in private schools (UNESCO IBE, 2007). According to the World Bank, in 2004, 7.4% of students in tertiary education enrolled in the private schools (Kingdom of Saudi Arabia, Ministry of Education, 2005).

There is no unified secondary exam at a national level at the KSA. Instead, all the final grades for secondary school are assigned locally by the student's school. This creates many variations in the measuring and benchmarking of student grades and creates additional problems. In the KSA, for example, there are approximately only 10,000 teachers teaching at the highest level. This means that there are more than 5000 different exams, with a lot of variation for the same course. In many cases, this misleads the universities regarding the level of ability of the students applying for its courses. In fact, it has been alleged that some students have admitted that they achieved higher grades due to help they received from relatives, friends or via other illegal routes. Moreover, it has been reported that in Saudi universities more than 5% of students change their major after some time.

Thus, according to the points mentioned above, the admissions system in Saudi universities is not integrated, comprehensive or flexible. The many shortcomings experienced with the current admissions system can lead to problems which the students' have to face when they apply to these universities. For example, it is difficult to achieve a fair distribution of students among all universities according to their grades. In addition, the system is not comprehensive across all universities and is not relevant to all universities.

The current system allows students to apply to more than one university and this ultimately wastes time, effort and money for both students and universities alike. Therefore, the current system needs to develop and change from a decentralised system into one single, centralised system. The best and most effective way to achieve this is to implement a DSS.

3.5 The university and college admission system in other countries

The admissions process is the method through which students apply for places on tertiary education programmes at universities and their faculties. Admissions systems are different from one country to the next; indeed, they may also differ from organisation to organisation within the

same country (Wikipedia, 2013). In many countries, prospective university students apply to universities during their final year at high school or community college. However, there are other independent institutions and government organisations that focus on the results of standardised admission examinations with specialist administration departments that deal with applications. Some examples are presented below. **Criteria** used to select these examples include:

- ✓ Egypt is selected as an example as a country with a long experience in applying a central admission system. This will help in getting benefits from this long experience.
- ✓ The United Arab Emirates (UAE) is selected as a Gulf country that applies a central admission system. This will help in getting benefits from the Gulf traditions and regulations.
- ✓ Jordan is selected as an example of a Middle Eastern country that applies a central admission system. This will help in getting benefits from this country experience.
- ✓ The United Kingdom (UK) is selected as an example of an advanced country. This will help in getting benefits from this high level of advancement.

3.5.1 Admission to higher education in Egypt

Admission to higher education courses in Egypt requires the student to achieve a General Secondary School Certificate, a Secondary School Technical Diploma with a minimum score of 65 %, or a Diploma in Advanced Technical Studies. Although, in principle, there are no entrance examinations, the minimum final mark required for admission is set by each faculty. For example, the highest final examination marks are required for admission into the faculties of Medicine, Dentistry, Engineering and Natural Sciences with the lower final marks granting entry to the faculties of Agriculture, Arts, Commerce and Law.

Students also need to have taken the correct subject cluster, which is either the science track or the language and literature track. Some faculties also set additional requirements, such as passing a second foreign language, personal or subject specific test. The number of available places in each faculty and the exact cut-off scores are set each year by the Supreme Council of Universities (for example see: EP-Nuffic Internationalising Education, 2015).

The entrance requirements for higher professional education are the same as those above; either a General Secondary School Certificate, a Diploma of Advanced Technical Studies, or a Secondary School Technical Diploma, with a minimum score of 65 per cent. Admission to a Higher

Technical Institute also requires a test in mathematics and English (for example see: EP-Nuffic Internationalising Education, 2015).

Three organisations govern and control higher education in Egypt (for example see EP-Nuffic Internationalising Education, 2015):

- The Ministry of Higher Education has the official power in higher education through coordination and supervision of all post-secondary education. In addition to planning, policy formulation and quality control, it also supervises teacher training for fundamental education.
- The Supreme Council of Universities, founded in 1950 and in compliance with the Royal Decree No. 496, forms the policies for university education and scientific research in universities. In addition, it defines the number of students to be admitted to each faculty and coordinates the public universities. It is presided over by the Minister of Higher Education and State Scientific Research.
- The Private Universities Council forms the policies for private university education and defines the number of students to be admitted to each faculty, the maximum tuition fee to be charged and the admissions criteria.
- The supervision and administration of the Al-Azhar higher education system has the responsibility for the Central Administration of Al-Azhar Sectors and Institutes. This includes the departments of the Supreme Council of Al-Azhar which is responsible for improving general policy and planning and implementing the use of the Arabic language and Islamic culture in the Al-Azhar higher education system.

In Egypt, access to universities is controlled and dictated by the final secondary education exam (known as Thanaweya Amma). The students who succeed this national exam are ranked according to their marks and are given a choice of disciplines from which to select their preferred place, according to a central management body (known as Maktab Al-tanseeq). This body is then in charge of distributing students to faculties and universities according to their choice, grades and proximity to the university; they are not required to undertake any additional admission examinations.

Entry to the private universities in Egypt may require the student to complete one or more admission exams. Furthermore, students wishing to study in certain disciplines must achieve a minimum grade in their final secondary exam certificate; for example, prior to being accepted into the faculty of medicine, students must attain an average grade of at least 90% in their final secondary school exam (Higher Education Finance and Cost-Sharing in Egypt, Mohsen Elmahdy Said, 2013).

It is worth mentioning that most of the students who successfully pass the general secondary education exam (Thanaweya Amma) continue their studies and enter into higher education institutions in Egypt. Furthermore, the majority of the technical secondary education system graduates move into the labour market without pursuing further education (Tempus, 2010).

Hence, there is one, centralised admissions process for the universities in Egypt, a process which has proved to be successful for the education system. With this system, students are only required to submit one application form which covers almost all of the governmental universities and saves time, effort and money. Furthermore, applicants will only be offered one place at one university at any given time, according to their grades and any other terms, as appropriate.

Thus, in Egypt, via application through a centralised office, students indicate their preferences for a specific university and programme after successfully completing their final secondary education exam (Thanaweya Amma). The application form permits each student to select up to 40 choices and the central management body declares all admissions to all universities. Admissions criteria takes into consideration the Thanaweya Amma certificate grades, the governorate of the student and schools with low pass rates.

However, this admission system is not suitable for use in the KSA. This is because the admissions process for entry to universities in the KSA is unique, because it includes two sub-systems, one for male students and the other for female students. In addition, there is no unified secondary exam at the national level as there is in Egypt. Rather, all the final secondary school grades are assigned locally by the students' schools. In addition, owing to the large number of students in Egypt, the admissions process goes through four stages whereas in the KSA, the admissions system requires only three stages as the number of Saudi students are much lower. Therefore, it is the researcher's opinion that admissions system for universities in the KSA should be structured and operated on a regional basis within Saudi Arabia.

3.5.2 Admission to higher education in the United Arab Emirates (UAE) as a Gulf country

In the UAE, a secondary school credential called ‘Shahadat Al-Thawasiya Al-Amma’ is required for admission to both university-level and non-university higher education studies with a minimum score of 60%. In some cases, for entry to Higher Colleges of Technology, there are other admission requirements, such as a foundation year. Aimed at developing skills in Arabic, English and mathematics, the foundation year is also an entry requirement for other universities. For the admission of foreign students, students should hold a General Secondary School Certificate and are required to have a visa. Proficiency in Arabic is required for all programmes and English is required for Engineering and Medical courses. All students must satisfy the basic university admission systems requirements. (For examples, see: National Tempus Office, 2010 and Foreign Consultants Inc., 2013).

Thus, the UAE has a centralised office where all students apply for their preferred university and programme after successfully completing high school. One application form allows students to indicate their choices. The central admissions office is responsible for allocating places for students in all universities in the UAE. The admissions criteria take the grades attained in the Thanaweya Amma Certificate, the governorate of the student and schools with low pass rates into consideration.

Some courses have specific obligatory acceptance criterion. For example, for acceptance onto an undergraduate degree course, applicants are required to meet the university’s minimum academic standards of the English language. Options may also be available for applicants to apply for an ‘advanced standing’ that can grant exceptions on the basis of previous work experience, as well the qualifications attained at another recognised post-secondary institution. Once accepted, students can sit ‘challenge tests’ to receive exemptions from certain foundation standard subjects. The minimum academic entry requirements and admission criteria for some universities are based on the study programmes the applicant has undertaken in high school.

Thus, similar to Egypt, there is one, centralised admissions process for entry into higher education in the UAE, a process which has proved to be successful for the education system. With this system, students are only required to submit one application form which covers almost all of the governmental universities and saves time, effort and money. Furthermore, applicants will only be

offered one place at one university at any given time, according to their grades and any other terms, as appropriate.

However, the university admission system in UAE need to be two subsystems one for Male and the other for Female in order to be fair.

Again, this admission system is not suitable for use in the KSA because the university admissions process in the KSA is unique because it includes two sub-systems, one for male students and the other for female students. Therefore, it is the researcher's opinion that admissions system for universities in the KSA should be structured and operated on a regional basis within Saudi Arabia.

3.5.3 Admission to higher education in Jordan

The Higher Education Board in Jordan is responsible for making decisions relating to admissions policies, requirements and criteria for public and private universities. With public universities, this Board decides the admission activities, the number of students allocated to each university and the Bachelor Degree courses offered by the university. The Board also sets the minimum grade pass rate for the Secondary School Certificate. The acceptance grades are 85% for medicine and dentistry, 80% for pharmacy, engineering, architecture and veterinary medicine and 65% for all other specialties. In private universities, the minimum grade is 60% (National Tempus Office, 2010).

The Higher Education Board in Jordan is the centralised office where all students apply for higher education courses after successfully completing high school. The applicants indicate their preferences in terms of university and courses on one application form that allows up to 30 choices. The central admissions office allocates student places in all the universities in Jordan. Admission criteria are based on high school certificate grades, the governorate of the student and schools with low pass rates (National Tempus Office, 2010).

Some students from governorates situated outside the capital are admitted with lower grades compared to their peers who have been educated in the capital. Moreover, students from schools located in remote areas may receive preferential treatment for admission. Individuals from the armed forces, including retired persons, along with [employees] of the Ministry of Education, receive certain quotas and must compete against each other for seats at the universities for their

sons and daughters. Moreover, the Royal Court sends lists of students to universities who are to be accepted into specific faculties (National Tempus Office, 2010).

The university staff are also allocated quotas for their sons and daughters. Students have quite free competition in some faculties especially the most competitive, like medicine and dentistry are less than half of all students joined in those faculties. The Higher Education Admission Centre decides the upper limit for the number of students accepted onto every course offered by private universities, in accordance with the number of staff and facilities available for each course. It is left to the individual universities to allocated student places. These decisions are based on whether the applicant meets the specified admissions criteria and are in line with the pre-determined number of places decided by Higher Education Admission Centre (National Tempus Office, 2010).

Many universities have special programmes targeting students who do not receive an offer of a university place through the regular admissions procedure. A very popular example with public universities is the Parallel Programme. Admission to this programme is easier than the regular one, but tuition fees are considerably higher (National Tempus Office). With highly popular specialisations such as medicine, students may also compete against each other to obtain seats through the Parallel Program. Apart from this, most universities have evening programmes or special lifelong learning courses for adults, and vocational education courses that are open to the public, irrespective of age. The Board of Higher Education determines the admissions policies and criteria for graduate studies in all universities (National Tempus Office, 2010).

The university admission system in Jordan is applied to undergraduate programs. It provides users with all necessary information on admission requirements, enrolment procedures, regulations, fees, programs of study, and lead users to many useful links that are necessary to newly-admitted students. It leads step-by-step to what you need to do in order to complete your admission and registration procedures.

The means, in Jordan, there is a centralised office where all students apply after successfully completing high school, indicating their preferences in terms of university and programme. The application form allows students to indicate 30 choices and the office announces admission to all universities. The admission criteria take into consideration high school certificate grades, the governorate of the student and schools with low pass rates.

However, the university admission system in Jordan need to be two subsystems one for Male and the other for Female in order to be fair.

Higher education in Jordan is divided into two systems (National Tempus Office, 2010):

- A. Community college education leading to an intermediate college degree. The link between community college and university is accepted for those students who achieve a performance grade point average (GPA) of ‘good’ and above.

- B. University education leading to a BA (BSc), High Diploma, Master or PhD.

Thus, as with Egypt and the UAE, there is one, centralised admissions process for entry into higher education in Jordan, a process which has proved to be successful for the education system. With this system, students are only required to submit one application form which covers almost all of the governmental universities, which saves time, effort and money. Furthermore, applicants will only be offered one place at one university at any given time, according to their grades and any other terms, as appropriate.

Again, this admission system is not suitable for use in the KSA because of the reasons stated above. Therefore, it is the researcher’s opinion that admissions system for universities in the KSA should be structured and operated on a regional basis within Saudi Arabia.

3.5.4 Admission to higher education in the United Kingdom (UK)

The United Kingdom uses two separate admission processes for undergraduate and postgraduate degrees courses. In addition, the Open University has an open door policy. The United Kingdom has a centralised system of admission to higher education at undergraduate level; namely, The Universities and Colleges Admission Service (UCAS). Generally, students are accepted onto a particular programme of study as opposed to being accepted by the university or college as a whole.

During the first academic term (September to December) of the final year of school or in sixth form college, at the age of seventeen, eighteen or after having left school, applicants enrol onto the UCAS website and choose five programmes of study at a higher education organisation. Fewer choices are permitted for the competitive subjects such as medicine and veterinary

medicine. If the applicants are still at school their teachers will give them their predicted grades for their A-level, Higher or IB subjects. Students will use these grades to apply for courses and provisional offers may be made on the basis that these results are achieved. If the applicant has already left school, they will provide their results with their application.

Applicants must provide a personal statement describing in their own words why they want to study that particular subject and why they would be a committed student; in addition, their school must supply an academic reference. Some universities, such as Oxford, Cambridge, Manchester and the Imperial College, and universities such as King's College London or the University College London, and some disciplines such as medicine, routinely require shortlisted candidates to attend an interview and complete special admissions tests before the decision is made to make an offer. Otherwise, the reference and personal statement are decisive, as many students are likely to apply to competitive programmes with similar predicted and actual grades (Badran, 2014).

Generally, applications have to be received mid-January for study programmes that begin the following autumn. However, the application period starts earlier in mid-October and lasts for three months for a medical, dentistry or veterinary programme, or any programme at Oxbridge (The Universities and Colleges Admission Service (UCAS)). The applicant will receive notification of the outcome of their application for each programme directly from the institution; this will be a rejection, conditional offer or unconditional offer. A conditional offer means that the student can only take up the place on the programme if they achieve the stated conditions of the offer, which is usually the accomplishment of specific grades in their examinations.

In cases where no offer is made or the applicant does not want to accept the offer they receive, students can apply for other courses via 'UCAS+'. However, this process only allows students to apply for one course at a time. When an offer is received, whether through the initial application or through UCAS+, the applicant then selects two programmes of study and indicates their first and second choices.

If the conditions of the first choice offer are met, the applicant might attend this programme. If the applicant only achieves the conditions of their second (insurance) choice, they may only attend this course. If the applicant does not achieve the entry requirements needed for their first and second choices, they will not be offered a place on either course. However, they then have the option of applying for courses through the 'clearing' system. This system involves calling other

universities to discuss their options and establish which courses they are eligible to apply to. They may then choose to apply for other courses at different universities. Many students successfully find a place using this route (The Universities and Colleges Admission Service (UCAS), 2013).

Ultimately, it is each individual university's decision whether or not to offer a place to an applicant. These decisions are made based on a number of factors but primarily, places are offered based on the predicted grades of school leaver examinations. As more applicants are accomplishing higher grades in the A standard examination, most universities also use secondary admission measures. These may include GCSE results or standard grade examination results, the references provided with the application and the information provided on the personal statement.

In many instances the personal statement can be the deciding factor between similar candidates and, as a result, services that provide false or manufactured personal statements to students for a fee are becoming prevalent across the UK. Thus, UCAS uses 'similarity detection software' to identify these false personal statements which have been written by third parties. Moreover, if detected, universities are likely to reject applications for this reason (The Universities and Colleges Admission Service (UCAS), 2013).

Personal statements can describe why the applicant wants to study the subject they have applied for and give the reasons why they believe they are a suitable candidate to study at degree level. It will also include any work experience they have acquired, their extracurricular procedures and any other relevant information. This is the best way for admissions tutors to get a good overall impression of what a candidate is really like and assess their commitment to the subject.(The Universities and Colleges Admission Service (UCAS), 2013)

Besides the information provided on the UCAS form, some universities request candidates to attend an interview. Interviews give the admissions tutors another opportunity to evaluate the candidate's suitability for the course (The Universities and Colleges Admission Service (UCAS), 2013). Oxford and Cambridge universities will always interview the applicants they are considering making an offer to. However, having already filtered out the majority of potential candidates, other universities might select to interview, though only in some subjects and on a much smaller scale.

Universities are being put under increased pressure from central government to accept people from a wide range of social backgrounds. However, in reality, an applicant's social background can be evaluated primarily by the kind of school attended, as information pertaining to income and background is not requested on the UCAS form.

A significant contributory factor as to whether or not an offer is made relates to the level of competition for a specific course. Indeed, with the most sought after and competitive courses, the less likely an offer will be made; thus, the stronger the application must be. In fact, less than 10% of applications for the most competitive courses will be offered a place. Conversely, however, with the less competitive universities, practically all applicants receive an offer of admission (The Universities and Colleges Admission Service, (ACAS), 2013).

The significance and relevance of an applicant's extracurricular activities and work experience will not be enough to guarantee an offer if the admission tutor does not think the candidate is academically capable of completing the course. Moreover, students applying for courses in medicine are expected to have undertaken extensive work experience in a suitable field in order to demonstrate their commitment to the course of study.

A well-qualified candidate applies under UCAS for five competitive courses; however, only 10% of the most highly qualified candidates will be accepted. This means that applicants only have a 40% chance of receiving at least one offer of a place. In another example, if five less competitive courses each have a 33% acceptance rate are selected, the chance of getting one offer is more than 85% at least. This shows that a strategy for promoting the chance of getting at least one offer, to perhaps 70%, is indicated even to well qualified candidates. (The Universities and Colleges Admission Service, (UCAS)) For postgraduate entry, all applications are made directly to the university or college. Students can apply for as many courses as they wish (Wikipedia, 2013).

Thus, within the UK, the student is referred to UCAS as a mechanism to provide a single entry point for students, This is near to be a centralised system of admission to higher education at undergraduate level which is 'the Universities and Colleges Admission Service (UCAS)'. This means that the UK university admissions systems is effective as it saves time, effort and money. This admissions system in the UK is different from the admission system in some ways from Arab countries such as Egypt, UAE and Jordon.

Under the UK system, the applicant receives a response from the university or college advising them of their rejection, or of a conditional or unconditional offer. In Arab countries, however, the applicant receives a response from the central organisation advising them of their acceptance into a specific college. In addition, some UK universities require candidates to attend an interview whereas in the Arab countries, some universities want candidates to attend an interview or a test. The UK admissions system is not appropriate for implementation in the KSA because of the reasons previously mentioned.

However, the Universities and Colleges Admission Service (UCAS) is not totally centralised admission process and it is not suitable for applying at the Kingdom of Saudi Arabia.

3.5.5 Justification for a proposed new admission system in Saudi Arabia

As highlighted in the preceding subsections, admission into university or college entails a process whereby students are enrolled for tertiary education and the process or driving mechanism for such an admission process varies extensively from one country to another and in some instances from one institution to another. In numerous countries, final year students of high school or colleges apply for admissions into universities. In some countries such as Turkey and the UK for example, the approach taken to admission is centralised and the entire process is hugely competitive. For instance, in Turkey, there is a standardised entrance exam organised by the Student Selection and Placement Centres, which must be taken by all applicants and a points-based system is adopted to control access to each degree programme with the overall numbers of students offered a place at a tertiary institution adjusted in accordance with the forces of demand and supply. On the other hand, in the UK admissions processes are governed centrally by the Universities and Colleges Admissions Service with a view to overseeing the application process for universities across the UK.

Contrary to conventional wisdom, in the United States, there is no country-wide official university entrance exam, rather there are numerous admissions tests that are written by prospective candidates coupled with their academic qualifications as well as extra-curricular interests that are taken into consideration before admissions is offered. Overall, the admission process varies from institution to institution. The approach to admission in Italy completely sways from the norm wherein any Italian student with a viable school-leaving certificate is entitled to enrol to any degree course at any state university and in any discipline regardless of their study background. In

recent time, critics have called for a re-examination of this approach with a view to enhance the quality of teaching in the educational system.

In light of the above, it is therefore clear that although different admission systems have been successful in some countries, similar approaches or mechanism cannot be applied or extended to every other country due to the different characteristics or the nature of individual countries. In addition, the fact that the challenges of admission vary from one country to another, makes direct import an impossibility. In the Kingdom of Saudi Arabia (KSA) for example, the inherent challenges of the country require a detailed and robust admission process. The government of the KSA has come to the realisation that the greatest representation of national education is the university where brilliant ideas and innovation are developed and has therefore placed emphasis on university education for its citizens. The KSA government and the universities have continued to work together with a view to put Saudi Arabia at the forefront in terms of providing education to its citizens.

Accordingly, a huge capital outlay in the budget of the country is focused on education with the expansion of new higher institutions of learning currently underway. The demand for access to tertiary education has therefore increased due to increase in population and the awareness about the importance of education but current admission processes within the Saudi Universities are not robust enough to handle the complexities and requirements of the increase in demand for access to university education. Although current systems have worked relatively fine for some time now, they result in wastage of time, financial resources and efforts and more importantly the entire process and procedure is redundant. There is therefore the need to develop a robust and new admission system that will be capable of living to today's complexity in university admission processes.

Currently, within the Saudi's admission mechanism into tertiary institutions, every university has its own individual admission systems unlike in other countries such as Egypt, the UAE, Jordan, Turkey and the UK where admissions are unified under a centralised admission system. The demerit of the current admission system in the KSA lies in the fact the potential applicants can apply for many courses and get several admissions at several universities at one time thereby leading to missed opportunities for students who have not received any offer of admission. The disadvantages are further heightened by the fact that prospective candidates with several

admissions can only honour one at a time thereby preventing other candidates from getting a place at the university.

The admission procedure in Egypt, for example, is based on a unified national exam from which successful candidates are offered a place at the University of their choice. This is not the case in the KSA where admissions are based mainly on the final grades awarded by individual schools from which the prospective candidates finish their secondary education. This process is not transparent enough as different criteria forms the basis of recruiting students into university. Furthermore, there is no tuition fees paid towards university education in the KSA, as such placements into universities are accessible free of charge. Moreover, every student is also entitled to a monthly bursary of approximately 200 Euros per month, rendering studying at university particularly appealing.

Overall, the education system in the KSA and its admission procedures have their own unique attributes and a profound understanding of those attributes is required in order to propose a new and robust decision support system that will facilitate admission processes in the country. For instance, the admission process comprises of two subsystems for male and female students and each subsystem is governed by different rules, policies and budgetary allocation for admission processes. The socio-cultural context of the KSA in terms of traditional values, individual thought processes, interests, views and perception also differs from other countries, as such decision support system upon which admission processes in other countries cannot be directly imported to the KSA although lessons can be learnt from them.

The current admission system for Saudi universities has some distinct features, which necessitates the development of a new system as detailed in the succeeding paragraphs:

- a) Each year, universities are inundated with a huge number of applications from students who have completed secondary school education and wish to further their studies by applying for specific courses at university. For instance, in 2010 more than 120,000 students were allocated places in Saudi universities (UNESCO IBE, 2007; The World Bank, 2008; Ministry of Education, 2005 and Wikipedia, 2011). There are no undergraduate fees, which means that university places are accessible to the majority of school leavers, and as students receive a monthly bursary of approximately 200 Euro per month, rendering studying at university particularly appealing. Additionally, most admissions are based on final exams from individual secondary schools and the standard of such exams varies from school to school,

thereby constituting problems in terms of admission into universities. There is therefore a need for a unified entrance exam that will be linked to the proposed DSS with the view that this will allow for transparency and ensure that students from various schools compete on the same level ground for admission into universities across the country. This is a major thrust towards the complete overhaul of the current admission system in the KSA, which is the goal of this research.

- b) Another issue is the impact of the cultural ambience of the Saudi Arabian society, especially as it pertains to influence from families who want their sons (or daughters) to get admission to study specific courses at the University even though their results and capabilities may not be enough to put in for courses such as medicine, pharmacy, engineering, dentistry amongst others. Parents go out of their way to ensure admission are granted to their sons (or daughters). The adoption of a unified admission system across the country will go a long way in eradicating this tendencies of admission racketeering. With the proposed DSS for admission processes, offer to places will be based on merit as well as the ability of the students to cope with their chosen courses of study in the university.
- c) Some governmental universities, such as King Saud University, do not accept the final grades of secondary school students to determine their field of study. Instead, these students are required to study basic maths and computer skills in the preparatory year and, based on these results, the university determines the eligibility of the student for the degree that he (or she) wishes to study. This approach creates big differences between government universities and adds extra costs to the students and their families in terms of financing this additional year of study. This discrepancy between admission requirements from different universities creates a great deal of tension and a new centralised admission system which takes all these factors into consideration will help in nullifying such tensions.
- d) Another issue is the existence of private universities, which grant admission to students more easily than public universities. These universities exist in many cities in the KSA and are regulated by The Ministry of Higher Education. However, there is a strong feeling that the study programmes offered by these universities and their approach to offering students admission are less rigorous; thus, many students who struggle in government universities switch to private universities. However, in general there are no transfers from private universities to government universities, which would support the view that different standards

are used to evaluate the students' qualifications for a specific course of study. In fact, private universities mostly accept students who have the financial resources and, at the same time, the desire to gain a specific degree. This situation does not reflect well on the overall quality of higher education in the KSA. A robust admission system as proposed in the DSS developed in this work could be a starting point towards correcting these anomalies.

- e) Yet another problem is the number of foreign students in Saudi Arabia who do not speak Arabic and graduate from schools which have adopted different education systems, such as the International Education System, which is only available in private schools. In this system, the courses taken and the scale for grades are different from those in other places. "In Saudi Arabia, private education is considered to be as one of the elements supporting governmental education at all education levels. The General Department for Private Education at the Ministry of Education supervises private schools for boys as well as those for girls, and the government provides private schools with free textbooks and annual financial aid. The government also appoints and pays for a qualified director in every private school (UNESCO IBE, 2007). According to UNESCO, 6.4% of students enrolled in general programmes are in private schools, while 70.3% of students enrolled in technical and vocational programmes are in private schools. As for secondary education, 13.4% of students enrolled in general programmes are in private schools and 61.6% of students enrolled in technical and vocational programmes are in private schools (UNESCO IBE, 2007). According to the World Bank, in 2004, 7.4% of students in tertiary education were enrolled in private schools" (Ministry of Education, 2005).
- f) There is no unified secondary exam at the national level in the KSA. Instead, all final grades for secondary school are assigned by the students' schools locally. This creates many variations in measuring and benchmarking for admission purposes. For example, the number of teachers in the KSA who teach only at the highest level is around 10,000 and this means that for the same course, there will be more than 5000 different exams. These exams induce wide ranging variation and, in many cases, mislead universities. In fact, it was reported that at Saudi universities, more than 5% of the students change their degree course after some time. It is alleged that some students have admitted achieving high grades due to help from relatives, friendships or via other illegal routes.

As highlighted above, the admission system for Saudi Universities is neither integrated nor comprehensive; posing challenges that requires a new structure and system. The many shortcomings with the current admission system can lead to students facing problems when they apply to university. For example, it is difficult to achieve a fair distribution of students across all universities according to their grades. The current system allows students to apply to more than one university, a scenario that deprives other students' places whilst resulting into wastage of time, efforts and resources. Therefore, the current system requires transformation from a decentralised system into a unified and centralised system that considers all the aforementioned factors. The best and most effective way to achieve this is to employ DSS whose platform will form the basis of admission policy and framework across the country. With the proposed system, students are only required to submit one application form, which covers all universities, and they will be offered only one place at one university at any given time. Moreover, the proposed system will give students all available chances to get a place in the best faculty, taking into account the students' preferences and grades.

Against this backdrop and more importantly, in an era where the citizens are encouraged to pursue quality university education coupled with the aforementioned incentives for this, the current system of admission in the KSA requires a complete overhaul. This research project therefore seeks to develop a robust decision support system in which all admission systems are centralised through an online submission system whereby admissions will be offered based on a number of key performance indicators and the predetermined admission criteria. In doing so, it is anticipated that the developed system will address some of the inherent challenges facing the current admission system across the country whilst improving its efficiency and effectiveness with a view to ultimately reducing time, redundancy and efforts for parents, students and admission systems administrators as well as providing financial savings for the Ministry of Education in the KSA.

3.6 The specifications for the new admission system

The current admissions systems for Saudi universities are problematic and need to improve. Currently, the Saudi universities have different admission systems which makes it is difficult for students to be distributed fairly amongst the universities according to their grades. In addition, these systems are not comprehensive, or appropriate, apropos of all. The current admissions systems let students apply to more than one university. Some universities want candidates to attend an interview, whereas in the Arab countries, some universities want candidates to attend an

interview and/or a test. Thus, resources including time, effort and money are wasted, for both students and universities alike.

Accordingly, these systems need to develop and evolve from decentralised systems into one, single centralised system. With the proposed system, students would only submit one application form to cover all universities in the KSA, rather than having to submit several application forms to several universities. Through this process, they will only be offered one place at one university at any given time.

The new admission system will provide important tools in supporting the decision-making process in several fields, including the field of education. It is, therefore, necessary to develop, implement, assess, maintain and upgrade the DSS to enable it to adequately support the decision-making process.

The **advantages and benefits** of the new admission system include:

- It accepts one application from each student which allows them to apply to any university.
- It offers one place to each student out of all the universities they applied to.
- It provides a consolidated database to help decision makers make the right decisions in good time.
- It gives students all available opportunities to gain a place in the best faculty, in line with their preferences and grades.
- Admission procedures will be easy to use because everything is in one place, and, consequently, will save time, cost and effort, especially for female students and their parents.
- Admission procedures will be universal and easy to understand rather than involving several different admission systems.
- The new admission system will be fair, clear and transparent.
- The new admission system will serve both genders, male and female.

However, there are **some disadvantages and limitations** of the new admission system. These include the following:

- The implementation of a new system will demand a great deal of effort and cooperation from all involved. This could also prove to be costly and time consuming.

- It gives each student only one place based on their preferences and grades.
- It needs to be regularly updated.

The **specifications** for the new admissions system are detailed below.

- In the new system, all applicants must enter the central admission system for Saudi universities by entering their ID and password.
- If the user is non-Saudi, requests will be entered at stage three, whereas if the user is Saudi, requests will be entered at all stages according to grade.
- All applicants are asked to indicate if they are a male or female.
- Saudi applicants will have two options asking whether they are a new applicant or an existing, registered user.
- Then, existing users or new users, will have another two options, selecting whether their grades are from inside or outside the KSA.
- Then, requests for places are entered according to the applicant`s grade and preferences.
- There are three stages based on students` grade for Saudi students, and one stage for non-Saudi students.

3.7 Conclusion

This chapter has explained the nature of the admissions process in Saudi universities; it has also outlined the problems with the systems that are currently used. It began by presenting background information about the Kingdom of Saudi Arabia (KSA) and its education system. Then, it sketched general profile of the admission system in Saudi universities whilst discussing the main problems that face this system. It presented, also, an outline of the higher education system in the KSA. Finally, it examined university and college admission processes in other countries.

Based on the research undertaken by the author, it is suggested that the implementation of one, central admission system, based on DSS, would be the most effective and appropriate way to eliminate the problems associated with the existing admissions system in Saudi universities. However, whilst DSS provides many advantages and benefits, this system also has some limitations and disadvantages which the Ministry of Higher Education and universities need to consider. Thus, universities need to ensure that adequate research is undertaken prior to installing DSS in their institution in order to ensure that they secure the maximum benefit and advantages and avoid experiencing the disadvantages of such systems.

Implementing this system would necessitate adequate training for all staff responsible for using the system to make the integration of the DSS as seamless as possible. Moreover, because of increased competition amongst the universities and with other higher education institutions, universities and the education system as a whole, should adopt more up-to-date and modern systems, such as DSS, as this would undoubtedly improve their admissions processes, as well save time, effort and money and ultimately, promote the delivery of quality education processes.

To describe the current admissions systems in Saudi universities and consider how best to develop these systems into one central system, it is necessary to perform an empirical study. The outline of the empirical study and methodology for testing admissions to universities in Saudi Arabia is outlined in the following chapter.

Chapter 4

The empirical study methodology of testing universities admission in Saudi Arabia (UASA)

Objectives:

- Present the research objectives and hypotheses.
- Explain the research approach.
- Describe the study sample.
- Describe the reliability of the questionnaire.
- Describe the administration of the instruments used in the main study.
- Explain the data analysis tools.

4.1 Introduction

This chapter explains the methodology and procedures used in the empirical part of the study, in order to test hypotheses and achieve the research objectives. As discussed in Chapter One, this study aims to test the following hypotheses:

- The shortcomings of the admission system lead to the problems facing students when they try to secure a place at Saudi Universities.
- Using a set of commonly agreed indicators for monitoring the admission of students enrolled in Saudi universities, leads to an improvement in the overall admission process and consequently improves the existing national education system in Saudi universities.
- Applying a central admission system to Saudi universities will improve the efficiency of the admission process and consequently improve national capabilities in the field of education.

This study also aims to achieve the following objectives:

- Describe the current admission system in Saudi universities;
- Test the existing admission system in Saudi universities by using a set of commonly agreed indicators for monitoring the admission of students enrolled in universities, in order to improve the overall admission process and consequently improve the existing educational national system in Saudi universities;
- Develop a framework for designing a system for university admission in Saudi Arabia.

4.2 Research approaches

Underlying the many different styles and methods of research are two basic approaches to social research: quantitative research and qualitative research. There has been a great deal of debate about the relative merits of these two different approaches to social research. The strengths of quantitative research are seen as lying in its highly structured nature, its reliability and the representativeness of the data it provides; whereas, the strengths of qualitative research are seen as lying in its investigative nature, its in-depth focus and the detailed complexity of the data it provides (for example see: Dawson, 2002; Chapman, McNeill and McNeill, 2005 and Creswell, 2009).

Accordingly, the current research is based on a good combination of the quantitative and qualitative approaches, so that they complement one another. It uses the survey method. The quantitative approach is applied through the use of questionnaires, whereas the qualitative approach is applied through interviews carried out during the survey research study.

Research carried out through survey and interviews involves collecting data through asking a set of pre-formulated questions in a pre-determined sequence. The questionnaire or interview is used with a sample of the selected individuals so as to be representative of a defined population (Trochim and Donnelly, 2001). The descriptive and analytic survey is the most well-known form of quantitative and qualitative research in social science (Cohen, Manion and Morrison, 2000).

Descriptive surveys are designed to portray the characteristics of particular individuals, situations, groups and so on (in terms of behaviour, attitudes and readiness to act), and to identify the frequency with which such behaviour occurs in the population being sampled. On the other hand, analytical surveys are concerned with testing hypotheses about the relationships between variables, in order to understand and explain a particular social phenomenon (Bulmer and Warwick, 1993).

Descriptive and analytical research is often essential to provide a descriptive and analytical foundation for developing other more specific lines of investigation. This kind of research is considered important in social sciences. It provides description and analysis of phenomena from the point of view of a systematically selected sample of respondents (for example see: (Osemy and Prodhan, 2001)).

The current research combines the benefits of both a descriptive and analytic survey. It also combines quantitative (via questionnaires) and qualitative (via interviews) research methods in the same study. It is worth also noting that information is obtained from a review of the literature, including theses, periodicals and books as well as government publications and international statistics related to the current research.

4.3 Research sample

If a survey is being undertaken the researcher must find people relevant to the research and representative of it. It would be impractical and serve no purpose to survey the entire population of Saudi. Therefore, it is essential to introduce sampling, as it is rarely the case that we have suitable sufficient time, effort and resources to conduct research on all of those individuals who could potentially be included in a study.

A sample is a segment of the population selected according to a specific method for the purposes of research in a particular area. The sample is chosen to represent the population as a whole and enable researchers to generalise results to the rest of the population (Kotrlik and Higgins, 2001). There are two main types of samples: non-probability and probability samples. Non-probability samples include those in which cases are selected on the basis of their availability. In this type of sample, the probability of each case in a population being selected as part of the potential sample is not known, and it is not clear how results can be generalised to a wider population, especially using statistical inferences. The selection of cases for this type of sample is arbitrary and relies on the personal judgement of the researcher (for example see: (Osemy and Prodhan, 2001)). In contrast, in a probability sample, the probability of each case in the population being selected as part of the potential sample is known and is usually equal for all cases; it is also clear how results can be generalised to a wider population (for example see, (Kotrlik and Higgins, 2001), (Saunders, Lewis and Thornhill, 2009) and (Zikmund, 2000)). In order to select a scientific sample, the following steps are necessary (for example see, (Kotrlik and Higgins, 2001), (Saunders, Lewis and Thornhill, 2009) and (Kotler, 2001)):

- identify a suitable sampling frame or list of all cases in the population to be sampled based on research questions or objectives;

- decide on a suitable sample size, taking into consideration the population size. (Large samples provide more trusted results than smaller ones. However, samples of less than 1 per cent of a population can be reliable with credible sampling procedures (Kotler, 2001, p. 69);
- select the most appropriate sampling method (to obtain a representative sample a probability sample should be drawn from the population) and select the required sample; and
- check that the sample is representative of the population.

Accordingly, the population of the current study was selected from three of the six universities in Riyadh City. These universities are King Saud University, Imam Mohammed Ibn Saud Islamic University and Prince Sultan University. The sample for research was selected as shown in figure 4.1 below:

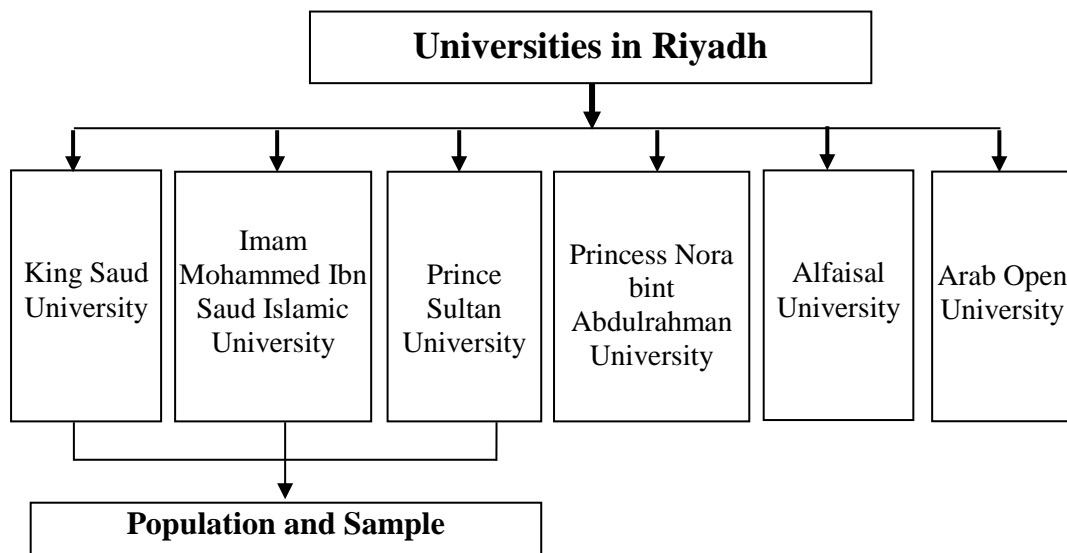


Figure 4.1 Research population and sample

The feedback received from both staff and students at all six universities in Riyadh City would provide invaluable insight for the study results. However, the researcher has decided to use only three universities, because it would require too much effort and be too arduous and time-consuming to survey participants from all the universities in Riyadh City. In other words, there was insufficient time and not enough available resources to conduct research in all six universities in Riyadh. Thus, the researcher concentrated on the three largest universities in Riyadh City as a sample frame (see Figure 4.1).

The size of the chosen sample is important as it is necessary to make the sample representative of the whole population so that comparisons can be made between the groups and inferences drawn (Moore, 1995). It was explained that the larger and more diverse the sample, the better the findings can be generalised to a wider population. Probability samples can be selected in different ways, such as stratified sampling, simple random sampling and systematic sampling. Moreover, samples can be selected using other methods, such as multistage sampling and cluster sampling (for example, see (Saunders, Lewis and Thornhill, 2009)). The purest and the most basic form of inferential statistics uses the simple random sample, in that every case in the population has a known and equal chance of selection for the sample (Bryman and Cramer, 2002).

The probability method of simple random sampling was used to select the research sample within the sample frame. This was carried out by giving each unit of sampling a number, shuffling these numbers, and selecting as many as were needed for the sample. This process was carried out for each university separately, in order to select approximately 20 units (respondents) from each university for the questionnaire. The researcher performed approximately 5 interviews from each university.

The sample for the questionnaire used in the present research consists of 60 respondents. 15 interviewees were included in the sample for the research interviews. It was necessary to check that the sample was representative of the population. The sample for the current study was considered representative of the population because it includes respondents (admission staff) and interviewees (admission staff) from the three main universities in Riyadh city, which are all three leaders in higher education in the KSA.

4.4 Survey instruments

It is worth noting that research instruments in social research can be applied according to an objective basis where measurement is carried out using a specific and clear method. They can also be applied on a subjective basis, depending on the researcher's experience and the responses of interviewees. The ways in which these instruments are used are very important and have serious implications (Osemy and Prodhan, 2001).

Complete objectivity is the aim of social research. However, pure objectivity in social research is an ideal; in reality there are many circumstances and events that are uncontrollable by researchers, and there is always a danger of bias creeping into social research instruments, because they relate

to human beings and not machines. The instruments and the way in which they are used may have an effect on the respondents, so it is necessary to take care when using them. On the other hand, in order to decrease the degree of bias and to increase objectivity, users of the survey method attach importance to measures of validity and reliability. However, in order to meet the aims of this study, the survey method was selected.

The following sections describe the survey instruments, which consist of a personal interview and a questionnaire.

4.4.1 Questionnaire

The researcher decided to use a questionnaire because it is a scientific instrument for the collection of a particular kind of data, such as feelings, motivations, experience, attitudes, and the accomplishments of the individuals involved in the survey (Borg and Gall, 1996). Most of the data required for the purpose of this study was in the form of views and experiences, which suggested that a questionnaire would be an appropriate instrument. A questionnaire is one of the most widely used social research techniques (Moore, 1995). As explained above, questionnaires are used to gain specific information and feedback, and that is what this study aimed to do.

There are several advantages in the use of the questionnaire as a research instrument. Some of these advantages are outlined below (for example, see: Cohen, Manion and Morrison, 2000; Borg and Gall, 1996; Oppenheim, 2008 and May, 1997):

- It provides sufficient time for respondents to think about the questions and answer accurately. The lack of direct contact allows the respondent to feel completely at ease when asked for information, particularly if responses are anonymous.
- Questionnaires can be delivered to very large samples at once by post, e-mail or fax, or can be administered directly (by hand).
- Using a questionnaire enables the researcher to gather data from a large number of respondents simultaneously. A questionnaire takes less time and costs less than other methods, such as personal interviews. This was an important consideration in this study, as we wanted to collect data from around 60 respondents across 3 universities in Riyadh City.
- The use of questionnaires is a central part of social research as they provide a relatively inexpensive way of discovering the beliefs and characteristics of the population at large.

- Data can be collected in a standardised form, which facilitates statistical analysis and aids comparison.

In contrast, there are a number of potential disadvantages attached to the use of the questionnaire. These disadvantages are outlined below (for example, see: Cohen, Manion and Morrison, 2000; Borg and Gall, 1996 and Oppenheim, 2008):

- If the responses indicate that the wrong questions were asked, or that they were phrased badly, it may be difficult to clarify the information, particularly if the respondents are anonymous. Therefore, the validity and reliability of the questionnaire needs to be measured to ensure that the questions are understandable and have a high degree of reliability.
- Postal questionnaires generally have a low response rate. Therefore, at the time and expense of the researcher, the majority of questionnaires must be distributed and collected by hand.
- Questionnaires cannot probe deeply into respondents' feelings, but this can be overcome by using other instruments, such as interviews. Therefore, the interview method should be used alongside the questionnaire.

Accordingly, questionnaire alongside interview is used to collect data relating to the research objectives, in order to avoid the disadvantages of using questionnaire alone.

There are several methods for carrying out a questionnaire, such as on-line questionnaire (through email or the internet), postal questionnaire (sending and collecting the questionnaire by mail), and personal questionnaire (delivering and collecting questionnaires by hand). In addition, it is possible to carry out a questionnaire using facsimile (fax) machine (for example, see: Kotrlik and Higgins, 2001). Each of these methods has advantages and disadvantages (for example, see: Bryman and Cramer, 2002 and Blaxter, Hughes and Tight, 2010). For this study, the researcher will use personal questionnaires (delivering and collecting the questionnaire by hand) in order to increase the response rate.

4.4.1.1 Constructing the questionnaire

It is worth noting that constructing the questionnaire is an important stage in performing a questionnaire-based survey. It is necessary to determine the general topics and areas of

investigation, draft the items to be included in the questions, place them in the correct sequence and design an effective layout for the questionnaire.

The first step in constructing the questionnaires consists of reviewing the related literature to clearly identify the general information needed and the objectives in applying this instrument; i.e. what the instrument is supposed to find out (Mallick and Verma, 2005). It is recommended that the first step in constructing the questionnaire should be a review to clearly identify what information is needed in order to achieve the study objectives, and to provide a touchstone against which the first draft of the questionnaire can be tested. Therefore, the following factors are considered when the questionnaire is constructed (for example, see: Bryman and Cramer, 2002; Blaxter, Hughes and Tight, 2010 and Anderson and Arsenault, 2005):

- Questions and/or statements should be related directly to the study objectives.
- Questions and/or statements should be short, precise, clear and understandable.
- Responses should be made to statements by ticking one of as few choices as possible.
- Statements that may be interpreted in more than one way should be avoided.
- A statement should not contain more than one question or double negatives.
- Personal questions should be avoided as much as possible.
- Too many questions, especially open-ended questions, should be avoided.

To develop the study questionnaire, the researcher first decides the general topics or the domains of the required information and determines the sort of people from whom data could be obtained. The general topic of the current research is the role of DSSs in improving the efficiency of the admission system for universities in Saudi Arabia. Accordingly, two types of data are required. The first relates to describing the current admission system for Saudi universities, whereas the second type relates to testing the current admission system for Saudi universities against a set of commonly agreed indicators.

Therefore, the questionnaire for this study consists of four parts. **Part One** aims to collect general data about the respondents such as their position, qualifications, university title and number of years' experience. This part is divided into four items. **Part Two** aims to describe the current admission system in the Saudi universities. This part is divided into sixteen items. **Part Three** aims to test the current admission system in Saudi universities against a set of commonly agreed indicators. This part is divided into ten items. **Part Four** aims to collect suggestions relating to

developing a framework for designing, implementing and institutionalising a DSS for the admission system in Saudi universities. This part is one item. (For more details, see the research appendix A).

Consequently, a large pool of items and questions were assembled to cover the four parts of the questionnaire. The items were sequenced within each topic area by grouping items against the relevance of each item to its area. In wording the questions, the researcher selected vocabulary that was clear and easy to understand.

The next step involved making a decision about the type of questions that would be adopted. In some instances, disagreement can occur among researchers about which style of questions are preferable, i.e. closed or open-ended. Both kinds of questions have advantages and disadvantages. In this case, the researcher used closed questions because he felt that they were more suitable for this particular study. This type of question was selected in accordance with the advice of (Oppenheim, 2008, p. 114) who stated that these questions are “easier and quicker to answer; they require no writing, and quantification is straightforward, this often means that more questions can be asked within a given length of time and that more can be achieved with a given sum of money”. The closed questions included in the questionnaire gave specific information relevant to the study, as the researcher also used interviews to collect more detailed data. Using two survey instruments, provided an opportunity to compare the answers obtained using both methods.

The categories of value to each response were different. The researcher used direct questions and multiple choices for Part One. He also used yes/no responses for the questions included in Part Two. However, for the closed structured questions in Part Three, the ordinal five-point Likert Scale (1 = strongly disagree, 2 ⇔ agree, 3 ⇔ neutral, 4 ⇔ agree and 5 ⇔ strongly agree) was adopted.

Regarding the questionnaire layout (see Appendix A), the first page included the title as well as an introductory letter explaining the purpose of the study; it also thanked the respondents for their co-operation and assured them that the information would be confidential and used only for the purposes of this research. The second page requested general data about the respondents, and yes/no responses to questions which asked them to describe the current admission system in their particular university. The third page covered the specific items for the five-point Likert Scale

responses, which related to testing the current admission system in Saudi universities against the common agreed indicators. The fourth page requested the respondent to provide suggestions and any additional information that was relevant to developing a framework for designing, implementing and institutionalising a DSS for the Saudi university admission system.

4.4.2. Interview

The second research instrument used was interviews conducted with interviewees selected from the three chosen universities in Riyadh City (Kerlinger, 1966). Interview can supplement other methods, such as questionnaire, and can collect more detailed data and go deeper into the motivations and attitudes of respondents and their reasons for responses. In other words, the interview can be used in conjunction with other research methods. Another reason for using a survey is to validate other methods and go deeper into the motivations of the sample group. Therefore, interviews were used in this study to validate the questionnaire findings, on the one hand, and to go deeper into the motivations and views of the interview sample and collect additional data, on the other hand.

There are several advantages to using the interview as a research instrument. These advantages include the following (for example, see: Bulmer and Warwick, 1993 and Oppenheim, 2008):

- The interviewer can answer the interviewees questions and can put him or her at ease. This can build a positive climate for both co-operation and honesty.
- The interview provides an opportunity to thoroughly question certain areas within the investigation and allows a great depth of response.
- The interview is flexible and adaptable to the individual situation.
- Experience has generally shown that the response rate is good when conducting interviews.
- Most interviewees are willing, and therefore provide data more readily as well as providing more valid data, than they would if filling in a questionnaire.

In contrast, there are a number of potential disadvantages associated with carrying out interviews. These disadvantages include the following (for example, see: Chapman, McNeill and McNeill, 2005; Osemy and Prodhan, 2001 and Oppenheim, 2008):

- The researchers require a lot of money and long period of time to gather data from a large number of respondents simultaneously using the interview method. As a result, in the

current study, interviews were carried out with a small number of respondents and the questionnaire was used with a large number of respondents.

- Interview data can easily become biased and misleading if the person being interviewed is aware of the perspective of the interviewer. Therefore, researchers should take care when designing the schedule, or when dealing with participants, in order to reduce bias as far as possible.
- Some interviewees do not like to be taped because they may be shy, have cultural objections to having their voice recorded, or they may not want their comments on record, particularly those from an elite background. Therefore, researchers have to be sensitive to the views and wishes of the interviewees and always carry a notebook in case the respondent refuses to be recorded.

Therefore, the interview method was used to gather data linked to the research objectives and to supplement the questionnaire, in order to avoid the shortcomings of relying on either the questionnaire or interview in isolation. This means that the researcher will use mixed methods (the quantitative method through questionnaires and the qualitative method through interviews).

There are many kinds of interview including the structured interview, semi-structured interview, unstructured interview and focus groups. The structured interview is the easiest type of interview and relies upon the use of a questionnaire as the data collection instrument. In this type of interview, each interviewee is asked the same questions in the same way so that any differences between answers are assumed to be real ones and not the result of the interview situation itself (May, 1997). This interview type involves a series of closed form questions that either have yes or no answers or can be answered by selecting a response from a set of short-answer choices (Borg and Gall, 1996). So, the structured interview relies primarily upon the use of a questionnaire as the data collection instrument.

Semi-structured interviews allow interviewees to answer more on their own terms than permitted during the structured interview, but they still provide a greater degree of structure than the focused interview or unstructured interview, and this aids comparison (May, 1997). Semi-structured interviewing includes asking a group of structured questions as well as probing more deeply using open form questions to obtain additional information (Borg and Gall, 1996). The reasons for conducting this type of interview include a concern with the meaning that individual

respondents give to concepts, events and so on, and to explore issues that are too complex or too sensitive to be investigated by quantitative approaches. Involvement in the interview process is a reminder of the importance and influence of the researcher in the research, and face to face interviewing makes more evident the 'power' relationships within the research (Moore, 1995).

Unstructured interviews may directly involve the researcher as a subject and participant in the data collection process and provide qualitative depth by allowing interviewees to talk about the subject in terms of their frames of reference (May, 1997). They do not involve a detailed interview guide. Instead, the interviewer asks questions that prompt the respondent to provide the desired information (Borg and Gall, 1996).

A focus group is an open-ended group interview that uses the group process to understand the ways that people think and feel about a particular topic and allows the participants to explain the reasons why they think and feel in these ways. “Group interviews constitute a useful tool of investigation, letting researchers focus upon group norms and dynamics around issues that they hope to investigate.” (Borg and Gall, 1996, p. 113). They include addressing questions to a group of individuals who have been assembled for a specific purpose (Borg and Gall, 1996).

The type of interview selected will, to an extent, depend on contractual conditions, the nature of the topic and exactly what the interviewer hopes to find out. However, Blaxter (2001) mentioned that interviews may take place face to face (for example, at the interviewee or interviewer’s home, place of work or at another selected place), or from a distance, for example, over the telephone (Blaxter, Hughes and Tight, 2010).

For the purposes of this study the researcher chose to carry out semi-structured interviews with employees in the admission department at the selected universities in Riyadh City. The reasons for choosing this type of interview were to allow respondents to answer more on their own terms and provide a greater degree of structure, which facilitates statistical analysis and aids comparison.

4.4.2.1 Constructing the interview schedule

It is worth noting that constructing the interview schedule is an important stage in performing an interview-based survey. It is necessary to determine the overall topics of investigation, draft the

items, put them in the correct sequence and design an effect layout for the interview schedule. More or less the same steps are used for the interview schedule as are used in constructing the questionnaire. In this case the researcher used open-ended questions in order to collect more details about the nature of the current admission system in Saudi universities.

The interview schedule in this study consists of four parts. **Part One** aims to collect general data about the interviewees, such as their positions, their qualifications and their university title. This section is divided into four items. **Part Two** aims to describe the current admission system in Saudi universities. This section is divided into five items. **Part Three** aims to test the current admission system in Saudi universities against commonly agreed indicators. This section is divided into five items. **Part Four** aims to collect suggestions related to developing a framework for designing, implementing and institutionalising a DSS for the Saudi university admission system. This section consists of one item. (For more details, see the research appendix B).

4.5 Validity of the survey instruments:

Questionnaire and personal interview are instruments used for collecting ideas and consequently for testing hypotheses (May, 1997). Therefore, the questions must not only reflect the survey's aims, but must also be understood by the respondents in a clear and unambiguous way. Hence, before applying any test, it is necessary to ensure that the survey instruments are valid tools. Therefore, there is a need to check the validity of the survey instruments.

The term validity is one that is frequently used in the world of research and measurement. "Validity tells us whether the question, item or score measures what it is given to measure" (Oppenheim, 2008, pp. 144-145). Neuman (2000) added that the validity of a survey is the degree of fit between a construct a researcher uses to describe, theorise, or analyse the social world and what actually occurs. Validity means how close the results are to the truth; to achieve validity, researchers aim to make sure that the survey items are clear and understandable and that the conceptual and operational definitions mesh with one another (Neuman and Kreuger, 2003).

Chapelle and Jamieson [1991] explain that validity is divided into two types: internal and external validity. Internal validity refers to the accurate attribution of the observed results to the factors that were supposed to be responsible for these results. External validity denotes the applicability of research results to instructional and research contexts other than the one in which the research was carried out (Chapelle and Jamieson, 1991). Neuman (2000) added that both internal and

external validity are primarily used in experimental research. He also added that internal validity is used to make sure that there are no possible errors or alternative explanations for the results, although errors arise, despite attempts to institute controls. External validity, on the other hand, is used to measure the ability to generalise findings from a specific sample to a wider population (Neuman and Kreuger, 2003).

Although it is not possible to have absolute confidence in the measurement of survey validity, some measures are more valid than others. There are many types of validity, such as content validity, face validity, criterion validity, concurrent validity, predictive validity, construct validity; convergent and discriminate validity (Neuman and Kreuger, 2003) and (Al-Wafi, 1989) and trustees' validity (Obidat, Adass and Abdulhagg, 1989). Each type of validity is tested in a different way. The most common type as well as the easiest to achieve is face validity. This is a judgement by the scientific community that the indicator really measures the intended construct (Neuman and Kreuger, 2003).

The researcher selected face validity for measuring the validity of the survey instruments because it is the most suitable and the most common measure for this study. To measure the validity of the survey used in this study and to confirm the clarity of the items and their relevance to their scales and parts, the following steps were undertaken:

- Copies of both the questionnaire and interview schedule were distributed to ten members of staff at King Saud University.
- A letter was given to the assessors indicating the nature and the aim of the survey and advising them that they were not required to respond to the items, but only to judge whether or not the items met the necessary criteria.

All questionnaires and interview schedules were collected personally. Each member of staff was interviewed after they had reviewed the questionnaires and the interview schedule. Around half an hour was spent with each person, face to face, to discuss all their notes, comments and opinions. A number of items on the questionnaire and in the personal interview questions were changed according to the judges' recommendations. In addition, a few items were removed from the questionnaires and the personal interview questions. Furthermore, most of the items were rearranged in a new sequence. The following changes were made:

- In the questionnaire, the question that related to the name of respondents being optional was removed.
- In Part Two of the questionnaire, most of the items were rearranged according to the general components of a DSS.
- In Part Three of the questionnaire, some items were rearranged according to the main commonly agreed indicators.
- In the interview schedule, the questions were summarised into five questions for Part Two and Part Three. In addition, the question that related to the name of the interviewee being optional was removed.

4.6 Piloting the questionnaire instruments

Neuman (2000) explained that before carrying out the main study a pilot study is considered to be very important. It is a vital step for several reasons, such as to make sure that the research instruments are suitable for use in the main study and that the research is significant (Neuman, Kreuger, 2003). Borg and Gall (1996) stated that the pilot study provides additional knowledge that leads to improved research, such as (Oppenheim, 2008):

- It provides ideas, approaches and clues not foreseen prior to the pilot study. These greatly increase the chances of obtaining clear-cut findings in the main study.
- It reduces the number of treatment errors, because unforeseen problems revealed in the pilot study can be overcome through redesigning the main study.
- It permits one to get feedback that can lead to important improvements in the main study.

Accordingly, the purpose of the pilot study is to ensure that no difficulties or weaknesses come up when applying the survey instruments to the main study.

The questionnaire was piloted using a small sample chosen at random from the main study sample. The pilot study was carried out before the main data collection began. The sample for the pilot study included 10 respondents from every university in the main sample. Questionnaires were delivered by hand to the selected sample. The researcher received 18 replies, as shown in the following table:

Table 4 1 The sample for the pilot study

No.	Universities	Distributed Questionnaires	Collected Questionnaires	
			No.	%
1	King Saud University	10	7	70%
2	Imam Mohammed Ibn Saud Islamic University	10	5	50%
3	Prince Sultan University	10	6	60%
Total		30	18	60%

The results of the pilot study revealed that the process of collecting the main data ought to proceed smoothly. It also indicated that almost all the questions were understood. A few questions were modified to make them easier to understand. The researcher used the questionnaires collected in the pilot study to measure the reliability of the questionnaire, as shown in the next section.

4.7 Reliability of the questionnaire instruments

Neuman (2000) mentioned that “reliability means consistency”. This means that the same findings can be obtained when the same method is repeated under identical or very similar conditions (Neuman, 2000, p. 164). Oppenheim (2008, p. 144) emphasized that “reliability refers to the consistency and purity of measuring, to repeatability; to the probability of acquiring the same result again if the measure were to be duplicated”. Hence, the reliability of a measuring instrument is the degree of consistency with which it measures whatever it is measuring. Accordingly, a measurement of reliability is a relevant test for gauging the level of similarity in the answers of the sub-sample. There are various types of test for reliability such as test re-test, alternative form and internal consistency. However, the most suitable one for the current study is a test of internal consistency. This will be used to test correlations between different items on the same test.

There are several methods for testing internal consistency, such as the split-half (subdivided test), the Kuder-Richardson method of rational equivalence, Guttman, Hoyt’s Analysis of Variance Procedure and Cronbach’s Coefficient Alpha. Each method is used with a specific type of data depending on the aims of study. The researcher chose the Cronbach’s Coefficient Alpha as the most suitable method for the current study, because it is a common method to estimate the internal consistency, has a single form of the test and it is much easier to compute. The results are shown in the following tables:

**Table 4 2 Item-total statistics for reliability analysis by using Alpha for the pilot study
(The nature of the current system for admission in Saudi universities)**

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Pearson Correlation	Cronbach's Alpha if Item Deleted
1	19.61	9.546	.000	.a	.802
2	18.89	8.810	.191	.333	.805
3	19.50	8.500	.499	.576*	.782
4	19.28	7.859	.533	.641**	.776
5	19.44	8.614	.348	.455	.791
6	18.61	9.546	.000	.a	.802
7	19.22	7.712	.568	.673**	.773
8	19.39	7.663	.717	.781**	.761
9	19.39	7.781	.663	.737**	.766
10	19.17	8.147	.390	.525*	.790
11	19.39	8.722	.253	.381	.799
12	19.56	9.791	-.204-	-.130-	.815
13	19.50	8.618	.434	.517*	.786
14	19.33	7.647	.662	.741**	.765
15	19.33	8.235	.415	.535*	.787
16	19.56	8.850	.457	.516*	.787

a. Cannot be computed because at least one of the variables is constant.

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

**Table 4 3 Item-total statistics for reliability analysis by using Alpha for the pilot study
(Evaluation of DSS)**

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Pearson Correlation	Cronbach's Alpha if Item Deleted
1	20.50	13.441	.783	.843**	.635
2	20.33	12.706	.861	.904**	.614
3	20.22	11.948	.899	.934**	.595
4	20.00	10.588	.883	.933**	.574
5	19.39	12.605	.905	.934**	.608
6	19.11	17.046	.164	.280	.723
7	20.39	13.663	.786	.843**	.638
8	20.28	11.742	.951	.968**	.585
9	17.39	23.193	-.738-	-.643-**	.850
10	17.39	23.428	-.764-	-.677-**	.852

**. Correlation is significant at the 0.01 level (2-tailed).

As shown in tables 4.2 and 4.3 above, the data obtained from the 18 questionnaires collected in the pilot study were used to determine whether the questionnaire has this type of reliability (internal consistency). It was found that there was a high degree of similarity between the

answers from the sub-sample that was tested, and the Cronbach's Coefficient Alpha for this part of the questionnaire (Table 4.2 shows that for No. of Cases = 18 and No. of Items = 16, Alpha was 0.80; Table 4.3 shows that for No. of Cases = 18 and No. of Items = 10, Alpha was 0.72). This means that the correlation coefficient (R) between items is high and therefore, this instrument is reliable. In other words, the probability that this questionnaire will give the same results if used again is 0.58 % (R^2 = the coefficient of determination). Therefore, the scale used in this study proved to be reliable according to the Cronbach's Coefficient Alpha, because the questionnaire questions were clear and direct. This result is supported by Oppenheim (2008, pp. 159-160) who said:

“Reliability isn't always perfect one; Reliability is a matter of degree. It is, in the social and behavioural sciences, rare to find reliability much above 0.90. The square of a correlation coefficient presents the ratio of participated true variance; therefore, a reliability coefficient of 0.90 means that the two measures have 81 % in public; they interlock, or participate a public variance, by just over four-fifths. If the reliability of a scale or other measures drops below 0.80 this means that repeated administrations will cover less than 64 per cent of the same ground, and that the error component is more than one-third; such a measure will come in for serious criticism and might well have to be rebuilt or discarded.”

4.8 Administration of the survey instruments in the main study

After considering all the assessors' comments, piloting the study, carrying out the changes necessary to ensure understanding and making sure that the survey instruments were reliable, the questionnaire and interview schedule was applied to the sample chosen for the basic study. The researcher distributed copies of the questionnaire and conduct personal interviews. All interviewees were very helpful in providing the data needed.

4.8.1 Administration of the questionnaire

The questionnaires were delivered to each respondent and collected personally. The researcher distributed 60 questionnaires of which 54 were returned, as shown in the following table and figure:

Table 4 4 Questionnaire response rate, by university

No.	Universities	Distributed Questionnaires	Collected Questionnaires	
			No.	%
1	King Saud University	20	19	95%
2	Imam Mohammed Ibn Saud Islamic University	20	18	90%
3	Prince Sultan University	20	17	85%
Total		60	54	90%

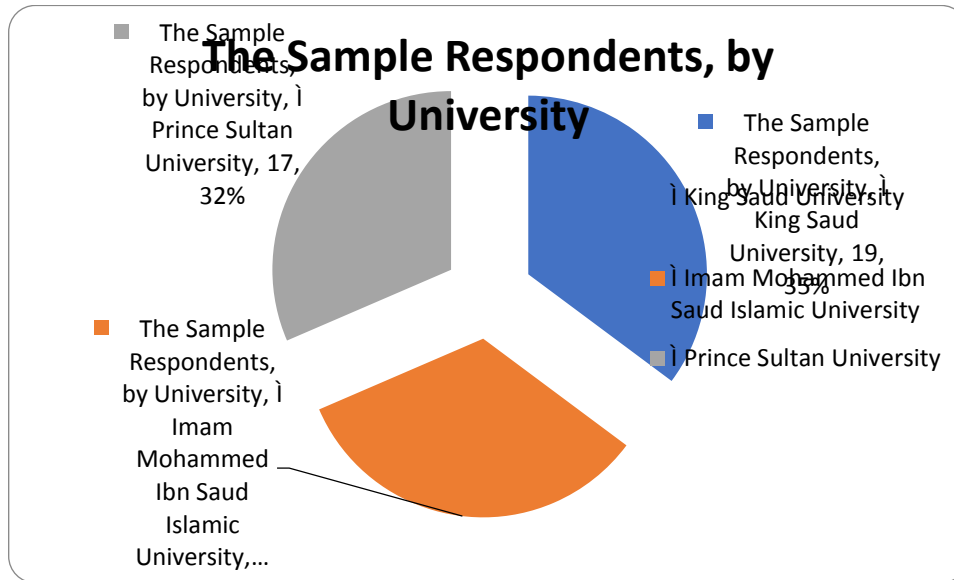


Figure 4 2 Questionnaire response rate, by university

4.8.2 Administration of the interviews

The interviews were conducted with a sample of employees from the admission departments. The sample for the interviews included 5 persons from each university, as shown in the following table:

Table 4 5 Interview sample, by university

No.	Universities	No.	%
1	King Saud University	5	100
2	Imam Mohammed Ibn Saud Islamic University	5	100
3	Prince Sultan University	5	100
Total		15	100

The researcher began each interview by explaining the aims to the interviewees. Then the researcher told the interviewees that all data is confidential and is used only for the purpose of the current research. Questions were asked according to the interview schedule. The respondent was permitted to provide a full answer before moving to the next question. Finally, at the end of the interview, the researcher expressed his thanks to the interviewees for their co-operation and went

through the questionnaire to clarify any ambiguous answers. Each interview took about 30 minutes. However, tape-recording wasn't used for any of the interviews, because most respondents were unwilling to have the discussion recorded.

The researcher recorded the response to the questions immediately by carefully noting down each answer as the respondent gave an answer on paper. If it wasn't clear, the researcher asked the interviewee or interviewees for further explanation.

4.9 Data analysis

Data are simply research observations recorded in a variety of forms including ticks, scores, question responses, and so on. Before any statistical analysis is undertaken, it is necessary to modify it in order to achieve the research objectives, answer the research questions, or test the research hypotheses.

4.9.1 Characterisation of data

It is worth noting that data can be described as qualitative (i.e. words) or quantitative (i.e. numbers). Quantitative data can be characterised using a system which distinguishes four levels of data measurement. These are nominal, ordinal, interval and ratio.

Nominal data imply that each data type is named, but clearly this could include a numbered system of identification as well as letters or labels. The most important characteristic of nominal data is that there is no implicit relationship between the different categories. Even if numbers are used, they are allocated arbitrarily and the traditional relationships between numbers (size, ordering or arithmetic accessibility, for example) do not apply (for example, see: Cramer and Howitt, 1997). Hence, a nominal variable is one where the values refer to the number or frequency of cases that fall within particular categories.

Ordinal data would normally be coded numerically but literal codes are used. Where objects are ranked according to a particular specification, such as importance or size, then the obtained data are ordinal. Attitude scales frequently employ gradations of agreement which are coded in a variety of ways including: Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree (for example, see: Devine, 1999).

An ordinal variable is one where it is meaningful to rank the categories according to some justifiable order. However, it isn't possible to identify precisely the degree of difference between the categories (see, for example: Cramer and Howitt, 1997 and Devine, 1999).

Interval data are classified in a way that is likely to be equally spaced as well as being ordered. It is difficult to know whether these data exist in social research. The usual assumption is that most scaled social data can be treated as interval unless the limitations already discussed obviously apply. However, many social statisticians would take the opposite stand, which is that data must be considered as ordinal unless the interval condition can be proven. In practice, the argument is not particularly productive or relevant since many other considerations must also be taken into account before any analysis can be accepted as valid (see, for example: Cramer and Howitt, 1997).

An interval variable is where the categories have a natural ranking and it is possible to determine precisely the differences between these categories. Age, if it is measured in years, is an interval variable, because, as well as ranking people according to their age, the precise difference between the ages can be determined. If age was simply measured as young, middle aged and old it would only be an ordinal variable, because it is not possible to determine precisely how much difference there is between the ages (Devine, 1999).

Ratio data rarely come up in social research. This type of data requires that the condition of rational equivalence should be satisfied, as well as the conditions already demanded for interval data. This means that, similar to most physical measurements, such as distance and weight, proportions hold at all points of a scale which has an absolute zero point that is measured as 0 (see, for example: Cramer and Howitt, 1997).

According to the above discussion, *the nominal scale* permits only the classification of data in terms of equality *or* difference, while *the ordinal scale* permits the classification of data in terms of equality *and* difference. In addition, *the interval scale* provides additional information regarding the level of difference among individual items in a group or set, whereas *the ratio scale* represents the highest level of precision, because it allows decisions to be made on ratio as well as interval (Collis, Hussey, 2013).

Some of the data related to the current study are qualitative, as is clear from the data gathered through the interviews. The other data are quantitative, as is clear from the data gathered through the questionnaires, as well as some of the interview data. This understanding will help in carrying out the in-depth analysis, as well as in obtaining good results.

4.9.2 Quantitative data analysis

It is worth noting that one of the unsolved issues in quantitative data analysis is the question of when parametric rather than non-parametric tests should be used. “The term Parameter points to a measurement that identifies the distribution of the population, like the mean and variance.” (Bryman and Cramer, 2002, p. 115).

Some authors (for example, see: Bryman and Cramer, 2001) have argued that parametric tests are only suitable when data meets the following three conditions (Bryman and Cramer, 2002):

- The level or scale of measurement is interval or ratio scaling, that is, more than ordinal.
- The distribution of the population scores is normal
- The variances of both variables are equal or homogeneous.

Bryman and Cramer (2001, p. 115) reported that “non-parametric tests are so called because they don’t depend on assumptions about the valuable form of the division of the sampled population”. This type of test is called a distribution free test (see also: Kotrlik and Higgins, 2001). These tests attempt to avoid reliance on any particular assumptions with respect to the form of the implied parameters or their distribution. It is worth mentioning that with interval or percentage data, a parametric test is more suitable, while a non-parametric test is more suitable for nominal and ordinal data.

Therefore, non-parametric tests were used in this study, particularly the Chi square (χ^2) test, correlation coefficient and frequency distribution. These tests are suitable for analysing the data, especially the data collected through the questionnaire, because of the categorical nature of the data. These tests are also suitable for achieving the aims of this study.

The chi-square (χ^2) test is possibly the most frequently used hypotheses. It is a non-parametric test, and is suitable for use in a wide range of situations when the data are categorical. Moore (1995) stated that the chi-square (χ^2) test is used to identify whether two repeated distributions

differentiate importantly from one another (Moore, 1995). This test is a test of statistical significance, meaning that it allows the researcher to ascertain the probability with which the observed relationship between two variables might have arisen by chance (Kotler, 2001).

With one degree of freedom (two categories), the expected frequencies for each category should be at least 5 before the test can be applied, but with more than one degree of freedom (more than two categories), some researchers, such as: (Bryman and Cramer, 2001) and (Howitt and Cramer, 2000), suggest that the only conditions in which the chi-square should not be used are when any expected frequency is smaller than 1 or when more than 20% of the expected frequencies are less than 5. In these situations, they suggest either combining categories or using alternative tests, such as the binomial test.

The popularity of the chi-square test may be due to the relative ease of conducting this test. In addition, it is useful in a wider variety of research situations than other tests.

The correlation coefficient is used to measure the strength of the relationships between two variables (strong or weak) and the type of this relationship (positive or negative). It lies between -1 and +1. Thus, it supplies data on the strength and the direction of relationships. The closer the correlation coefficient is to +1, the higher the positive association. This means that the two variables increase and decrease at the same time. The closer the correlation coefficient is to -1, the higher the negative association. In this case, the two variables tend to move in opposite directions. The closer the correlation coefficient is to 0, the lower the degree of association between the two variables (for example, see: (Bryman and Cramer, 2001).

It is worth noting that Pearson's r must be used with interval and ratio data, and the relationship between the variables must be linear. Spearman's ρ and Kendall's τ must be used with nominal and ordinal data. The interpretation of the results of the method is typical for Pearson's r . Moreover, unlike Pearson's r , Spearman's ρ and Kendall's τ are non-parametric methods, which mean that they can be used in a wide variety of contexts since they make fewer assumptions about variables (for example, see: Bryman and Cramer, 2001 and Fielding, Gilbert and Gilbert, 2006).

Frequency distributions are used as a statistical tool for describing the data for a single variable. (Fielding, Gilbert and Gilbert, 2006) stated that this tool allows the researcher to ascertain how

many and what percentage of the sample fall into a particular category. So, it allows the comparison of information between groups of individuals. This is considered a popular method for describing variables.

It is worth noting that the most commonly used computer software for survey data analysis is SPSS, the Statistical Package for Social Sciences. A program, like SPSS, has two main components: the data analysis facilities and the data management facilities (for example, see: Fielding, Gilbert and Gilbert, 2006). So, the SPSS program is considered a very important tool for researchers as it plays an important part in presenting and analysing data.

The chi square (χ^2) test will be used to examine the importance of the association between a DSS and the effectiveness of the admission system in Saudi universities. In addition, the correlation coefficient will be used to measure the strength of the relationships between DSS and the effectiveness of admission system in Saudi universities. The researcher will use Spearman's rho, because this is commonly used by other researchers. In addition, this test is suitable for analysing the data collected by the survey method used in this study (nominal and ordinal data). Descriptive statistics (frequencies, percentages of responses) will also be used to describe the research variables. This will lead to a good picture of the current admission systems in the Kingdom of Saudi Arabia. Consequently, it will help in establishing the proposed admission system. The researcher selected these tests, because these tests are adequate for achieving the study objectives and testing their hypotheses.

4.9.3 Qualitative data analysis

Qualitative data is dependent on meanings presented through words. The collection methods of this type of data depends on the use of a descriptive framework. Analysis of the qualitative data involves the following activities (for example, see: Saunders, Lewis and Thornhill, 2009 and Silverman, 2013):

- Categorisation: this procedure involves organising data into meaningful parts, in order to help achieve the research objectives.
- Gathering data: this procedure involves linking relevant bits or chunks of the original data to the proper categories. Data gathering is a selection of words, a sentence, a number of sentences, an end paragraph or some other segment of textual data that suits the category.

- Recognising relationships between categories of data in order to help achieve the research objectives.
- Developing categories and testing hypotheses to produce well-grounded conclusions.
- Developing recommendations from the research conclusions.

Qualitative analysis is used to check the data gathered through the interviews. The researcher based the analysis on a descriptive approach to provide a summary of the essential ideas that are linked to the research aims. Therefore, this analysis will be used to describing the existing admission systems in Saudi universities. In addition, it will be used for testing and assessing the existing admission systems against a set of commonly agreed indicators. These commonly agreed indicators are used to monitor the admission of students enrolled in universities to improve the overall process of admission, and consequently improve the existing national education system in Saudi universities.

4.10 Conclusion

This chapter has explained the research methodology for the present study. It began by introducing the research hypotheses and its objectives. The research approach, which was both quantitative and qualitative, was then explained. Following this, the study sample (sampling frame, sample size and sampling technique) and the research instruments were described. The two instruments of survey, questionnaire and interview, were described, and the reasons why they were used in this study were explained. A pilot study was carried out. The reliability of the questionnaire was also discussed in this chapter. The scale used in this study proved that the questionnaire is reliable according to the Cronbach's Coefficient Alpha, because the questionnaire questions were clear and direct.

The administration of the instrument used in the main study was described in this chapter. Finally, this chapter explained the data analysis tools used. The data collected during the study will be presented and discussed in the next chapter.

Chapter 5

The analysis of data from an of testing universities' admission in Saudi Arabia (UASA)

Objectives:

- Presentation of the data obtained from the empirical survey.
- Analysing and explaining the different data obtained.
- Discussion of the results, as well as testing the hypotheses.

5.1 Introduction

Following the presentation of the design and methodology of the empirical study in the previous chapter, the purpose of this chapter is to present the data obtained from the empirical survey through questionnaires and interviews. Frequency distributions are used to describe the survey variables.

This chapter describes the current admission system in Saudi universities. In addition, it tests the existing admission system in Saudi universities by using a set of commonly agreed indicators for monitoring the admission of students enrolled in universities. This work is carried out in order to improve the overall process of admission, and consequently enhance the existing national education national system in Saudi universities.

5.2. Description of the questionnaire variables

The researcher will depend on frequency distributions, as mentioned in the previous chapter, for describing the different groups of people samples during the research. This tool, also, will be used to present some of the interview data.

5.2.1 Description of the research sample (general information)

In this section the researcher gives a description of the groups sampled during the research. The different sample groups, according to their position, can be presented as follows:

Table 5. 1 The distribution of the groups in the research sample according to their position

Position	Frequency	Percentage
Employee in admission department	21	38.9
College Registrar	6	11.1
Head of admission department	9	16.7
Admission supervisor	3	5.6
Admission coordinator	3	5.6
Dean of admission and registration	9	16.7
Director of admission	3	5.6
Total	54	100.0

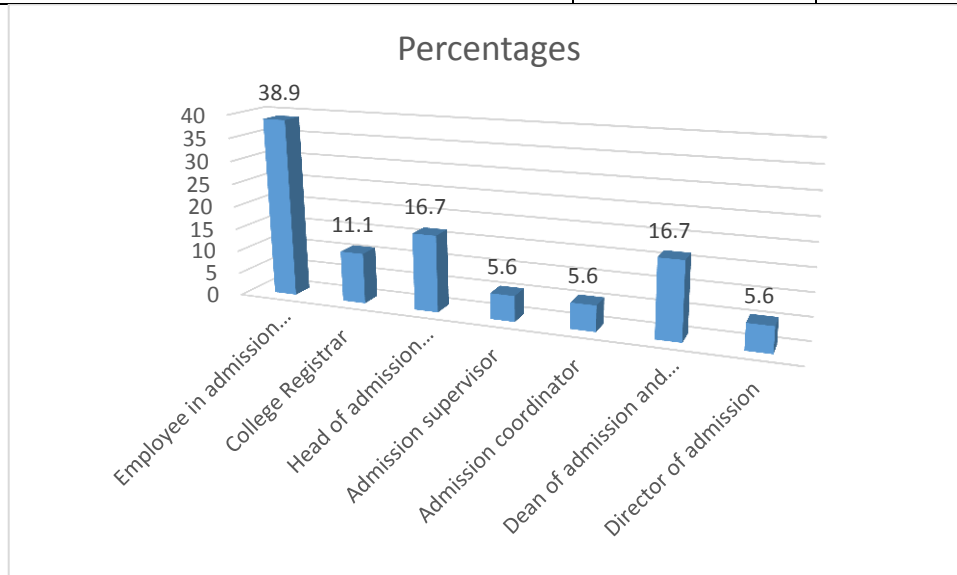


Figure 5 1 The distribution of the groups in the research sample according to their position

From Table 5.1 and Figure 5.1, it can be seen that the highest percentage response comes from the employees in the admission departments, representing 38.9%. The percentage response coming from head of admission and dean of admission and registration is equal, representing 16.7%. The third largest group is made up of college registrars, representing 11 %. Finally, admission supervisor, admission coordinator and director of admission all have the same percentage representation (6%). This means that the survey concentrated on people employed in the admission departments in Saudi universities. The responses show us that the survey will help to collect the required data regarding the admission departments in Saudi universities. In addition, it will help to collect relevant opinions regarding the admission departments from several viewpoints. Thus, it will be useful for properly evaluating the current admission systems in Saudi universities. It offers the opportunity to form a comprehensive picture of the current admission systems in Saudi universities, thus supporting the study results and achieving the study objectives. These results will also help to develop and design the proposed admission system in the Kingdom of Saudi Arabia.

The distribution of the research sample according to their qualifications can be shown as follows:

Table 5. 2 The distribution of the research sample according to their qualifications

Qualifications	Frequency	Percentage
Certificates in IT	15	27.8
Certificates in Information systems	15	27.8
MBA	9	16.7
Ph.D. in IT	3	22.3
BSc. In Public Administration	3	5.6
Total	54	100.00

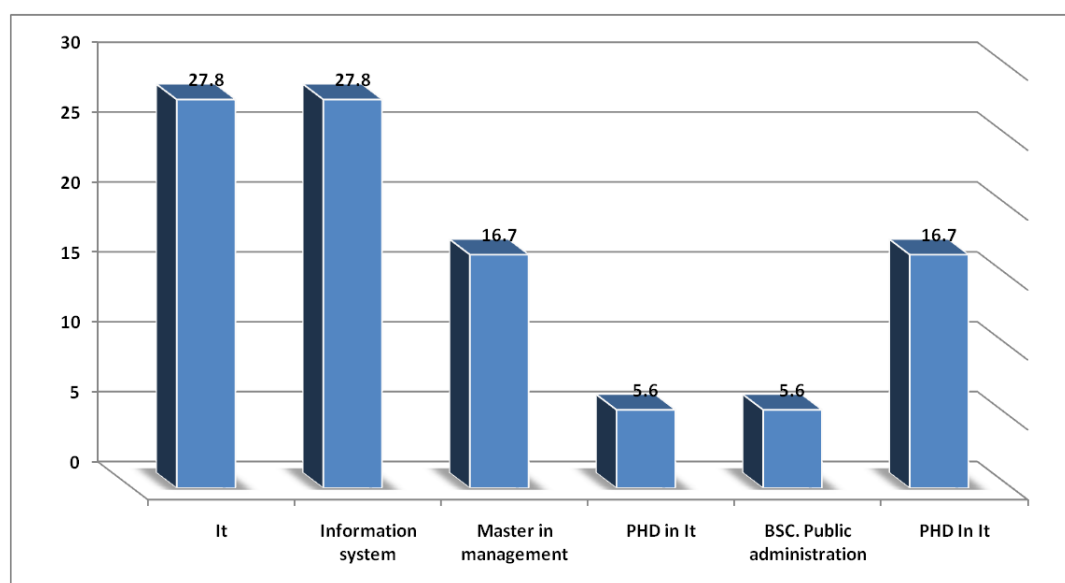


Figure 5 2 The distribution of the research sample according to their qualifications

From Table 5.2 and Figure 5.2, it can be seen that the highest percentage of responses came from those with certificates in IT and information systems, representing 56%. Around 22 % of respondents have a PhD represents around 22%, and around 17 % of respondents have an MBA (respondents with either a PhD or an MBA represent 39% of the sample). The lowest percentage is those with a BSc, representing around 6%. This means that although some respondents have higher degrees, the number who has academic qualifications is smaller than the number of those with non-academic certificates. The results also show that the survey concentrated on people who were employed in IT departments.

The survey will help in collecting the required data regarding the IT departments in Saudi universities. Consequently, it will be useful for evaluating and developing the current admission systems in Saudi universities and therefore supporting the study objectives. It will also help in developing and designing the proposed admission system in the Kingdom of Saudi Arabia.

The distribution of the sample of those studied according to university can be shown as follows:

Table 5. 3 The distribution of the research sample according to the university

The university	Frequency	Percentage
Imam University	15	27.8
King Saud University	18	33.3
Prince Sultan University	21	38.9
Total	54	100.0

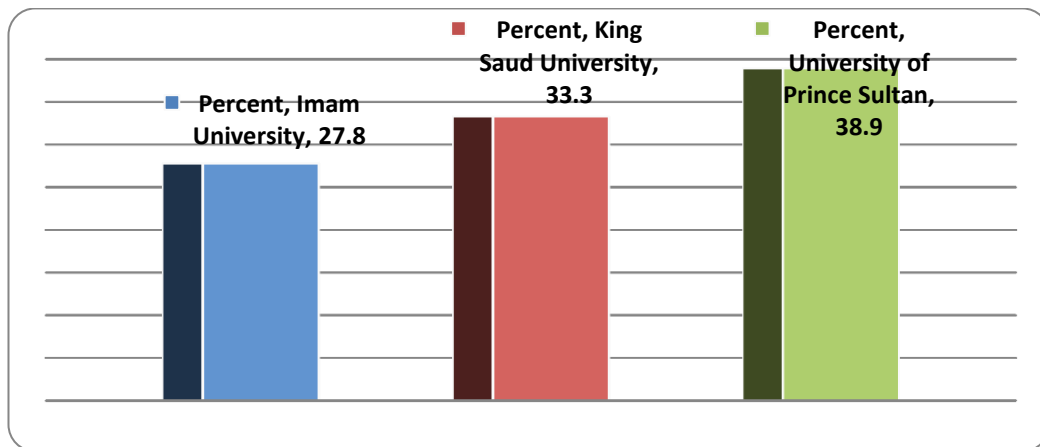


Figure 5 3 The distribution of the research sample according to the university

From Table 5.3 and Figure 5.3, it can be seen that respondents from Prince Sultan University make up the largest group, representing 39% of the total, while the respondents from Imam University make up the smallest group and represent 28%. These results mean that the respondents include some from private universities (represented by Prince Sultan University), and others from governmental universities (represented by King Saud University and Imam University). This will allow us to build up a good picture and gather relevant opinions regarding the current admissions systems in the governmental and private universities in Saudi Arabia. In turn, this will support the development and improvement of the current admission systems in Saudi Arabia. Consequently, it will help in the development and design of the proposed admission system in the Kingdom of Saudi Arabia.

The distribution of the research sample according to their experience can be shown as follows:

Table 5. 4 The distribution of the research sample according to experience

Experience	Frequency	Percentage
Less than 5 years	20	37.0
From 5 to less than 10 years	21	38.9
More than 10 years	13	24.1
Total	54	100.0

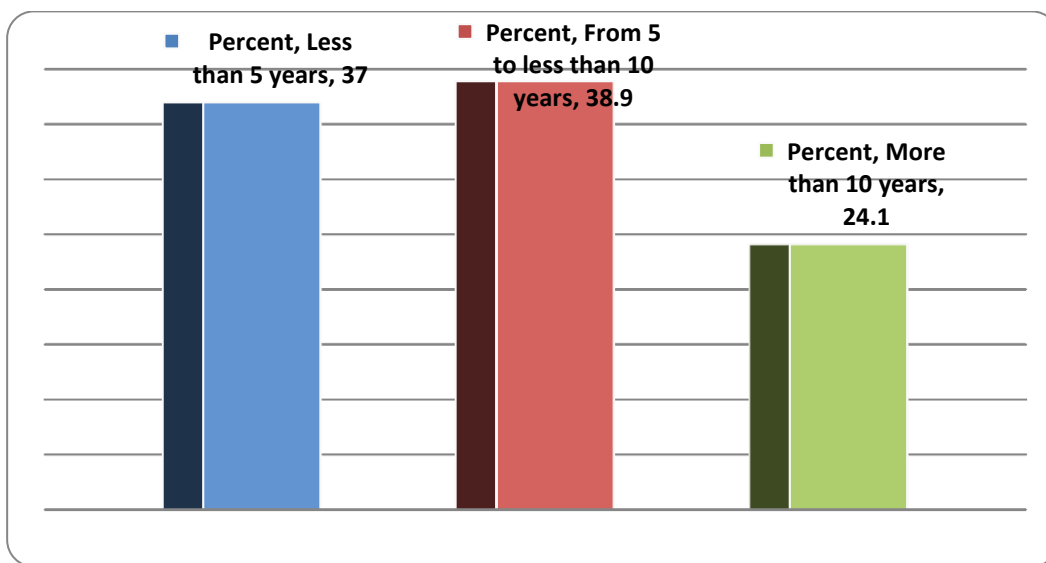


Figure 5 4 The distribution of the research sample according to experience

From Table 5.4 and Figure 5.4, it can be seen that respondents with between 5 and less than 10 years’ experience make up the largest group, representing 39% of the total, while respondents who have more than 10 years’ or more experience make up the lowest group, representing 24%. This result shows that the majority of respondents have around 10 years’ experience indicating that the respondents have different kinds of experience. This will reflect different points of view regarding the university admissions systems in the Kingdom of Saudi Arabia. In turn, this will support the study of the development process of the current admission systems in Saudi universities. Consequently, this will help in establishing an improved central and unified admission system to universities in the Kingdom of Saudi Arabia.

5.2.2 Describing the current system for admission in Saudi universities

The researcher used percentage and frequency to describe the current admission system in Saudi universities; the results were as follows:

Table 5. 5 The nature of the current Saudi admission system

Items		Yes	No
Is your admission system fully manual?	No.	0	54
	%	0	100
Is your admission system partially computerized?	No.	39	15
	%	72	28
Is your admission system fully computerized?	No.	6	48
	%	11	89
Do you have an advanced database?	No.	18	36
	%	33	67
Do you have a system for feedback?	No.	9	45
	%	17	83
Does your admission system works online?	No.	54	0
	%	100	0
Do you have a database management system	No.	21	33
	%	39	61
Do you have the query facility?	No.	12	42
	%	22	78
Do you have a data director?	No.	12	42
	%	22	78
Do you have qualified people?	No.	24	30
	%	44	56
Do you have a model base?	No.	12	42
	%	22	78
Do you have a model management system?	No.	3	51
	%	6	94
Do you have a model directory?	No.	6	48
	%	11	89
Do you have a dialog process?	No.	15	39
	%	28	72
Do you have a dialog style?	No.	15	39
	%	28	72
Do you have a dialog system management?	No.	3	42
	%	6	94

The above table shows that 100% of respondents stated that their admission system is not fully manual and works online, while 72% (39 respondents) reported that their admission system is partially computerised; 6 respondents (11%) said that their admission system is fully computerised. This means that there are different types of university admission systems in Saudi Arabia. This information will support the study objectives in establishing an improved central and

unified admission system to universities in the Kingdom of Saudi Arabia, in order to save time, effort and reduce costs.

Regarding the database element, 18 respondents (33%) stated that they have an advanced database and 17% (9 respondents) reported that they have a system for feedback in their admission system. In addition, 21 respondents (39%) said that they have database management and 12% (6 respondents) indicated that they have a data director and a query facility in their admission system. This means that databases and related factors in Saudi universities need development in order to become more integrated and comprehensive so that they can meet the requirements of the proposed admission system. This will support the process of developing admission systems to universities in the Kingdom of Saudi Arabia.

Concerning the human element, 24 respondents (44%) reported that they have qualified people using their admission system. This means that the human element in the admission systems in Saudi universities needs development in order to be more fit to meet the requirements of the proposed system of admission. This will support the process of developing admission systems to universities in the Kingdom of Saudi Arabia.

Regarding the model base element, 12 respondents (22%) said that they have a model base; 6% (3 respondents) reported that they have model management, and 11% (6 respondents) said that they have a model directory in their admission system. This means that the model bases and related factors in Saudi universities need to be developed in order to become more integrated and comprehensive so that they meet the requirements of the proposed admission system. This will support the process of developing admission systems for universities in the Kingdom of Saudi Arabia.

Related to the dialogue element, 15 respondents (28%) stated that they have dialogue process and dialogue style, and 6% (3 respondents) mentioned that they have dialogue system management in their admission system. This means that the dialogue element and related factors in Saudi universities need to be developed in order to become more integrated and comprehensive so that they meet the requirements of the proposed system of admission. This will support the process of developing admission systems to universities in the Kingdom of Saudi Arabia.

5.2.3 Testing the existing admission system in Saudi universities by using a set of commonly agreed indicators

After evaluating the existing admission system in Saudi universities by using a set of commonly agreed indicators the following results were found:

Table 5. 6 Evaluating the existing system for admission to Saudi universities

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Your admission system is comprehensive	No.	51	0	0	3	0
	%	94	0	0	6	0
Your admission system is flexible	No.	42	9	0	3	0
	%	78	16	0	6	0
Your admission system is easy to use	No.	39	9	3	3	0
	%	72	16	6	6	0
Your admission system is easy to update	No.	33	12	6	0	3
	%	61	24	11	0	6
Your admission system is easy to control	No.	0	45	6	0	3
	%	0	83	11	0	6
Your admission system is relevant	No.	0	24	30	0	0
	%	0	44	56	0	0
Your admission system is reliable	No.	45	3	6	0	0
	%	83	6	11	0	0
Your admission system is comparable	No.	42	6	3	3	0
	%	78	11	6	6	0
Your admission system is costly	No.	0	3	3	24	24
	%	0	6	6	44	44
Your admission system is complex	No.	0	3	3	24	24
	%	0	6	6	44	44

From the table above, it can be seen that the current admission system in Saudi universities is flexible and is easy to use and update. In addition, it is reliable and comparable, not costly and not complex. However, neither relevant, integrated nor comprehensive. This means that depending on a set of commonly agreed indicators for monitoring the admission of students enrolled in Saudi universities helps in evaluating the overall process of admission, and, consequently, enhancing the

existing national education system in Saudi universities. This will support the process of developing admissions systems for universities in the Kingdom of Saudi Arabia. These results are confirmed by the results from the interviews.

5.3 Presenting the results from the interviews

Concerning the nature of admissions systems, the results revealed that the majority of the study sample (87%, 13 interviewees) agreed that their systems are very simple and are not comprehensive. Also, they mentioned that their systems are incomplete, don't give flexibility to the user and need to be developed to meet the requirements of the proposed system of admissions. This will support the process of developing admissions systems to universities in the Kingdom of Saudi Arabia.

When questioned about the main component of the admissions system, the results showed that the majority of those interviewed (93%, 14 interviewees) agreed that the main components of the admissions system are the student and the college. Thus, in order to help a student to select the best college according to their grade, it is necessary to develop the current Saudi admissions systems into one central system. This will save time, effort and money for users.

Concerning the development of the skills of employees in admissions systems, more than 50% of those interviewed (8 interviewees) mentioned that they develop employees' skills by putting them through training courses. However, the development of the employees' skills needs to meet the requirements of the proposed admissions system. This will support the process of developing admission systems in Saudi Arabia.

Regarding the procedures of the admissions systems, the results revealed that these procedures are a very important factor for students to gain a place on their required degree course (according to 100% of interviewees). Thus, these procedures need to be more suitable to meet the requirements of the proposed system of admission. This will support the process of developing admission systems for universities in the Kingdom of Saudi Arabia.

Concerning updating the admission systems, the results showed that some respondents (55%, 8 interviewees) felt that the admission system needed to be updated and replaced immediately. Also, the majority of those interviewed (73%, 11 interviewees) mentioned that they would design

and rebuild a new admission system for their universities. This reflects the importance of establishing a central admission system for all Saudi universities. The proposed system will save time, effort and money for users. This will support the process of developing admission systems to universities in the Kingdom of Saudi Arabia.

About the main characteristics of admission systems, the results (60%, 9 interviewees) showed that flexible and easy to use and the ability to update are the main characteristics of admission systems in Saudi universities. Improving these characteristics will provide the opportunity to develop the Saudi current admission systems to become a central admission system for all Saudi universities. The proposed system will save time, effort and money for users.

Regarding being satisfied with their admission system, the results revealed that 8 interviewees (55%) are not satisfied because their systems are not relevant and do not give multiple options for admission. Also, these systems are not unified with one another and do not give students varied opportunities or a confirmation of acceptance at a given university. Therefore, it is necessary to develop the current Saudi admission systems to become a central admission system for all Saudi universities. The proposed system will save time, effort and money for users.

Concerning the comprehensiveness of their admission systems, 8 interviewees (55%) admitted that their systems are not comprehensive. Therefore, it is necessary to develop the current Saudi admission systems to become a central admission system for all Saudi universities. The proposed system will save time, effort and money for users.

Regarding the model base in admission systems, the results showed that the majority of interviewees (93%, 14 interviewees) agreed that they take the students' data and then they compare them with the proportion of college, in some times, the simple rule based up the distribution and acceptance of students by grades. This will result in some students accepted by more than one college at the same time, thus wasting time, effort and money for users. In addition, regarding the skills required for using admission systems, the results revealed that the majority of those interviewed (93%, 14 interviewees) agreed that the system requires qualified team work. These insights will support the process of developing admission systems to universities in the Kingdom of Saudi Arabia.

When interviewees were asked for their views on developing a framework for designing, implementing and institutionalising the DSS in the Saudi admission systems, their suggestions included designing a new system which is able to address many of the existing problems, as well as the modernisation and development of the current systems into a more flexible and unified admission system for all Saudi universities. This will give students better opportunities to select the relevant college according to their grade. Implementing these suggestions requires establishing a central and unified admission system to help students gain acceptance to Saudi universities. This will support the process of developing admission systems to universities in the Kingdom of Saudi Arabia.

5.4 Discussion of survey results and testing the research hypothesis

After collecting data through questionnaires and interviews, it was necessary to analyse it in order to discuss the results. This section will discuss the findings of the survey, focussing particularly on the relationship between the DSS and improving the efficiency of the admission system in Saudi universities. However, the main results revealed that using a set of commonly agreed indicators for monitoring the admission of students enrolled in the Saudi universities helps to evaluate the overall process of admission, and, consequently, enhance the existing national educational system in Saudi universities. In addition, the current admission system in Saudi universities is not comprehensive and not relevant. Therefore, this system needs to be developed by using a DSS. Thus, applying a DSS will help to improve the current admission system in Saudi universities.

This research is based on the following hypotheses:

- The shortcomings of the admission system lead to the problems faced by students when trying to secure a place in Saudi Universities.
- Using a set of commonly agreed indicators for monitoring the admission of students enrolled in Saudi universities, leads to an improvement in the overall process of admission and consequently enhances the existing national education system in Saudi universities.
- Applying a central admission system to Saudi universities will improve the efficiency of the admission process and consequently improve national capabilities in the field of education.

To test these hypotheses, the chi-square test was applied to some of these common indicators and the results are shown in the following tables:

Table 5. 7 Chi-square test and correlation coefficient of the relationship between the availability of an advanced database and the comprehensiveness and relevance of the current Saudi admission system

Evaluation Method	Chi-square (χ^2)		Spearman Correlation Coefficient	
	Value	Significance	Value	Significance
The comprehensive	6.353	0.033	- 0.343	0.011
The relevance	5.400	0.040	0.316	0.020

Table 5. 8 Chi-square test and correlation coefficient of the relationship between the availability of a feedback system and the comprehensiveness and relevance of the current Saudi admission system

Evaluation Method	Chi-square (χ^2)		Spearman Correlation Coefficient	
	Value	Significance	Value	Significance
The comprehensive	23.040	0.000	- 0.620	0.000
The relevance	8.640	0.003	-0.400	0.003

Table 5. 9 Chi-square test and correlation coefficient of the relationship between the availability of a model base and the comprehensiveness and relevance of the current Saudi admission system

Evaluation Method	Chi-square (χ^2)		Spearman Correlation Coefficient	
	Value	Significance	Value	Significance
The comprehensive	3.664	0.160	- 0.099	0.475
The relevance	19.286	0.000	0.598	0.000

Table 5. 10 Chi-square test and correlation coefficient of the relationship between the availability of qualified people and the comprehensiveness and relevance of the current Saudi admission system

Evaluation Method	Chi-square (χ^2)		Spearman Correlation Coefficient	
	Value	Significance	Value	Significance
The comprehensive	3.971	0.082	- 0.271	0.047
The relevance	5.704	0.027	0.325	0.016

The results of the chi-square test indicate that there is a significant statistical association between the availability of an advanced database, on one hand, and the comprehensiveness and relevance of the current admission systems, on the other. This means that the availability of an advanced database affects the comprehensiveness and relevance of the current admission systems. In addition, the correlation coefficient between the current database and the comprehensiveness of the current admission system is weak and negative, whereas the correlation coefficient between the current database and the relevance of the current admission system is weak and positive.

However, the chi-square test indicates that there is a significant statistical association between the availability of a feedback system, on one hand, and the comprehensiveness and relevance of the current admission system, on the other. In addition, the correlation coefficient between the current feedback system and the comprehensiveness of the current admission system is weak and negative.

Furthermore, the chi-square test indicates that there is a significant statistical association between the availability of a model base and the relevance of the current admission system. The correlation coefficient between the current model base and the comprehensiveness of the current admission system is weak and negative, whereas the correlation coefficient between the current model base and the relevance of the current admission system is average and positive.

Moreover, the chi-square test indicates that there is a significant statistical association between the availability of qualified people and the relevance of the current admission system. The correlation coefficient between the current availability of qualified people and the comprehensiveness of the current admission system is weak and negative, whereas the correlation coefficient between the current availability of qualified people and the relevance of the current admission system is weak and positive.

Accordingly, using a set of commonly agreed indicators for monitoring the admission of students enrolled in the Saudi universities helped in evaluating the overall process of admission, and consequently enhancing the existing national educational system in Saudi universities. This means that the first research hypotheses and objectives have been achieved.

Furthermore, making improvements to the database to enable it to be more comprehensive and relevant, as well as providing the ability for effective feedback, depends on the availability of qualified people, leading to the effective application of a DSS system in Saudi universities. Therefore, this means that the second research hypothesis has also been achieved.

In addition, applying a central admission system to Saudi universities will give students the chance to apply to all Saudi governmental universities nearly simultaneously using one application form instead of several forms. In this way, they can gain acceptance to only one university according to their grades and meeting other terms and conditions, thus saving time, effort and money for users (students and administrators). Consequently, it will improve the

efficiency of the admission process, as well as national capabilities in the field of education. This means that the second research hypothesis has also been achieved.

5.4 Conclusion

This chapter has explained the rationale behind the selection processes in the institutions involved in the empirical survey used in this study. This included general and specific information about the institutions and the current status of their admission systems and procedures.

Following this, detailed descriptions of the research sample from the selected universities have been provided, along with in-depth information relating to participants in respect of their university and position, as well as their qualifications and number of years' experience.

In addition, this chapter has presented the data obtained from the empirical survey, which was carried out using a series of questionnaires and interviews. The various data obtained on the admission systems in Saudi universities were analysed and explained. Following this, the results were discussed and the hypotheses tested.

Following the thorough analysis of all information and data obtained during this process (from questionnaires and interviews), the researcher has concluded that the current admission systems in Saudi universities are flawed, and he has highlighted a number of issues and shortcomings that need to be addressed. The next chapter will describe how to improve the admission processes in the universities of Saudi Arabia, depending on DSS to rectify the current problems. This will require establishing a new framework for the Saudi admission system. These issues will be discussed in the next chapter.

Chapter 6

A New Framework in Saudi Arabia (Prototype)

Objectives:

- Present a framework for admission system for the Saudi universities.
- Describe the proposed system according to all stakeholders.
- Present an evaluation of the proposed system.
- Present the proposed program as print screens.
- Present a critical review of the proposed system.

6.1 Introduction

Due to challenges faced by the higher education system in the KSA (including admission systems), as mentioned in the previous chapter, these systems need to some improvements and developments. This requires establishing a new admission system for the Saudi universities. Saudi universities need a smart decision support system (DSS) that can be applied at the national level for all Saudi universities that will remove challenges and problems. The proposed admission system will consider many factors and assign a new grade and major to each student.

Accordingly, the purpose of this chapter is to develop a framework for designing a central and unified admission system that will improve the admission process for Saudi universities based on the evaluation outcomes in Chapter 5. It is anticipated and expected that this new admission system will lead to a drastic improvement in the quality and effectiveness of the admission process in Saudi universities.

In spite of the benefits of the proposed system, this system needs huge effort, cost, and time for implementation, especially in the short term. It needs, also, regular update based on new circumstances, especially the development in IT. In general, the return of investment in the proposed system will be excellent.

6.2 Framework design of UASA

The framework of the admission system which will meet the requirements of the proposed admission system and also help the end users is as follows:

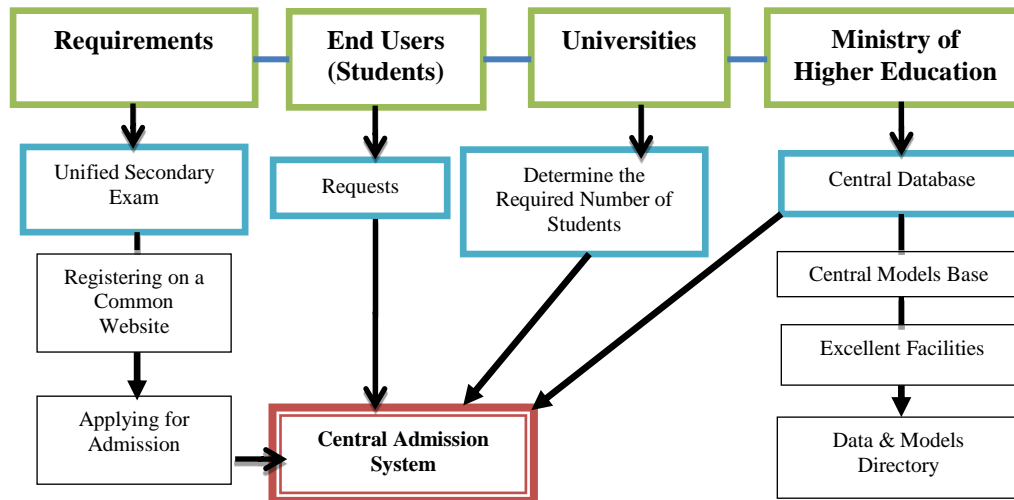


Figure 6 1 Framework of UASA

According to Figure 6.1, the requirements for university admission are a unified secondary exam, registering on a common website, and then applying for admission to Saudi universities. In addition, each student needs to fill in an application form with his (her) requests, and then submit it to a central admission system website. Universities are also required to determine the required number of students for each college. Each student will then receive his (her) acceptance in only one university via the central admission system website. Therefore, the Ministry of Higher Education should have a central database, a central models base, excellent facilities and a database and models directory.

6.3 A Prototype for UASA

A prototype is a sample, model or release of a product or system built to test a concept or process, or to act as an item to be replicated or learned from. It is a term used in a variety of contexts, including semantics, design, electronics and software programming. A prototype is designed to test and try out a new design (product or system) to increase accuracy for system analysts and users. Prototyping serves to provide specifications for a real, working system rather than a theoretical one (Wikipedia, 2014). This means that the prototype is a design tool used to help create a new system, much like a model.

There are different kinds of prototypes; some are more like rough drafts and some are more like final versions (Howstuffworks.com Contributors, 2011). It is possible to use prototype testing to reduce the risk that a design may not perform as intended; however, prototypes generally cannot eliminate all risk. There are pragmatic and practical limitations to the ability of a prototype to match the intended final performance of the product or the system and some allowance for

judgment is often required before moving forward with a production design (Wikipedia, 2014). The prototype used in this study can be explained as follows:

To enter requests, users should log into the central admission system within Saudi universities by entering their ID and password on the Ministry of Higher Education website. If the user is non-Saudi, requests will be entered directly at Stage Three. Conversely, if the user is a Saudi they will be presented with two options depending on whether they are a new or old user. Then, if you are an old user or a new user, you will have another two options: your grade from inside or outside the KSA. After this, you need to enter your requests according to your grade. There are three stages according to students' grade. For example, these could be defined as: Stage One for a grade of 90% or more, Stage Two for grades between 75% and just less than 90%, and Stage Three for grades between 60% and just less than 75%. The proposal gives students all available chances to get a place in the best faculty, taking into account their requests and marks, and the student's priorities. This can be seen in Figure 6.2.

Some scenarios are presented below:

Scenario 1: A student, who is interested in pursuing law, goes online to check the proximity and the requirements of law colleges in the KSA. After deciding on which colleges he wishes to apply to, he then enters the official website of the Ministry of Higher Education of the KSA, logs in using his personal ID and password, follows the given instructions, and fills in his grades and requests for the colleges he decided upon earlier in a related step within his stage (Stage 1, Stage 2 or Stage3). After reviewing his data carefully, he then submits it to the admissions office to be reviewed and sorted. The admissions office, after reviewing and matching his grades with his requests, sends him a report, which shows which requests he is eligible for. If he, indeed, gets accepted into his college of choice, he just waits for further instructions from the given college, e.g. regarding interviews. If, on the other hand, he doesn't get accepted into his college of choice, he has the option of choosing a single college, as his last resort, from a select few based on his grades and administrative region.

Scenario 2: In the old admission systems, medical colleges with an average of 500 available places, each get an average of 1500 applications. About half of these applications are

made by the same students, i.e. the same student applies to each and every medical college within the Kingdom. This blocks opportunities for the other half of the applications to be accepted. This dilemma is prevented in the new admission system, since each student will be allowed one application form and will only get accepted by the college most suitable for his capabilities.

Scenario 3: Student X in the new admission system, who would like to apply for a Medical college but prefers a college in his (or her) district and isn't sure he (or she) will be accepted, starts by applying to his (or her) local Medical college and then fills up other medical colleges by order of proximity, all in one application form. However, the same student under the old admission systems would have to literally go to each and every medical college inside and outside his (or her) district (taking days or even weeks) in order to apply to every medical college within the KSA to ascertain entry to a Medical college. This means the proposed admission system will save money, effort and reduce cost. (Note: the new admission system will be two subsystems one will be for male students and the other one will be for female students).

The steps for applying for a place under the proposed system are the following:

- Step 1:** The student shall check out the colleges, departments and percentages required for admission to the public universities and technical colleges in the KSA
- Step 2:** The student shall enter the official website of the Ministry of Higher Education of the KSA.
- Step 3:** Then, the student shall log in to the website using his personal ID and given password.
- Step 4:** Then, the student must select his (or her) administrative region e.g. Riyadh, Makkah, etc.
- Step 5:** Then, the student, if Saudi, must opt for yes in the tab for Saudi (yes or no). If not, the student must select “no”.
- Step 6:** If the student chooses “yes”, then he (or she) will be asked whether he (or she) is a new user or an old user, accordingly.
- Step 7:** Then, the student has to fill his (or her) relevant grades in the available tabs.
- Step 8:** Then, the student fills in his requests (which universities the student desires) according to the student’s grades and priorities.
- Step 9:** Then, the student saves his (or her) applied data and submits them to the website.
- Step 10:** The admissions office – a central Ministry of Higher Education office -, meanwhile, receives the students’ submitted data and then assorts these data based on several criteria

including administrative region, student grades, student requests, etc., thereby acting as a central office for students from all places. Then, the admissions office tries to match the students' submissions to the available seats in the respective universities across the KSA based on the aforementioned criteria.

- Step 11:** Finally, the student waits for the results of the matching process. He will get acceptance for only one selection (one place) from the Central Admission Centre. This will be based on several criteria including administrative region, student grades, student requests, etc.
- Step 12:** In case a student is not allocated at a university of choice in his (or her) locality, he (or she) has the option of submitting a request to the admissions office for them to reconsider the student's submission and try to find him an equivalent seat in a nearby university.
- Step 13:** In case the student doesn't get accepted into his (or her) college of choice – the number one college the students wishes to enrol into - or in the worst case scenario doesn't even get accepted into any of his (or her) requested colleges – the total list of colleges applied for by the students - , he (or she) has the option of choosing only one college from a few colleges selected by the admissions office according to the student's respective grade.
- Step 14:** Candidates for interviews at colleges that require a personal interview will be notified as they enter the unified admission portal on the day specified in the submission schedule. This will be supported by SMS and e-mail. If universities reject a student after the interview, the student will get acceptance from another university according to his grade.
- Step 15:** In case of non-Saudi students, they follow almost the same steps but are restricted by certain conditions and regulations. For example, only a handful of colleges accept submissions from non-Saudi students. Furthermore, these particular colleges assign certain minimum scores, below which the student's submission is not even considered.

These steps are summarised in the following figure:

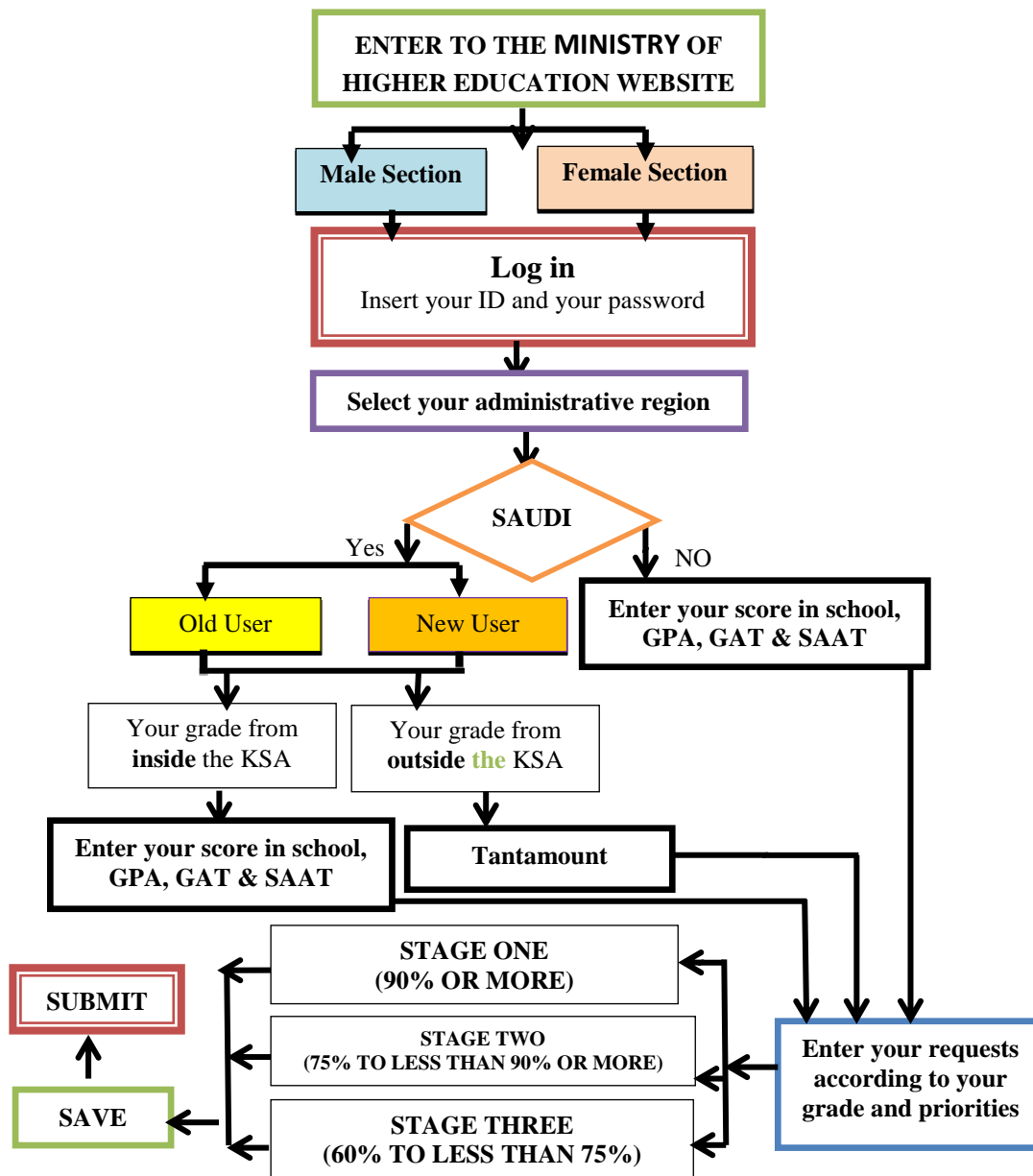


Figure 6 2 Proposed procedural framework for UASA

To create a new account, users have to access the Ministry of Higher Education website and fill in an application form. If the user already has an account, they have the option of updating their personal details if they have not previously done so. Once this has been done, the form can then be submitted, as shown in the following figure:

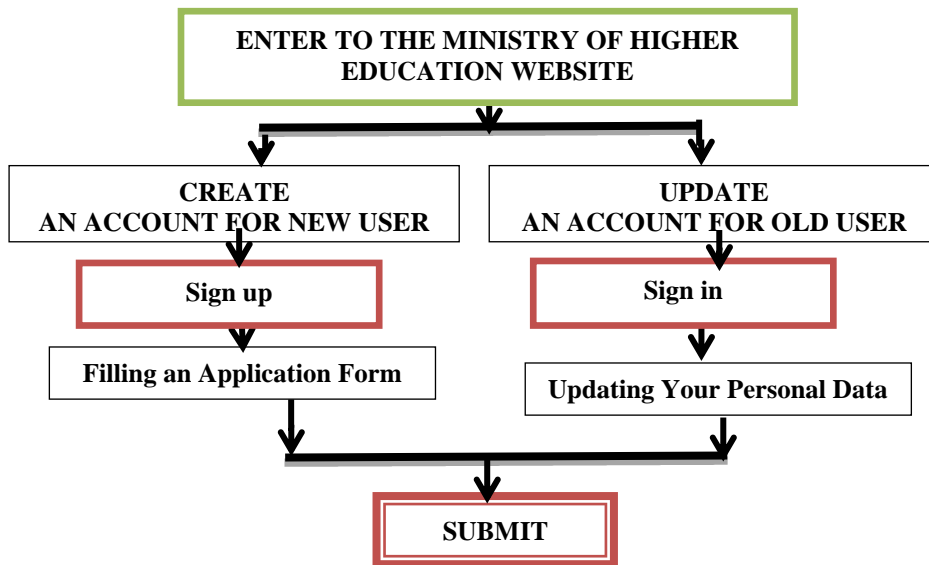


Figure 6 3 How to create an account for a new user and update one for an old user

The steps to create or update an account are as follows:

Step 1: The student shall enter the official website of the KSA Ministry of Higher Education.

Step 2: The student chooses whether to update their existing account or (if the student hasn't yet created an account) to create a completely new account.

Step3: In the first case, the student signs in to the existing account and simply updates their data as required, e.g. photos, grades, etc. In the second case, the student signs up for a new account and fills in an application form from scratch. In a final stage for both cases, the student submits whatever data they have filled in.

The administrative regional divisions of the KSA, included by the Royal Decree No. A/92 dated 27/8/1412H, are based on the regional government system and are regarded as the basis of collection, distribution, and publication of geographical and statistical data. The Kingdom is divided into 13 regions as shown in the following table:

Table 6 1 The administrative regional divisions of the KSA (Wikipedia, 2011)

Code Number	Region	Headquarter
01	Riyadh Region	Riyadh Region
02	Makkah Region	Makkah City
03	Madinah Region	Madinah City
04	Qassim Region	Qassim City
05	Eastern Region	Eastern City
06	Asir Region	Abha City
07	Tabouk Region	Tabouk City
08	Hail Region	Hail City
09	Northern Border Region	Arar City
10	Jizan Region	Jizan City
11	Najran Region	Najran City
12	Baha Region	Baha City
13	Al-Jouf Region	Sikaka City

The administrative region is divided into several governorates, its numbers differing from one region to another. The governorate is divided into municipalities that are administratively related to the governorates of Emarah. The Administrative Regions of the KSA are illustrated in the following maps:

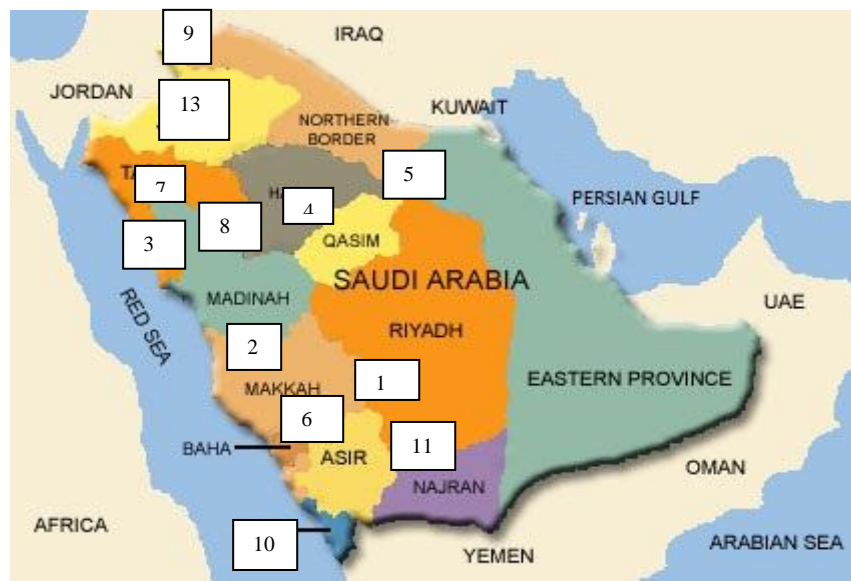


Figure 6 4 Map of the administrative regional divisions of the KSA (United Nations, 2004)

It is worth noting that the relationship between the student and the central admission system includes a request from the student, as either a new or old user, to the E-student system on the Ministry of Higher Education website, then a request from the E-student system to the observation system in the central admission system within Saudi universities. The request will generate a response from the observation system to the E-student system, followed by a response from the E-student system to the user. This can be shown in the following figure:

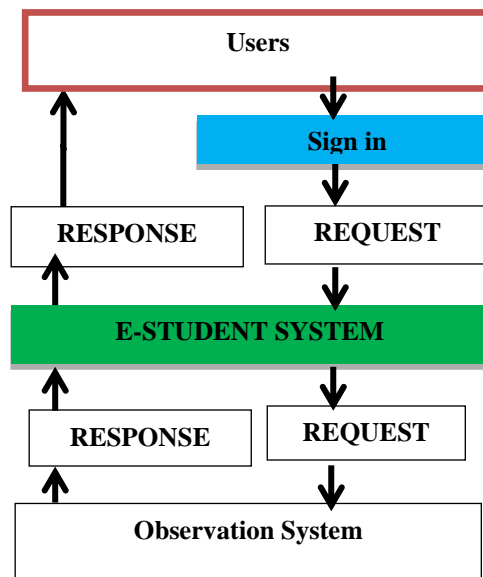


Figure 6 5 The relationship between the student and the central admission system

6.4 The proposed system description according to all stakeholders:

The proposed system includes a central admission system website for students' registration at Saudi universities. The website is designed with HTML. Each university will have at least one account on the website which allows them to check and follow up on students' requests. The website is designed to divide the users into three types (stakeholders): Student, Employee, and Administrator. The responsibilities of the three types will be as follows:

a) The responsibilities of student include:

- The student must register on the website in order to apply to a faculty.
- The student has the option to submit requests (up to 40 requests or faculties) to apply for a place within a faculty. These are ordered according to the student's preferences.
- The student can check the status of his or her application at any time.
- The student will receive an automatic email informing them of any decision that has been made.

b) The responsibilities of the admissions office employees include:

- The employees at the admissions office receives the students' submitted data and then sorts these data based on several criteria including administrative region, student grades, student request, etc., thereby acting as a central office for students from all places. Then, the admissions office tries to match the students' submissions to the available seats in the respective universities across the KSA based on the aforementioned criteria.

- The employee rechecks everything once again before finalizing the outcome to avoid unwarranted errors.
 - The employee is able to display and search for student requests.
 - The employee registers the students' college application and secures his or her college seat.
 - The employee responds to the students' enquiries and requests.
- c) The responsibilities of the administrators include:
- The administrator has full privileges over the admission system.
 - The administrator is able to gain access at any time to the admission system.
 - The administrator is able to maintain and make updates to the admission system.
 - The administrator is responsible for managing office equipment.
 - The administrator is responsible for handling external or internal communication or management systems.
 - The administrator manages clerical or other administrative staff.
 - The administrator organizes, arranges and coordinates meetings.
 - The administrator supervises employees' work and analyses feedback from the students for better service.

The website is created with ASP.net using visual basic. The system will identify the user types at the login stage and display the different options for each type of user.

6.5 The proposed program

This prototype was developed to give an outline of the proposed admission system and make the development easy. The prototype includes several forms. For more details regarding this prototype, see **Appendix D**.

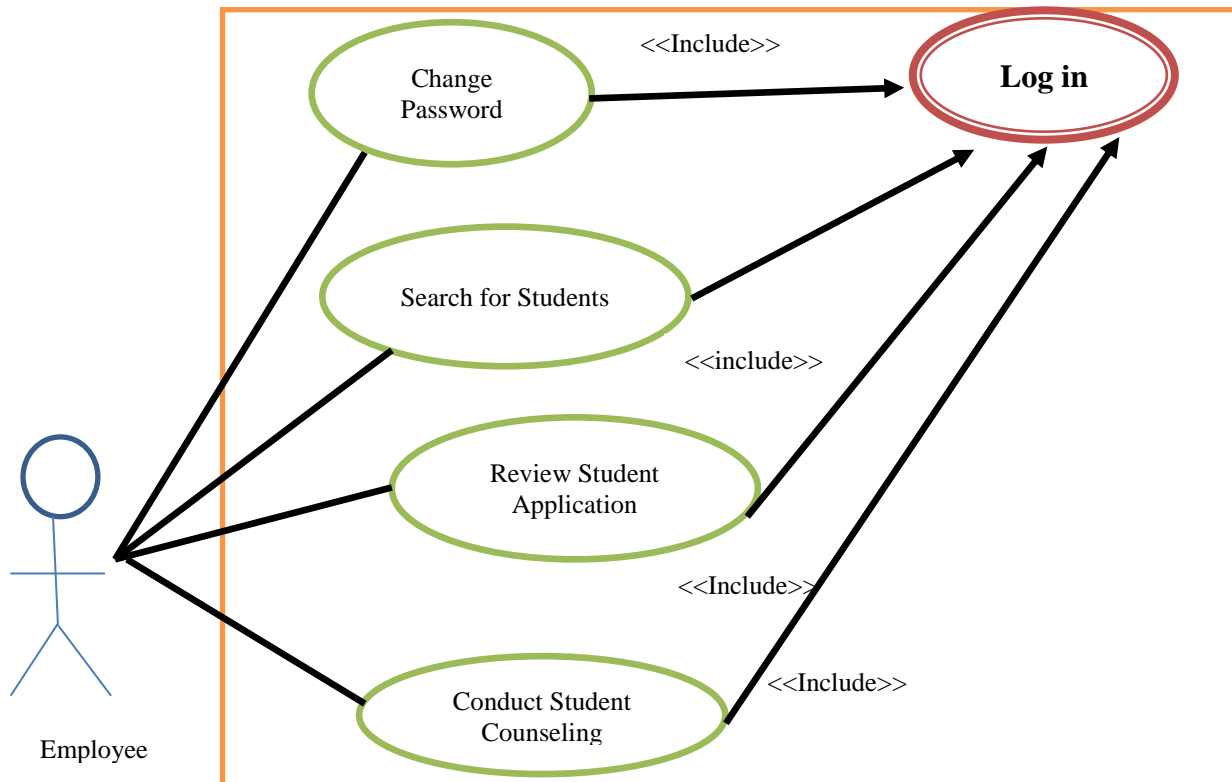


Figure 6 6 Ministry of Education – cases of employee use

As shown in Figure 6.6, university employee will search for students who registered into the portal for universities admission system based on criteria like grades, region and his major, and employee will find the list of student applications which matching his criteria. Moreover, university employee will review the student applications. Then, university employee will send notification to the student if the application satisfies his university criteria. Then, university employee will review the response notifications from the student based on that he will arrange counselling. Then, University employee will conduct counselling with students who accepted the interview and negotiation will happen between university and students. Finally, University will offer the major course to student.

General assumptions:

All users have unique permissions based on the roles assigned to them, and each requires valid login credentials. When a user logs in through the Ministry of Higher Education Portal, the system will authenticate the login and authorise the users to access the assigned resources, based on user roles and system functions. This is summarised in the following table:

Table 6 2 Ministry of Education – cases of employee use

User Case Name	Description
Change Password	Irrespective of roles, a user who logs into the system can change his password at any time
Search for Students	University employee will search the students who registered into the portal for universities admission system based on criteria like grades, region and his major and employee will find the list of student applications which matching his criteria.
Review Student Application	University employee will review the student applications
Conduct Students Counselling	University employee will conduct counselling with students who accepted the interview and negotiation will happen between university and students

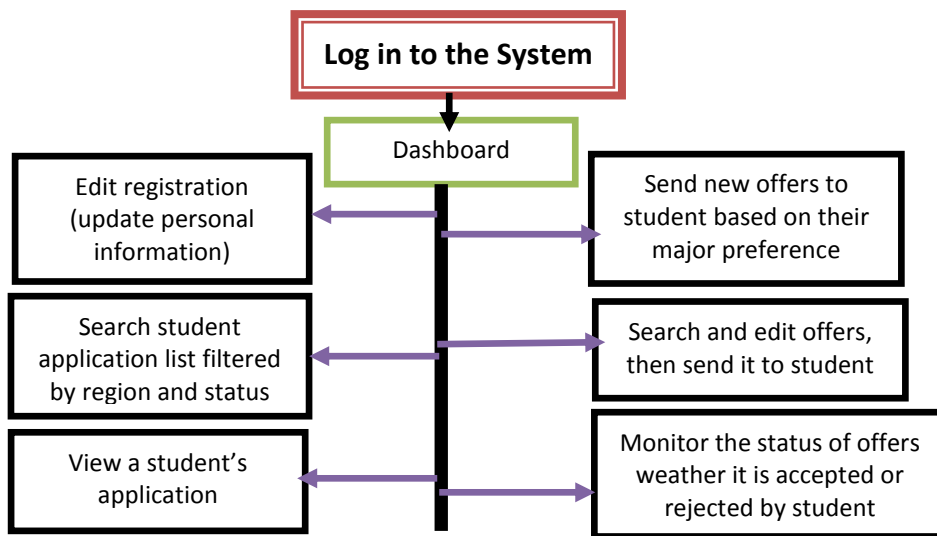


Figure 6 7 Employee workflow

As demonstrated in the figure above, the employee will Edit registration (update personal information). Then, he (or she) will search for student application list filtered by region and status. Then, he (or she) will view application of an applicant. After that, he (or she) will send new offers to students based on their major preference. Then, he (or she) will search and edit offers, then send it to students. Finally, he (or she) will monitor the status of offers weather it is accepted or rejected by student.

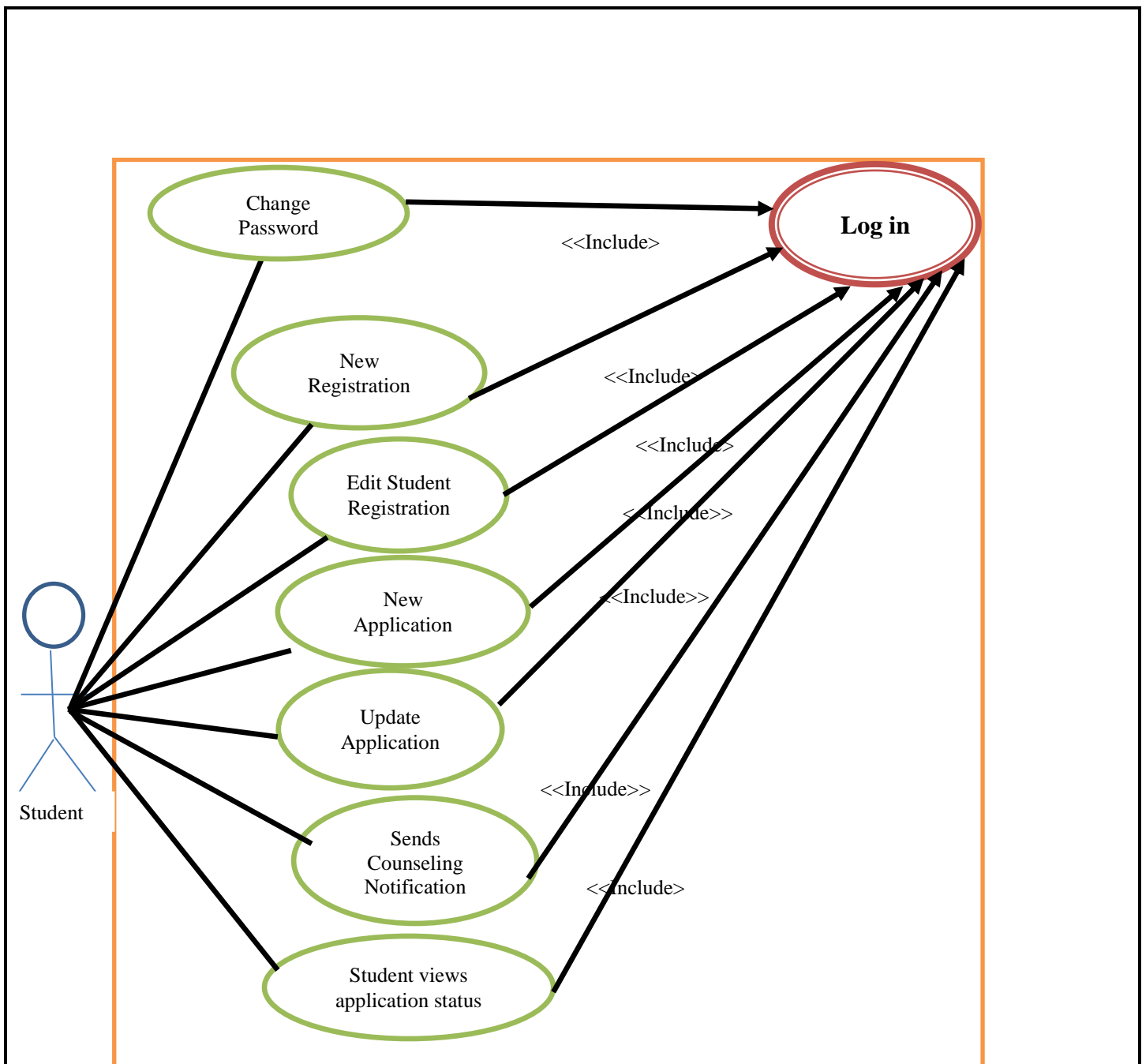


Figure 6 8 Ministry of Education – Cases of student use

Figure 6.9 shows that by using their ID card number as reference, the student can register on the portal, fill in personal information and obtain a user name and password. The student can also update their personal information. The student fills in the application by giving their grades, region and chosen major. This can also be edited later. The grade system automatically evaluates the student’s application and assigns the stage based on the percentage attained (Stage 1 is 90 % or more, Stage 2 from 75 % to less than 90%, Stage 3 from 60% to less than 75%). Student will receive notification from the university for counselling. Finally, after counselling, the student will either be accepted or rejected by the university. This is summarised in the following table:

Table 6 3 Ministry of Education – Cases of student use

User Case Name	Description
Change Password	Irrespective of roles, any user who login into the system can change his password at any time.
New Registration	Student can register himself with his personal information along with user name and password in the portal by using ID card number as reference.
Edit Student Registration	Student can update his personal information
New Application	Student fills the application with his grades, region and his major
Update Application	Student can edit the application with his grades, region and his major
Counselling Notification	Student will receive notification from the university for counselling
Accepts/Rejects Counselling	Student Accept or Reject the Counselling Request

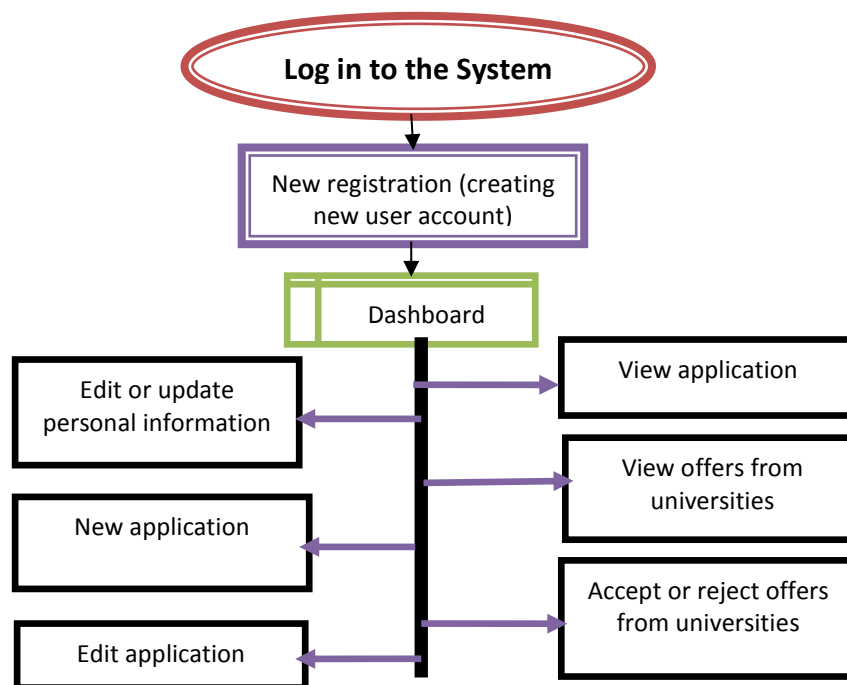


Figure 6 9 Student workflow

As shown in Figure 6.10, the student can edit and update personal information or start a new application. They can view their application and view offers from universities. Finally, they can accept or reject the offers from universities.

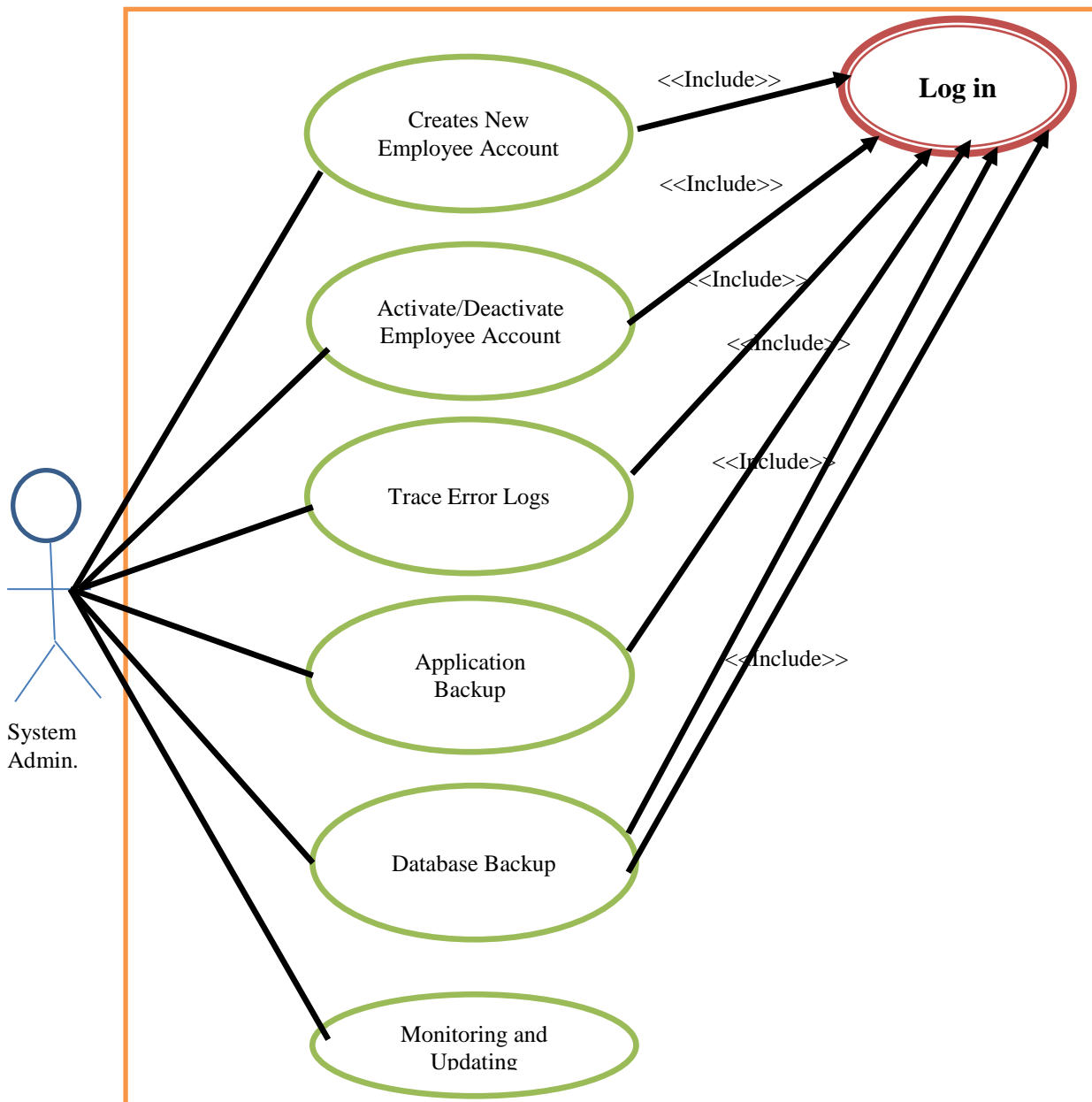


Figure 6 10 Ministry of Education – Cases of administrator use

As shown in Figure 6.11, the system administrator creates employee accounts for universities. They can also activate or deactivate the university employee account. The system administrator traces error logs generated by the portal to review bugs in the system. The system administrator will also backup the application and database. Finally, the system administrator monitors and updates the system in order to improve performance. This can be summarized in the following table:

Table 6 4 Ministry of Education - Cases of administrator use

User Case Name	Description
Creates New Employee Account	System admin creates employee accounts for universities
Activates / Deactivates Employee Account	System admin activates or deactivates university employee account
Trace Error Logs	System admin traces error logs generated by the portal to review bugs in the system
Application Backup	System admin backups application
Database Backup	System admin backups database
Monitoring and Updating	System admin performs monitoring updates to increase the performance of the system

Figure 6.12 shows how the administrator can edit and update their personal information. They can search the student application list filtered by region and status and view applications. In addition, they can manage user accounts for students, employees and administrators. The administrator also has the ability to search for student, employee and administrator accounts, and can send new offers to students based on their major preferences. In addition, they can search and edit offers, then send an offer to a student. They can also monitor the status of offers and whether an offer is accepted or rejected by the student. Finally, they can manage regional information and university information.

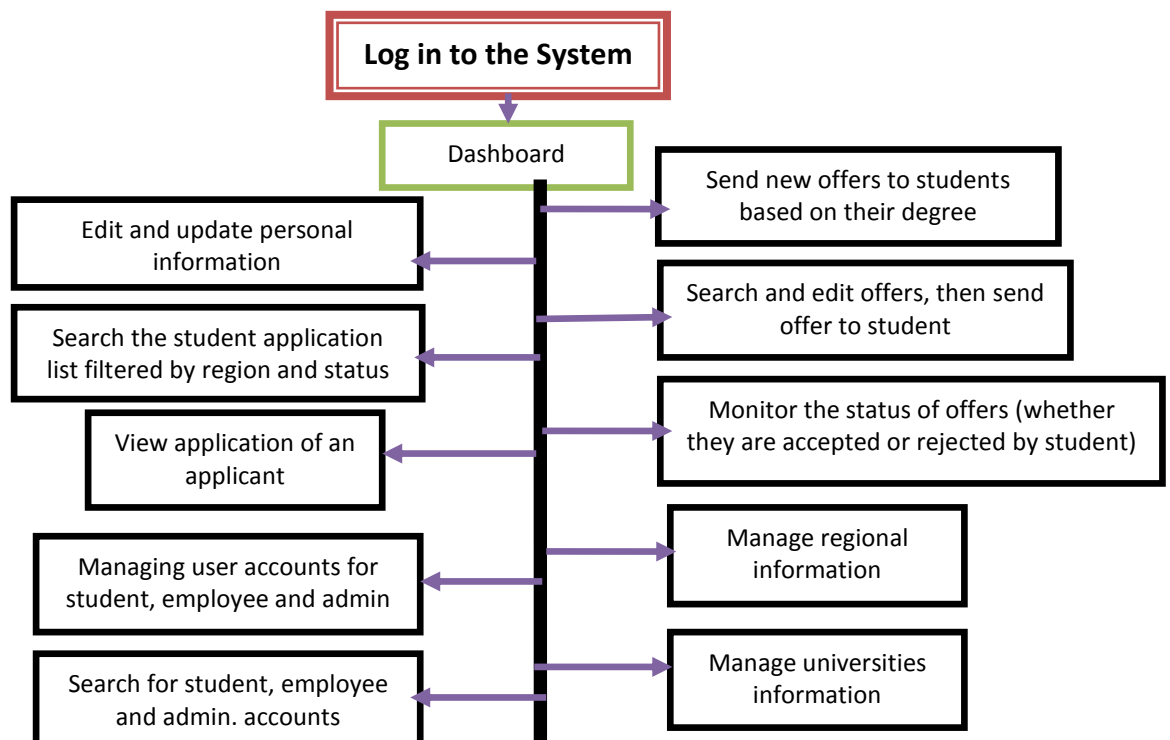


Figure 6 11 Administrator workflow

Business process diagram



Figure 6 12 The process of the system

The business process diagram in Figure 6.13 describes the system process, as follows:

- Step 1: The process starts when a student signs up to the central admission system on the Ministry of Higher Education website.
- Step 2: The central admission system assigns admission stages (Stage One 90 % or more, Stage Two from 75 % to less than 90%, Stage Three from 60% to less than 75%).

- Step 3: The central admission system assigns student applications to the appropriate stage according to their marks.
- Step 4: The central admission system maintains the pool of student applications.
- Step 5: University employees can search the application from the pool of students based on their selection criteria.
- Step 6: The administrator reviews the student applications. When an application meets the specified criteria the application will be selected for counselling. If the application is rejected for a particular request, then, it will be sent back to the application pool and considered for the next request requested (step 3).
- Step 7: Notification will be sent to the applicant for counselling; if it is accepted by the student then counselling will be conducted, otherwise the application will send back to the application pool (step 3).
- Step 8: Counselling between the student and university will be conducted if the student accepts the major offered. Following a successful discussion, the student will, then, be enrolled at the university. His or her application will, then, be removed from the application pool. If the counselling is unsuccessful the application will go back to the application pool (step 3).

6.6 Prototype testing

In order to test the prototype for the Saudi universities, we interviewed potential users of the proposed admission system. This process will help us gain valuable feedback. In order to test the prototype, interviews were conducted with a group of admission staff from the Ministry of Higher Education in Saudi Arabia, during which we opted to use closed questions.

The interviews included three parts:

- a. The first part aimed to collect general employee data about the interviewees.
- b. The second part aimed to test the prototype for Saudi university admission through running the new system.
- c. The third part aimed to gather suggestions related to developing the proposed prototype for Saudi universities.

The sample selected for interview included 25 persons from the admission department.

In order to test the proposed admission system in the Saudi universities, the researcher interviewed potential users (admission system administrators). This process will help to give valuable feedback for the evaluation process. The proposed system is distributed as a document

(Appendix D) and is explained to them orally before making interviews with a sample of admission system administrators. They know the problems of the current systems. The differences between the current systems and the proposed system are explained to them.

The interview schedule in this study consisted of three parts. **Part One** aimed to collect general data about the interviewees, such as their positions, their qualifications and their number of experiences in years in respect of using University admission systems. This part was divided into three items. **Part Two** aimed to evaluate the proposed admission system for Saudi universities. This section was divided into ten items. **Part Three** aimed to collect suggestions related to developing the proposed admission systems in Saudi universities. This section consists of one item.

For **Part Two** of the interview open-ended questions were used to facilitate the data analysis. The researcher selected the criteria used in Part Two of the interview to compare the current admission system and the proposed admission system, and consequently, to achieve the research objectives. These factors were identified from the earlier interviews and questionnaires which were carried out at the start of the research, and were chosen to help evaluate the proposed admission system.

Part Three involved the process of gathering more detail on the nature of the proposed admission system in Saudi universities. These details will help to evaluate the proposed admission system. Moreover, this part of the interview will back up the data collected in part two.

The interviews were conducted with a sample of admission staff from the Ministry of Higher Education in Saudi Arabia. The initial consultation was used for feedback and evaluation of the prototype. The sample of interviews included around 25 persons.

Some of the criteria used were common indicators mentioned in many references, such as: the Cost/Benefit Indicator, Reliability Indicator, Comparability Indicator, and so on (for example see: Irani and Love, 2008 and Gordana and Nedo, 2009). The criteria used explained the features of the proposed system and supported the effectiveness of the prototype.

Qualitative analysis (such as, frequency distribution) was used in order to analyse the data collected by interviews. The researcher depended on presenting a summary of the main points and ideas that related to the evaluation of the proposed system.

It emerged from the interviews that the majority of the interviewees work with the universities' admission system at the Ministry of Higher Education, seven of whom have PhDs in Computer Science and Information Systems, one has a Masters in the field of Information Systems, and eight have bachelor`s degrees in Computer Science. In addition, their experience ranges from 2 years to 8 years. However, interviews were also carried out with nine employees who use the admission systems in King Saud University, Prince Sultan University and Imam Mohammed Ibn Saud Islamic University. Six of them have bachelor`s degrees, while three have a diploma in different fields, as shown in the following table:

Table 6 5 General data of the interviewees

No.	Position	Academic Qualifications	Number of years' experience
1	Vice-ministry of educational affairs	Ph.D. degree	8
2	General manager of IT for admission systems	Ph.D. degree	6
3	General supervisor of admission systems	Ph.D. degree	5
4	The head of the admission department	Ph.D. degree	4
5	General manager of admission coordination	Ph.D. degree	7
6	Manager of information centre for admission	Bachelor`s Degree	3
7	General manager of admission results	Bachelor`s Degree	8
8	General manager of admission centres	Ph.D. degree	7
9	Database manager	Bachelor`s Degree	8
10	General manager of admission systems	Ph.D. degree	6
11	Supervisor of admission systems	Bachelor`s Degree	3
12	Supervisor of admission systems	Bachelor`s Degree	2
13	Supervisor of IT for admission systems	Bachelor`s Degree	4
14	Supervisor of IT for admission systems	Bachelor`s Degree	3
15	Manager of admission systems	Master`s Degree in IS	6
16	Supervisor of admission coordination	Bachelor`s Degree	3
17	Manager of admission system in KSU	Bachelor`s Degree	7
18	Supervisor of admission system in KSU	Bachelor`s Degree	4
19	Employee in admission system in KSU	Diploma	3
20	Manager of admission system in IMISIU	Bachelor`s Degree	6
21	Supervisor of admission system in IMISIU	Bachelor`s Degree	4
22	Employee in admission system in IMISIU	Diploma	2
23	Manager of admission system in PSU	Bachelor`s Degree	5
24	Supervisor of admission system in PSU	Bachelor`s Degree	4
25	Employee in admission system in PSU	Diploma	2

From Table 6.6, it can be seen that more than 60% of interviewees agreed that the proposed admission system is comprehensive and that it will serve all governmental universities. In addition, the majority of the interviewees (around 75%) agreed that the proposed admission system is flexible and easy to use. Furthermore, 70% of the interviewees agreed that the proposed

admission system is easy to update and control as it primarily depends on advanced technology with the concept of the program being simple and clear. 60% of the interviewees agreed and 20% disagreed with the fact that the proposed admission system is relevant and reliable because the proposed system is a new system and they did not have enough knowledge about it. However, 50% of the interviewees agreed and 30% of the interviewees disagreed with the fact that the proposed admission system is comparable with the existing one. Finally, 80% of the interviewees mentioned that the proposed admission system is costly and complex. This means that the proposed system will require a lot of money and effort. This will only be in the short term, however. In the long term, the benefits of the proposed system will outweigh its costs.

Table 6 6 Testing the proposed system for admission in Saudi universities

Commonly Agreed Indicators		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
3.1- The Proposed Admission System Is Comprehensive	No		15	5	5	
	%		60%	20%	20%	
3.2- The Proposed Admission System Is Flexible	No		19	2	4	
	%		75%	10%	15%	
3.3- The Proposed Admission System Is Easy to Use	No	1	19	2	4	
	%	10%	75%	10%	20%	
3.4- The Proposed Admission System Is Easy to Update	No		18	2	5	
	%		70%	10%	30%	
3.5- The Proposed Admission System Is Easy to Control	No		18	3	4	1
	%		70%	10%	20%	10%
3.6- The Proposed Admission System Is Relevant	No		15	5	5	
	%		60%	30%	20%	
3.7- The Proposed Admission System Is Reliable	No		15	5	5	
	%		60%	30%	20%	
3.8- The Proposed Admission System Is Comparable	No		13	5	5	2
	%		51%	30%	20%	10%
3.9- The Proposed Admission System Is Costly	No		20	1	1	
	%		80%	10%	10%	
3.10- The Proposed Admission System Is Complex	No		20	4	1	
	%		80%	16%	4%	

From this, it can be concluded that the proposed admission system for Saudi universities is efficient and effective. On the other hand, the sample selected for interview believed that this system will consume a large amount of money, effort, and time, because it will be costly and complex. This will be in the short term. However, in the long term, the benefits of the proposed system will outweigh its costs. The main objectives of the proposed solution are to save effort, time and money for users in the long term. With the proposed system, students are only required to submit one application form which covers all governmental universities and they will be

offered only one place at one university at any given time. Moreover, the proposed system will give students all available chances to get a place in the best faculty, taking into account their preferences and grades.

A number of interviewees were neutral regarding the introduction of the proposed system. This reflects the necessity of taking care before introducing the proposed system, because this system is new and unique to the Gulf Area generally and to the KSA, in particular. This means that the interviewees from the Ministry of Higher Education in the KSA do not have enough knowledge about the proposed system. Consequently, those people need to be educated about the new system through, for example, training workshops to furnish them with enough information, especially in view of plans already in place to establish a similar system in the KSA.

It is also noted that, while 80% of the interviewees said that it is a complex system, 60% stated that it is easy to use, update, and control with appropriate training. This confirms the fact that the proposed system is a large, comprehensive, central system that can meet the needs of several types of users. It highlights the importance of preparing qualified teams to implement the proposed system through organising training courses.

Regarding the second part of the interview, 22 interviewees (88%) suggested establishing an integrated database for supporting the proposed admission system. In addition, another interviewee suggested preparing a qualified team to implement the proposed admission system effectively. They suggested planning workshops and seminars in order to build up qualified teams for working with the system. In addition, they indicated that it is necessary to introduce help and support for system users, both employees and students. This reflects the importance of the proposed admission system within Saudi universities.

The researcher met 25 interviewees for follow up interviews which lasted around 30 minutes. In these meetings, the interviewees emphasised the importance of the proposed admission system to Saudi universities. They reiterated that the system will be easy to use by a qualified team working with new technology and relevant software. Although implementing the new system would require a huge amount of effort, money and time, it will ultimately lead to the optimum use of available resources and the achievement of targets in the field of education in the KSA in the long term. Some interviewees intimated that they were afraid of the system, because it was new to them and they did not have enough knowledge about it. However, they mentioned that with good

design and implementation, it would be effective and acceptable. In addition, to apply the proposed system effectively, it would be necessary to let the students, parents and other interested parties know the main features of the new system. Some interviewees mentioned that the new system would initially face some difficulties, but that it would be easy to use in the future, because it is flexible. Therefore, it would take time for the new system to gain total acceptance. According to some interviewees, the Ministry of Higher Education in the KSA intends to apply a similar system during the coming years. This in itself supports the view that a new admission system is required for Saudi universities.

20% of interviewees disagreed with several points, because the proposed system is a new system and they do not have enough knowledge about it. They are therefore worried about factors such as cost, efficiency, and whether the program will be a success. These concerns will apply in the short term. However, in the long term, the benefits of the proposed system will outweigh its costs. The time schedule for the whole process will depend on several factors, such as the availability of qualified people, the required programs and equipment, and the necessary money. However, the time scale proposed for putting this system into place is from 2 to 3 years.

The acceptability criteria for applying the new system include total cost, time needed to establish the system, employee qualifications, available budget, available technology etc.

6.8 How do students apply for admission under the proposed system?

With the current admission systems, students can apply to multiple universities in Saudi Arabia, and can therefore be accepted into more than one college. This could result in missed opportunities for other students who may miss out on places allocated to students who then opt for a course in another college. Under the proposed system, students are only required to submit one application, which covers all governmental universities, and through the process of the new system, they will be offered only one place at one university at any given time. In other words, the current admission systems allow students to apply to and gain acceptance from more than one college at the same time. Although they then accept one college and enrol in it, they will keep the offers of courses from other colleges for at least one or two years.

In order to evaluate the proposed admission system for Saudi universities, the researcher distributed questionnaires to 100 new students in two governmental universities (64 from King Saud University and 36 from Imam Mohammed Ibn Saud Islamic University). This process will

help to gain valuable feedback for the evaluation. The researcher selected only governmental universities, because it is suggested that the proposed system will only apply to the governmental universities. The proposed system is distributed to students as a document (Appendix D) and is explained to them orally before distributing the questionnaires. Some of students asked some questions for further explanations.

The questionnaire comprises two parts. **Part One** aims to evaluate the proposed admission system for Saudi universities. This section contains eight questions. **Part Two** aims to gather suggestions related to developing the proposed admission system. This section contains one question. The results are as follows:

Table 6. 7 Testing the proposed system for admission to Saudi universities

Commonly Agreed Indicators		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
1- The Proposed Admission System Is Comprehensive	No	20	60	20		
	%	20%	60%	20%		
2- The Proposed Admission System Is Flexible	No	15	75	10		
	%	15%	75%	10%		
3- The Proposed Admission System Is Easy to Use	No	10	80	10		
	%	10%	80%	10%		
4- The Proposed Admission System Is Relevant	No	20	60	30		
	%	20%	60%	30%		
5- The Proposed Admission System Is Reliable	No	20	60	30		
	%	20%	60%	30%		
6- The Proposed Admission System Is Comparable	No	10	50	40		
	%	10%	50%	40%		
7- The Proposed Admission System Is Costly	No		80	10	10	
	%		80%	10%	10%	
8- The Proposed Admission System Is Complex	No		80	10	10	
	%		80%	10%	10%	

When the data is analysed, it can be seen that more than 80% of the research sample agreed that the proposed admission system is comprehensive, because it will serve all students in the governmental universities. In addition, the majority of the research sample (around 90%) agreed that the proposed admission system is flexible and easy to use. Furthermore, 80% of the research sample agreed that the proposed admission system is relevant and reliable because the proposed system is a comprehensive system. In addition, 60% of the research sample agreed with the fact that the proposed admission system is comparable. Finally, 80% of the research sample said that the proposed admission system is not costly and not complex. This indicates that the proposed system will be generally acceptable.

According to the above results, it can be concluded that the proposed admission system for Saudi universities is efficient and effective. The proposed solution saves effort, time and money for students and their parents. With the proposed system, students are only required to submit one application form which covers all governmental universities and they will be offered only one place at one university at any given time according to their grades and preferences. Moreover, the proposed system will give students all available chances to get a place on the best faculty, taking into account the student's preferences and grades.

Regarding Part Two of the questionnaire, 88 people from the research sample (88%) suggested establishing an integrated database for supporting the proposed admission system. In addition, 80 people (80%) suggested preparing a qualified team for implementing the proposed admission system effectively.

6.9 Critical review

In spite of the benefits of the proposed systems, implementation would result in considerable costs and a huge amount of effort, and a realistic timescale for implementation is needed. It would also need to be regularly updated, based on new circumstances, especially developments in IT. It gives each student only one place based on his or her preferences and his or her total grade (GPA). Thus, this system depends solely on the academic ability of each student who applies for admission. Therefore, it needs to be flexible in order to consider other factors in the future. Doing so will save resources and help the decision-makers make suitable decisions in good time. In addition, it is necessary to develop administrators' skills from time to time to meet ever-changing requirements.

Due to the fact that the current admission systems for Saudi universities are not comprehensive and relevant, it is necessary to apply the proposed system as soon as possible. The proposed system will help in improving the efficiency of the admission system in the Saudi universities. This system will save time and effort, and reduce costs for parents, students and university administrative staff. The system may need monitoring and maintaining for up to one or two years after implementation before it is fully acceptable. For more details, see Chapter Seven.

6.10 The feasibility study of the proposed system

The feasibility study is an assessment of the practicality of the proposed admission system for Saudi universities. The feasibility study contains a layout of the proposed system and how it will be delivered. For making the feasibility study of the proposed system, secondary data collected from literature review and the Ministry of Higher Education. (Note: the responsible for making a real feasibility study is the Ministry of Higher Education. The real feasibility study will need a big effort and time, big amount of money and specialists).

The feasibility study of the proposed admission system consists of the following:

- ✓ Marketing feasibility study – A market assessment helps identify opportunities in a market or market segment. It describes the effective demand of the users of the proposed admission system (for example students, parents, administrators and so on). There are several users of the proposed system. It is not necessary to explain the marketing feasibility of this system because it will be compulsory for users (such as student and their parents). Accordingly, the proposed system is feasible from this perspective, because it will help users save time, effort and money, since, instead of applying for admission in several colleges in different areas inside the Kingdom, you can apply for around 40 colleges using one application form at the same time.

Therefore, the proposed admission system is feasible, since the system will be compulsory and useful for the system users.

- ✓ Technical feasibility study – Technical feasibility is assessed to evaluate whether the new system will perform adequately and whether the Ministry of Higher Education has the ability to construct the proposed system. The technical assessment helps answer the question of whether the technology needed for the new system exists, and whether the Ministry of Higher Education in the KSA has enough experience using that technology. It lays out details of how the service will be delivered, including issues such as transportation, location, technology, materials and labour. This assessment is based on an outline of the system requirements, to determine whether the Ministry of Higher Education has the technical expertise to handle the completion of the project. We conclude that these elements will be available.

In other words, this assessment focuses on the technical resources available to the new system. It helps the Ministry of Higher Education in the KSA determine whether the technical resources meet capacity and whether the technical team is capable of converting the ideas into working systems. Technical feasibility also involves evaluation of the hardware, software, and other technology requirements of the proposed system (see for example: Chen et al., 2006).

In developing the new system, one has to investigate and compare technology providers, determine the reliability and competitiveness of that system, and identify the limitations or constraints of technology, as well as risks to the proposed system, which depend on system size, complexity and the group's experience with similar systems (see for example: Chen et al., 2006).

Therefore, the proposed admission system is technically feasible, since the whole system is designed to use the latest technologies, which are readily available.

- ✓ Financial feasibility study – This study involves predicting the amount of funding or start-up capital needed, what sources of capital can and will be used, and what kind of return or benefit can be expected on the investment in the proposed admission system. Financial viability can be judged on the following parameters (see for example: Chen et al., 2006):
- Total estimated cost of the new system including fixed assets, working capital (raw materials, labour and other costs).
 - Financing of the new system in terms of its capital structure.
 - Projected cash flow.

The proposed admission system is financially feasible, since the Kingdom of Saudi Arabia is a rich country and the Saudi government is able to finance the entire project. However, the Ministry of Higher Education in the KSA began applying the idea of the proposed system in Riyadh city last year.

- ✓ Economic feasibility study – Economic feasibility is a vital part of the evaluation of the new system, and deals with factors that can be quantified, measured, and compared in monetary terms (see for example: Chen et al., 2006).

The new admission system will involve the expenditure of capital funds and other resources to generate future benefits, whether in the form of profits or social benefits. For the new admission system to be worthwhile, the future benefit should compare favourably with the prior expenditure of resources needed to achieve it (see for example: Wikipedia, 2011).

This assessment involves a cost/ benefit analysis of the new admission system, helping the Ministry of Higher Education determine the viability of the proposed system as well as costs and benefits associated with it before financial resources are allocated. It also helps decision makers determine the positive economic benefits to the Ministry of Higher Education which could be provided by the proposed project (see for example: Chen et al., 2006). As mentioned many times throughout this thesis, the proposed system will help users save time, effort and money. However, in the economic, conducting cost-benefit analysis is particularly challenging because the benefits and costs of developing the proposed admission must take into account social consideration highlighted in the justification for the development of the admission system.

Therefore, the proposed admission system is economically feasible, since the new admission system will be accepted by the majority of users.

- ✓ Legal feasibility study – this type of study determines whether the proposed system conflicts with legal requirements, e.g. a data processing system must comply with the local data protection regulations. It also determines whether the proposed system is acceptable and in accordance with the laws of the KSA. The proposed system may face legal issues after completion if this factor is not considered at the first stage (see for example: Wikipedia, 2011).

The proposed system is legally possible, as demonstrated in Egypt and other countries. The proposed system will not allow individual governmental universities to make their

own admission rules. Under the new system, only private universities will have their own admission rules. The new system will be compulsory for all governmental universities.

- ✓ Operational Feasibility study - this assessment involves undertaking a study to analyse and determine whether and how well the Ministry of Higher Education's needs can be met by completing the proposed system in the KSA. Operational feasibility studies also analyse how the plan for the proposed system satisfies the requirements identified in the requirements analysis stage of system development (see for example: Mukund, 2012).
- ✓ Political feasibility study – Political feasibility is assessed to gain an understanding of how key stakeholders view the proposed system. The proposed system may affect the distribution of power and can have political ramifications. Therefore, those stakeholders not supporting the project may block or disrupt the project (see for example: Chen et al., 2006).

The factors identified in the feasibility study are as follows:

- Availability of required money. It is concluded that the proposed admission system is financially feasible.
- Availability of the required technology, professionals and experts needed to establish this system. It is concluded that the proposed admission system is technically feasible.
- Other countries, such as Egypt, Jordan, and the United Arab Emirates, have already applied very similar admission systems. This means that the Ministry of Higher Education can benefit from the experience of other Arab countries.
- The government's current position of being proactive in devising a systematic plan for the new admission system.
- Availability of volunteers ready to train people how to use this new admission system in an easy and translucent manner.

6.11 Conclusion

This chapter has presented a framework for designing, implementing and evaluating the proposed admission system for Saudi universities. It described the main features of the framework and the main elements of the proposed system. In addition, it presented an evaluation of the proposed system (advantages and disadvantages). Moreover, it presented the proposed program as a series

of print screens (see all print screens in Research Appendix D). In addition, it presented the results of the evaluation of the proposed system via interviews conducted with some of the potential users of the new system. Finally, it presented a critical review of the proposed system.

It is found that the new admission system will help in improving the efficiency of the admission system for Saudi universities. This system will save time and effort and reduce costs for the system users. In order to get maximum benefit from the new admission system, it will be necessary to have a plan for updating the system.

Chapter 7

Critical review of framework and prototype for universities admission in Saudi Arabia (UASA)

Objectives:

- Present a background of Universities Admission in Saudi Arabia (UASA)
- Present the requirements of Universities Admission in Saudi Arabia (UASA)
- Present an evaluation of Universities Admission in Saudi Arabia (UASA)

7.1 Introduction

This chapter presents a critical review of the admission system in Saudi universities and presents the problems prevalent in this system. It also outlines the requirements that have to be fulfilled in order to improve the current system of admission to Saudi universities.

Due to the challenges and problems facing the education system in the KSA, this system needs to improve. This requires establishing a new admission system based on DSS (smart decision support system) which is formally structured and designed to collect, maintain and supply relevant, reliable, and timely information to guide educational policy, planning, and the decision-making process.

7.2 Background of UASA

First of all, a huge demand exists from Saudi students who have passed their secondary school exams. They apply to universities in order to try to gain admission to specific degree courses.

However, no unified secondary exam exists at a national level. Instead, all final grades for secondary school are assigned by the student's school locally. This creates many variations in standards. For example, the number of teachers in the KSA who teach only at the highest level is around 10,000 and this means that for the same course, there will be more than 5000 different exams. A lot of variation exists between these exams, and in many cases, they mislead universities. In fact, it was reported that more than 5% of university students change their degree course after some time. Some of these have admitted using relatives, friends or even illegal means to get high grades.

In the KSA there is no centralised system of admission. Every Saudi university has an admission system. Under the current admission system, students can apply to multiple universities in Saudi Arabia, and can therefore be accepted into more than one university. This could result in lost opportunities for other students who may miss out on places which are allocated to students who then opt for a course at another university.

In spite of the fact that the current systems for admission to Saudi universities are not comprehensive, integrated or relevant, it turns out that this system is flexible, and easy to use and update because it is not comprehensive. The system needs to develop to become more comprehensive and integrated.

In view of the above, the researcher will develop a smart decision support system (DSS) that can be applied at a national level to all Saudi universities, including private universities. It will make some adjustments to the student applications in order to remove the variations between them. The proposal will consider many factors and assign a new grade and major to each student who applies for admission. This will lead to the optimum use of available resources and the achievement of targets in the field of education in the KSA. This system will save time and effort, and reduce cost.

Under the proposed system, students are only required to submit one application form which covers all universities, and they will be offered only one place at one university at any given time. Each student will apply to a specific number of colleges. The current study therefore puts forward the proposed system as a centralised admission system for the KSA. This will help to improve the efficiency of the admission system to the Saudi universities. This system will save time, effort and cost for parents, students and system administrators.

7.3 The requirements of UASA

Due to the challenges and problems facing the current admission systems in the KSA, these systems need to improve. It is difficult to achieve a fair distribution of students among all universities according to their grades. This is due to the different Saudi universities having different admission systems. In addition, these systems are not comprehensive and able to take all universities into account, and are not suitable for all universities. The current admission system allows students to apply to more than one university. Doing so wastes resources, including time, effort, and money for both students and universities. Improving the situation requires establishing

a new admission system, based on DSS, which is formally structured and designed to collect, maintain and supply relevant, reliable and timely information to guide educational policy, planning, and the decision-making process.

Because the student introduces many requests to more than one university, the current admission systems in Saudi universities give him or her acceptance to more than one university. Doing so leads to wasting many opportunities for other students. The proposed system accepts only one application from each student that will allow them to apply to all universities. On the other hand, it helps the universities by having one centralized system for receiving the students' applications.

In spite of the benefits of the proposed systems, implementation would require a huge amount of effort, and would come at a cost. A realistic timescale is also needed as well as regular updates to keep up with changing circumstances, especially developments in IT. It gives each student only one place based on their preferences as well as their total grade (GPA). Thus, this admission system depends solely on the academic ability of each student. Therefore, it needs to be developed so that other factors can be taken into account in the future. Doing so will save resources and help decision-makers take suitable decisions in good time. In order to meet these ever-changing requirements, it will be necessary to develop administrators' skills from time to time.

Due to the fact that the current admission system for Saudi universities is not comprehensive or relevant, it is necessary to apply the proposed system as soon as possible. The proposed system will help to improve the efficiency of the admission system in the Saudi universities. This system will save time, cost and effort for parents, students and university administrative staff. The system may need monitoring and maintaining for up to one or two years after implementation before it is totally suitable.

The proposed system will not allow individual governmental universities to make their own admission rules. Only private universities will have their own admission rules. This is legally possible, similar to the situation in Egypt.

End users (students) must register on the website in order to be able to apply for a place in a faculty. Students, must also submit transcripts of their secondary school education, and must follow the application procedures specified by the Ministry of Higher Education, who oversee the application process. Every student admitted as an undergraduate to any of the Saudi universities

must meet all requirements for admission prescribed by the Ministry of Higher Education. Applicants should be advised that meeting minimum requirements will not guarantee admission to a university. Institutions may set additional requirements.

The admissions employee should be able to display and search for student applications. The administrator should have full privileges on the website and be able to access it at any time.

Universities should determine the number of students required every year. This will be done according to a national policy inside the Kingdom.

7.4 The evaluation of UASA

By comparing the current system and the proposed system using questionnaires, an evaluation of the prototype is achieved. Because students, when applying to Saudi universities, introduce many applications at more than one university, the current admission systems offer them places in more than one university. This leads to the waste of many opportunities for other students, who may miss out on places allocated to students who then opt for a course in another university. The current admission system wastes time, effort, and money. On the other hand, the proposed admission system accepts only one application from each student, which allows them to apply to all universities. It helps universities by having one centralised system for receiving all student applications. The proposed admission system saves time, effort, and money.

With the current admission systems in Saudi universities, it is difficult to ensure that students are accepted fairly across all universities according to their grades. This is due to Saudi universities having different admission systems. In addition, these systems are not comprehensive, in that, they do not include all universities, nor are they suitable for all universities. The current admission systems allow students to apply to more than one college and gain acceptance to more than one college at the same time. The student will then accept one college and enroll in it. At the same time, they will keep their acceptance to other colleges for at least one or two years. Doing so, wastes resources, including time, effort, and money, for both the students and the universities. Therefore, the installation of a DSS is highly recommended in order to improve the efficiency and performance of admission to Saudi universities. This requires establishing a central and unified admission system for all Saudi universities. The proposed system will give students the opportunity to apply to nearly all universities using one application form, instead of using several application forms. It will also give them an offer of acceptance to only one university. This will

save time, effort and money for users (students and administrators). This system will improve the quality of the admission system in the Saudi universities. It will also lead to optimum use of available resources and achievement of targets in the field of education in the KSA.

In other words, with the proposed system, students are only required to submit one application form, which covers all Saudi universities, instead of submitting several application forms to several universities under the current systems. Through this process, they will be offered only one place at one university at any given time, according to their grades. The proposed admission system will be one central system instead of several admission systems operating in every Saudi university. This will save time, effort and money for users (students and administrators). This system will improve the quality of the admission procedure in the Saudi universities. Also, it will lead to optimum use of available resources and achievement of targets in the field of education in the KSA. Thus, the return of investment in the proposed system will be high, especially in the long term.

Accordingly, the prototype can be evaluated as follows:

The **advantages and benefits** of the proposed system include:

- It accepts one application from each student which allows them to apply to any university.
- It offers one place to each student out of all the universities they applied to.
- It provides a consolidated database to help decision makers make the right decisions in good time.
- It gives students all available opportunities to gain a place in the best faculty, according to their preferences and grades.
- Admission procedures will be easy to use because everything is in one place, and, consequently, will save time, cost and effort, especially for female students and their parents.
- Admission procedures will be universal and easy to understand rather than involving several different admission systems.
- The new admission system will be fair, clear and transparent.
- The new admission system will serve both genders, male and female.

However, there are **some disadvantages and limitations** of the proposed system, these include:

- The implementation of a new system will demand a great deal of effort and cooperation from all involved. This could also prove to be costly and time consuming.
- It gives each student only one place according to their preferences and grades.
- It needs to be regularly updated.

A SWOT analysis is a tool can be carried out for evaluating a company, product, place, industry, person or system (see for example: Humphrey, 2005). Therefore, a **SWOT analysis** is used here as a tool to evaluate the **strengths, weaknesses, opportunities and threats** involved in the proposed admission system for Saudi universities.

There are some advantages and benefits of the proposed admission system in the KSA (**strengths**); these include:

- It accepts one application from each student which allows them to apply to any university.
- It offers one place to each student out of all the universities they applied to. This will save time, money and effort.
- It provides a consolidated database to help decision makers make the right decision in good time.
- It gives students all available chances to get a place on the best faculty according to their preferences and grades.

Therefore, the proposed admission system will save time and effort, and will reduce costs for parents, students and system administrators. This means that depending on IT, including DSS, can help improve the efficiency of UASA.

However, there are some disadvantages and limitations of the proposed admission system in the KSA (**weaknesses**); these include:

- At the start, a great deal of effort, money and time will have to be put into implementing the proposed system. It will also require time for establishment. These costs will be particularly high in the short-term.
- It needs regular updates, especially to keep up with rapid developments in IT. This means that updating the system will require additional effort, cost, and time.

However, applying the proposed system to university admission in Saudi Arabia is considered a good **opportunity** to improving the efficiency of the admission system in Saudi universities. The proposed system will save time and effort, and will reduce costs for parents, students, and system administrators. It will help to rationalise the users' decisions.

The proposed admission system in the KSA will face some **threats**, for example, from viruses and hackers. In addition, updating the proposed admission system will require money, effort and time to keep up with continuous changes in IT. Moreover, the proposed admission system will serve and help all provinces throughout the KSA, and the system will be compulsory for all governmental universities. Thus, it is necessary to take these threats and considerations into account in order to achieve targets.

As can be seen, there are both advantages and disadvantages to the proposed system. The advantages include, for example, the lack of human error, as well as the fact that the system will save time for users since nearly all of the system will depend on IT. In addition, the proposed system will save money and effort for users, as implementing a central admission system for Saudi universities will give students the chance to apply to all Saudi governmental universities at more or less the same time using one application form, instead of filling in several application forms. The system will also allow them to gain acceptance to only one university, taking into account their grades and other terms and conditions. Therefore, it will improve the efficiency of the admission process, and consequently improve national capability in the field of education. Moreover, the proposed system will give students all available chances to gain a place in the best faculty, taking into account the student's preferences and grades. Moreover, it will help to rationalise the users' decisions, especially those of students. However, the disadvantages include, for example, the danger of the computer crashing, the fact that the system requires regular updates as well as the considerable effort, cost, and time required to implement and establish the system, especially in the short-term. In addition, this system may face threats, such as, viruses and hackers.

In summary, the proposal gives students all available chances to gain a place in the best faculty, taking into account their preferences and grades.

In comparison to admission systems in the USA, students apply to one or more colleges or universities by submitting an application which each college evaluates using its own criteria. The

college then decides whether or not to extend an offer of admission (and possibly financial aid) to the student. The system is decentralized; each college has its own criteria for admission, even when using a common application form (the most widely used form is The Common Application). This means that USA admission systems are somewhat similar to the old Saudi admission system. However, the USA admission systems are totally different from the new Saudi admission system.

7.5 The components of the prototype

The components of the prototype generally consist of six main parts: people, procedures and instructions, data, software, information technology infrastructure and internal controls, as follows:

First: People

The people in the prototype are simply the system users. Professionals who may need to use the prototype include consultants, analysts, managers, chief officers and auditors. The prototype should be designed to meet the needs of the people who will be using it. The system should also be easy to use, should improve rather than hinder efficiency, and should provide good results. From a technological perspective, it is necessary to develop administrators' skills and build valuable expertise. This reflects the importance of preparing qualified teams to implement the proposed system, which, in turn, requires organising training courses, workshops, lectures and seminars.

Second: Procedure and Instructions

The procedure and instructions of the prototype are the methods it uses for collecting, storing, retrieving and processing data. These methods will be both manual and automated, and the data can come from either internal sources or external sources. Procedures and instructions will be coded into the prototype software; they should also be "coded" into employees through documentation and training. Updates in procedures must be consistently followed up with relative updates in instructions in order to be effective. From a technological perspective, it is necessary to develop procedures and instructions which meet the requirements of modern technologies considering the rapid changes in information technology.

Third: Data

Most data contained in the prototype is data pertinent to the users, especially students' data. From a technological perspective, it is necessary to put into place an integrated and updated database.

So, it is important to depend on integrated software, such as Oracle or SAP. Also, it is necessary to develop the database to meet the requirements of modern technologies considering the rapid changes in information technology. In addition, it is necessary to depend on the concept of data warehousing.

Fourth: Software

The software component of the prototype is the computer program used to store, retrieve, process, and analyse the data. Quality, reliability and security are key components of effective prototype software. The prototype software programs can be customised to meet the unique needs of different types of users. If an existing program does not meet a user's needs, software should also be developed to meet the requirements of modern technologies. In addition, it is important to make use of integrated software, such as Oracle or SAP.

Fifth: Information Technology Infrastructure (the hardware)

Information technology infrastructure is just a fancy name for the hardware used to operate the prototype. Most of these hardware items include personal computers, servers, printers, surge protectors, routers, scanners, storage media, possibly a backup power supply, and so on. In addition to cost, factors to consider in selecting hardware include speed, storage capability and whether it can be expanded and upgraded. Perhaps most importantly, the hardware selected for the prototype must be compatible with the intended software. Ideally, it would be not just compatible, but optimal; a clunky system will be much less helpful than a speedy one. A good prototype should also include a plan for maintaining, servicing, replacing and upgrading components of the hardware system, as well as a plan for the disposal of broken and outdated hardware so that sensitive data is completely destroyed.

Six: Internal Controls

The internal controls of the prototype are the security measures that protect sensitive data. These can be as simple as passwords or as complex as biometric identification. The prototype must have internal controls to protect against unauthorised computer access and to limit access to authorised users. The prototype contains confidential data belonging, not just to the admission system itself, but also to its employees and users. The prototype also requires internal controls that protect it from computer viruses, hackers and other internal and external threats to network security. Furthermore, it must be protected from natural disasters and power surges that can cause data loss.

7.6 Conclusion

This chapter presented a critical review of the proposed admission system for Saudi universities (UASA). It presented the features of UASA. In addition, it presented the requirements of UASA. Finally, it presented an evaluation of UASA. A SWOT analysis is used to evaluate the strengths, weaknesses, opportunities and threats involved in the proposed admission system for Saudi universities.

As was mentioned earlier in this chapter, the proposed admission system for Saudi universities has several advantages and a few disadvantages and challenges. Therefore, it is necessary to maximise the advantages of the new system, and to avoid the disadvantages.

To develop the admissions process for Saudi universities, the researcher proposed a system which will improve the efficiency and effectiveness of admissions. This system should be a single, centralised system.

As was shown in this chapter, the proposed central admission system, will save time and effort, and will reduce cost for system users. This means that setting up a system which is more dependent on IT, including DSS, can help improve the efficiency and effectiveness of UASA.

This chapter has shown that the proposed admission system will improve and develop the current admission systems in the KSA into one central admission system. It will save time and effort, and will reduce cost for parents, student, and system administrators. This means that introducing a system which is dependent on IT, including DSS, can help improve the efficiency of UASA. Thus, the proposed system will help make the best use of available resources, in order to meet targets and rationalize decision-making processes in the field of higher education in the KSA.

Chapter 8

Conclusions

8.1 Summary

The core of this thesis has involved an examination of the role of DSS in improving the efficiency of the admission system for universities generally and for Saudi universities, in particular.

This research aimed to describe the existing system for admission to Saudi universities and test it using a set of commonly agreed indicators for monitoring student admission. This will improve the overall process of admission, and consequently bring improvements to the existing Saudi national education system. In addition, the research aimed to describe a framework for designing and implementing a new system for university admission in Saudi Arabia.

Chapter One set out the general framework of the study, including a literature review, a description of the problem, and the hypotheses. The research questions, objectives, importance, methodology and structure were also explained. The limitations of the research and its contribution were also presented.

In Chapters Two and Three, the researcher presented a review of the literature in relation to the nature of admission systems in Saudi universities, the nature of DSS and the relationship between the two.

Chapter Two described decision support systems (DSS) and began by presenting definitions related to the DSS. The relationship between Artificial Intelligence and DSS was presented, as well as some applications that are related to DSS. Finally, it presented important adjuncts to the DSS.

In Chapter Three, the researcher explained the nature of the admission process in Saudi universities, as well as the problems which this process involves. The chapter began by presenting background information about the KSA and its educational system. It then described the general profile of the admission system in Saudi universities, whilst explaining the main problems facing this system. It also presented an outline of the higher education system in the Kingdom of Saudi Arabia, and a theoretical background regarding DSS, as well as areas in which DSS can be

applied. Following this, some of the benefits of a DSS to university admission systems processes were discussed. In addition, the chapter outlined some of the limitations associated with using DSS in universities.

In Chapter Four, the researcher explained the research methodology for the present study which began with a discussion around the research hypotheses and objectives. Then the research approach (either quantitative or qualitative) was presented along with a detailed description of the study sample (sampling frame, sample size and sampling technique) and the research instruments. The two instruments for the survey, a questionnaire and an interview, were then explained along with a breakdown of the pilot study. The reliability of the questionnaire was also discussed. The application of the instruments to the main study was then described. Finally, the chapter explained the tools used for data analysis.

In Chapter Five, the data obtained from the empirical survey by questionnaires and interviews were presented. The chapter described the research sample in Riyadh City according to the respondents' positions, qualifications, university and experience. Chapter Five also presented the data obtained through interviews, including general information about the interviewees, followed by various data about the admission systems in Saudi universities. The results were discussed, and the hypotheses tested.

In Chapter Six, the researcher presented a framework for designing, implementing and evaluating a proposed admission system for the universities of Saudi Arabia (UASA). Chapter Six also described the main features of the current and the proposed admission system for Saudi universities, as well as the main elements of the proposed system. In addition, it presented an evaluation of the proposed system (including advantages and disadvantages). Finally, it presented the proposed program as a series of print screens.

In Chapter Seven, the researcher presented a background to University Admission in Saudi Arabia (UASA), as well as the features of UASA. This was followed by information on the requirements of the UASA. Finally, it presented an evaluation of the UASA.

In Chapter Eight, the researcher brought together the summary, conclusions, recommendations and contributions to research.

In light of the above, the study's four questions are restated, and the main findings in relation to each are summarised:

A. How can the current legacy system for admission to Saudi universities be developed in order to manage changes smoothly?

Due to the systems for Universities Admission in Saudi Arabia (UASA) facing challenges and problems, as described in this thesis, these systems need to improve. This requires establishing a new admission system. Saudi universities need a smart decision support system (DSS) that can be applied at a national level to all Saudi universities, in order to remove challenges and problems. The proposed system considers many factors, in order to assign a new grade and degree course to each student. Within the proposed system, students are only required to submit one application form which covers all universities, instead of submitting several application forms to several universities under the current systems. Through this process, they will be offered only one place at one university at any given time. The admission system will be one central system instead of different admission systems for each Saudi university. This system will improve the quality of the admission system for the Saudi universities. Also, it will lead to optimum use of available resources and the achievement of targets in the field of education in the KSA. With the proposed system, students are only required to submit one application form, which covers all universities, and they will be offered only one place at one university at any given time. Moreover, the proposed system will give students all available chances to get a place in the best faculty, taking into account their grades and preferences. For more details, please see Chapter Six.

B- How can the new framework be developed to meet the new requirements?

To develop a framework for designing and implementing the proposed system of University Admission in Saudi Arabia (UASA), a new system is proposed. The use of IT, including DSS, can help improve university admission in Saudi Arabia. This can be done by establishing a new, unified, central system. The proposed system will be a comprehensive, large, and central system that can meet the needs of several uses and users. This reflects the importance of preparing qualified teams to implement the proposed system, which, in turn, requires the organisation of training courses. For more detail, please see Chapters Six and Seven.

C- How can the framework be evaluated?

In order to test the proposed admission system for the Saudi universities, the researcher carried out interviews with potential users. This process will provide valuable feedback for the evaluation. In order to evaluate the proposed system, interviews were conducted with a sample of

admission staff from the Ministry of Higher Education in Saudi Arabia, during which the researcher opted to use closed questions. Only admissions staff currently have experience with the admission system. However, a student applies for admission once using the instructions and procedures provided to them. For more detail, see Chapter Six and Chapter Seven.

8.2 Conclusions

The conclusions of this research are as follows:

- A-** The current systems for admission to Saudi universities are flexible and easy to use and update, but are not suitable because they are not comprehensive and integrated, and consequently require development. This is supported by a reliable questionnaire. According to the Cronbach's Alpha Coefficient, the scales used in this study showed that the questionnaire is reliable, because the questions were clear and direct.
- B-** The results of the chi-square test indicate that there is a significant statistical association between the availability of an advanced database and the comprehensiveness and relevance of the current admission systems. In addition, the correlation coefficient between the current database and the comprehensiveness of the current admission systems is weak and negative, whereas the correlation coefficient between the current data base and the relevance of the current admission systems is weak and positive.
- C-** The chi-square test indicates that there is a significant statistical association between the availability of a feedback system and the comprehensiveness and relevance of the current admission systems. In addition, the correlation coefficient between the current feedback systems and the comprehensiveness and relevance of the current admission systems is weak and negative.
- D-** The chi-square test indicates that there is a significant statistical association between the availability of a model base and the relevance of the current admission systems. In addition, the correlation coefficient between the current model base and the comprehensiveness of the current admission systems is weak and negative, whereas the correlation coefficient between the current model base and the relevance of the current admission systems is average and positive.
- E-** The chi-square test indicates that there is significant statistical association between the availability of qualified people and the relevance of the current admission systems. In addition, the correlation coefficient between the current availability of qualified people and the comprehensiveness of the current admission systems is weak and negative,

whereas the correlation coefficient between the current availability of qualified people and the relevance of the current admission systems is weak and positive.

F- In the KSA there is no centralised system of university admission. Every Saudi university has its own admission system. With the current admission systems, students can apply to multiple universities in Saudi Arabia and can therefore be accepted into more than one university. This could result in missed opportunities for other students who may miss out on places which are allocated to students who then opt for a course at another university. In light of this, the proposed admission system will make important improvements.

G- A few interviewees disagreed with several points, because the proposed system is a new system and they do not have sufficient knowledge about it. Therefore, they are worried about factors like cost, efficiency, and whether the program will be a success. These concerns will apply in the short term. However, in the long term, the benefits of the proposed system will outweigh its costs.

8.3. Recommendations:

The recommendations of this research are as follows:

- A.** In order to achieve optimum exploitation of available resources in Saudi universities, it is necessary to improve the current admission system by applying a DSS. Thus, applying an e-admission system will help to improve the current systems for admission to Saudi universities.
- B.** In order to improve the performance of the current admission systems in Saudi universities, it is necessary to improve their efficiency by applying a central electronic admission system related to a DSS. This system will save time and effort and reduce cost.
- C.** To improve the current systems for admission to Saudi universities, a comprehensive, integrated and relevant database should be developed which includes all Saudi universities in one admission system.
- D.** To meet the requirements for applying DSS, we require an advanced database, a relevant feedback system, qualified people and good models base.
- E.** To develop the admissions process and improve its effectiveness, the researcher proposed a system for admission to Saudi universities. This will help the Saudi universities achieve their targets. For more details, see the prototype in Appendix D.
- F.** Due to the fact that the current systems for admission to Saudi universities are not comprehensive or suitable, it is necessary to apply the proposed system as soon as possible. This will help improve the efficiency of the Saudi university admission system.

Under the proposed system, students are only required to submit one application form, which covers all universities, and they will be offered only one place at one university at any given time. Therefore, the current study proposes a new, centralised admission system for the KSA. This will help improve the efficiency of the Saudi university admission system, thus saving time and effort and reducing cost for parents, students, and admission systems administrators. For more details, see the prototype in Appendix D.

8.4 Recommendations for future research

The researcher suggests the following topics for further research:

- A- The role of decision support systems (DSS) in improving the efficiency of the admission system in Saudi universities.
- B- The role of centralised systems to improve efficiency in university administration.
- C- The role of intelligent decision support systems to improve admission management in higher education institutes.

8.5 Contributions

A. The current study has described the current system for admission to Saudi universities. In the KSA there is no centralised system of admission. Every Saudi university has its own admission system. For more details, see Chapter Five.

The current study tested the existing systems for admission to Saudi universities by using a set of commonly agreed indicators for monitoring the admission of students enrolled in universities. This aimed to improve the overall process of admission, and consequently the existing national education system in Saudi universities. 100% of respondents reported that their admission system was not fully manual and worked online, and around 72% said that their admission system was partially computerised; some respondents (around 11%) reported that their admission system was fully computerised. For more details, see Chapter Five.

B. The current study proposed a framework and prototype for the Saudi university admission system. These will make use of an e-admission system. This system will be integrated and comprehensive for all students within the KSA (either Saudi or non-Saudi). The proposed system will be a single, centralised system. Under the proposed system, students are only required to submit one application form which covers all universities, and they will be offered

only one place at one university at any given time. (For more details, see Chapter Six and Appendix D).

The current study has therefore proposed a centralised system of admission in the KSA for both male and female students. This will help improve the efficiency of the Saudi university admission system. The new system will save time and effort and reduce costs for parents, student, and admission systems administrators. It will help to rationalise the users' decisions. For more details, see Chapter One, Chapter Six and Appendix D.

Under the proposed system, students are only required to submit one application form which covers all universities instead of submitting several application forms to several universities. Through this process, they will be offered only one place at one university at any given time. For more details, see Chapter One, Chapter Six, Chapter Seven and Appendix D.

The proposed system will help improve the efficiency of the Saudi university admission system.

C. The current study evaluated the proposed admission system via interviews conducted with some of the potential users. More than 60% of the interviewees agreed that the proposed admission system was comprehensive. In addition, the majority of the interviewees (around 75%) agreed that the proposed admission system was flexible and easy to use. 70% of the interviewees also agreed that the proposed admission system was easy to update and control. 60% of the interviewees agreed and 20% disagreed with the fact that the proposed admission system was relevant and reliable, but this may be attributed to the fact that the proposed system is new and they did not have sufficient knowledge about it. 50% of the interviewees agreed and 20% of the interviewees disagreed with the idea that the proposed admission system was relevant and reliable. The proposed system was accepted by the majority (80%) of the stakeholders, including students, parents, administrators and others. It is difficult to get 100 % acceptance from all the different stakeholders for any new system. However, 50% of the interviewees agreed and 30% of the interviewees disagreed with the fact that the proposed admission system was comparable. Finally, 80% of the interviewees reported that the proposed admission system would be costly and complex. This means that the proposed system will need a large amount of money and require a lot of effort. This will apply in the short term. However, in the long term, the benefits of the proposed system will outweigh its costs. The time schedule for the whole process will depend on several factors such as the availability of qualified people, the required programs and equipment,

and the availability of money. However, the time scale proposed to put this system in place is from 2 to 3 years.

The system may need monitoring and maintaining for up to one or two years after implementation before it would be totally acceptable. See the results of the evaluation in Chapter Six.

D. The current study has presented a critical review of the proposed admission system for Saudi Universities. A **SWOT analysis** was used to evaluate the **strengths, weaknesses, opportunities and threats** involved in the proposed admission system. For more details, see Chapter Seven.

E. The current study has presented recommendations for further research. (For more details, see Chapter Eight).

In conclusion, this research is considered important to:

- The country where the researcher proposes applying the new proposals for university admission systems in Saudi Arabia (UASA). This system will save time, effort and cost for parents, student, and admission systems administrators. For more details, see Chapter Six.
- The researcher in improving his career position and his work in the KSA.
- The academic community, especially in the field of DSS and university admission systems, through publishing the main findings of this research.

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Appendices

Appendix A

Questionnaire for identifying the role of decision support systems in improving the efficiency of the admission system in Saudi universities

Dear Sir/Madam

My study aims to determine **the Role of Decision Support Systems in Improving the Efficiency of the Admission System in Saudi Universities.**

The questionnaire will be given to admission staff in the admission department in Saudi universities in Riyadh City. I would be very grateful if you would participate in this questionnaire. It will take approximately 10-15 minutes to complete. The information you provide is very important as it will reflect the role of decision support systems in improving the efficiency of the admission system in Saudi universities

Your response will be treated **with complete confidentiality and used only for research purposes.**

Finally, I would like to take this opportunity to **thank you** for spending your valuable time in answering the questions in this survey, and for your opinions and your suggestions, which will be useful.

Yours Faithfully

AWAD ALOTAIBI
Akoshim@stc.com.sa

Part (1): General Data:

1.1 Position

1.2 Qualifications

1.3 Which university do you work at?

1.4 Number of years' experience in the admission department.

Less than 5 years From 5 to less than 10 years More than 10 years

Part (2): The Nature of the Current Admission System

Please answer the following questions by placing a tick (✓) in the box which applies to your university (choose Yes or No):

Question	Yes	No
2.1 Is your admission system fully manual?		
2.2 Is your admission system partially computerised?		
2.3 Is your admission system fully computerised?		
2.4 Do you have an advanced database?		
2.5 Do you have systems for feedback?		
2.6 Does your admission system works on line?		
2.7 Do you have a database management system?		
2.8 Do you have the query facility?		
2.9 Do you have a data directory?		
2.10 Do you have qualified people?		
2.11 Do you have a model base? ¹		
2.12 Do you have a model base management system? ²		
2.13 Do you have a model directory? ³		
2.14 Do you have a dialog process?		
2.15 Do you have dialog styles?		
2.16 Do you have a dialog system management?		

¹ 2.11 Model base means a base includes all models required for solving all potential problems.

² 2.12 Model base management system means a program is prepared for helping in management the model base and make a link between the model base and other components of Decision Support Systems (DSS).

³ 2.13 Model directory means a detailed statement with all models within the model base for helping in selecting the required (the relevant) model for solving the current problem.

Part (3): The Commonly Agreed Indicators

Please complete the following table by placing a tick (✓) in the box which best describes your opinion regarding development and testing of a set of commonly agreed indicators for monitoring your admission system:

Commonly Agreed Indicators	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
3.1 Your admission system is comprehensive					
3.2 Your admission system is flexible					
3.3 Your admission system is easy to use					
3.4 Your admission system is easy to update					
3.5 Your admission system is easy to control					
3.6 Your admission system is relevant					
3.7 Your admission system is reliable					
3.8 Your admission system is comparable					
3.9 Your admission system is costly					
3.10 Your admission system is complex					

Part (4): Suggestions:

What are your suggestions for developing a framework for designing, implementing and institutionalizing of Decision Support Systems (DSS) for the admission system in your university?

Thank you very much

Appendix B

Interview for identifying the role of decision support systems in improving the efficiency of the admission system in Saudi universities

Part (1): General Data:

1.1 Position

1.2 Qualifications

1.3 Which university do you work at?

1.4 Number of years' experience in the admission department.

Less than 5 years From 5 to less than 10 years More than 10 years

Part (2): The Nature of the Current Admission System

2.1- Please, tell me about the nature of your admission system?

2.2- Please, could you mention the main component of your admission system?

2.3- How do you develop the skills of your employees?

2.4- Please, explain to me the procedures of your admission system?

2.5- How do you update your admission system? How often is this done?

Part (3): The Commonly Agreed Indicators

3.1- Please, explain to me the main characteristics of your admission system?

3.2- Are you satisfied with your admission system? If so, why? If not, why not?

3.3- Do you think that your admission system is comprehensive? If so, why? If not, why not?

3.4- What the nature of the model base in your admission system?

3.5- What are the required skills for applying your admission system?

Part (4): Suggestions

What are your suggestions for developing a framework for designing, implementing and institutionalizing of Decision Support Systems (DSS) for the admission system in your university?

THANK YOU VERY MUCH

Appendix C

A personnel interview for evaluating a prototype of the proposed admission system in Saudi universities

Dear Sir/Madam

The aim of these interviews is to evaluate a prototype of the proposed admission system in Saudi universities. These interviews will be made with some of the admission staff in the Ministry of Higher Education in Saudi Arabia. The prototype of the proposed admission system in Saudi universities will be distributed to the admission staff in the Ministry of Higher Education in Saudi Arabia before doing interviews.

Part (1): General Data:

1.1 Position

1.2 Qualifications

1.3 Which university do you work at?

1.4 Number of years' experience in the admission department.

Less than 5 years From 5 to less than 10 years More than 10 years

Part (2): The Evaluation

Please complete the following table by placing a tick (✓) in the box which best describes your opinion regarding the evaluation of the proposed admission system:

Commonly Agreed Indicators	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
3.1 The proposed admission system is comprehensive					
3.2 The proposed admission system is flexible					
3.3 The proposed admission system is easy to use					
3.4 The proposed admission system is easy to update					
3.5 The proposed admission system is easy to control					
3.6 The proposed admission system is relevant					
3.7 The proposed admission system is reliable					
3.8 The proposed admission system is comparable					
3.9 The proposed admission system is costly					
3.10 The proposed admission system is complex					

Part (3): Suggestions:

What are your suggestions for developing the proposed admission system in Saudi universities?

THANK YOU VERY MUCH

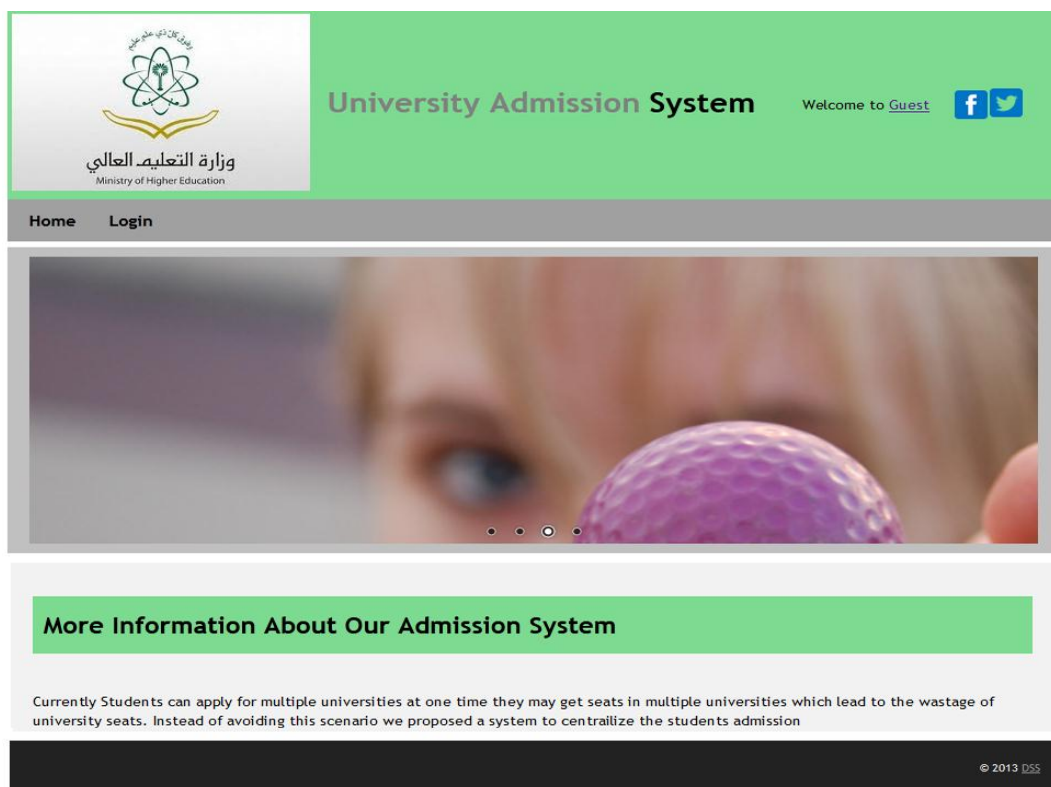
Appendix D

The proposed program (the prototype)

This prototype was developed to give an outline of the proposed admission system and make the development easy. The prototype includes the following:

Home Page

The figure below shows the home page for the proposed system. It has a menu option provided where the user can login. There are other menu options which can be viewed following a successful login. However, before login every user should look for the Home Page of Ministry of Higher Education on the internet in order to create an account. Then, the user will find the following screen:



Form D 1 Home Page of Ministry of Higher Education

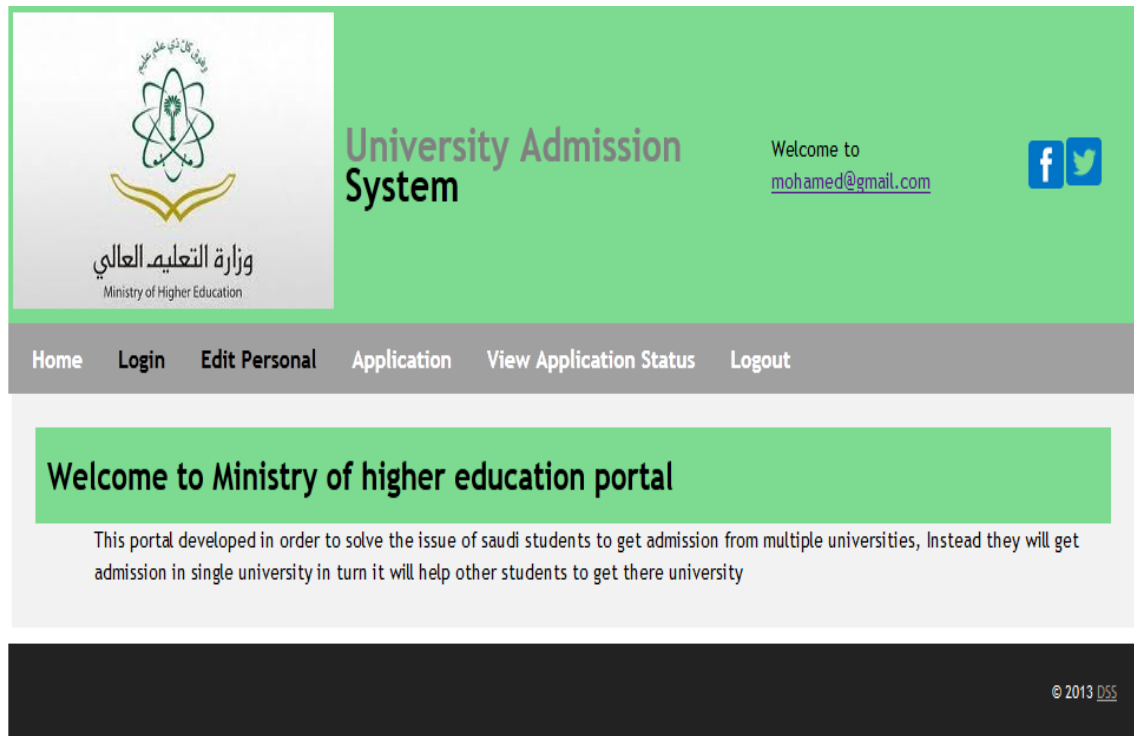
Login Page

This page has a user control which gets the ID / Iqama No. and Password as two inputs. On click of the submit button the two values are validated. Then, the user will find the following screen.

The screenshot displays the login interface for the University Admission System. At the top left is the logo of the Ministry of Higher Education, featuring a stylized atom and the text 'وزارة التعليم العالي' and 'Ministry of Higher Education'. To the right, the text 'University Admission System' is displayed in a large font, followed by 'Welcome to Guest' and social media icons for Facebook and Twitter. Below this is a navigation bar with 'Home' and 'Login' links. The main content area is titled 'Login Page' and contains two input fields: 'Id/Iqama No' with the value '2000000001' and 'Password' with three dots indicating a masked password. A red 'Login' button is centered below the fields. At the bottom of the login area are links for 'New Registration' and 'Forget Password'. The footer contains the copyright notice '© 2013 DSS'.

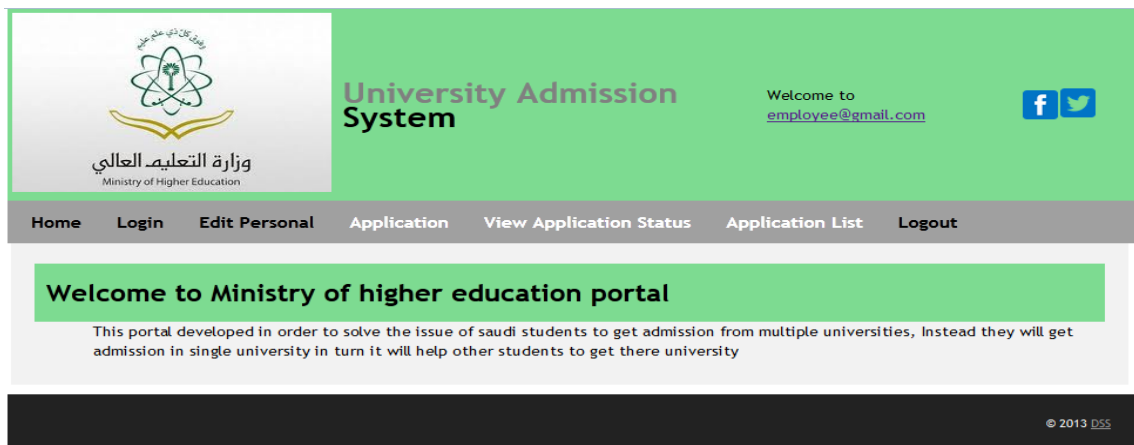
Form D 2 Login Page

Case 1: If the validation succeeds the next screen is:



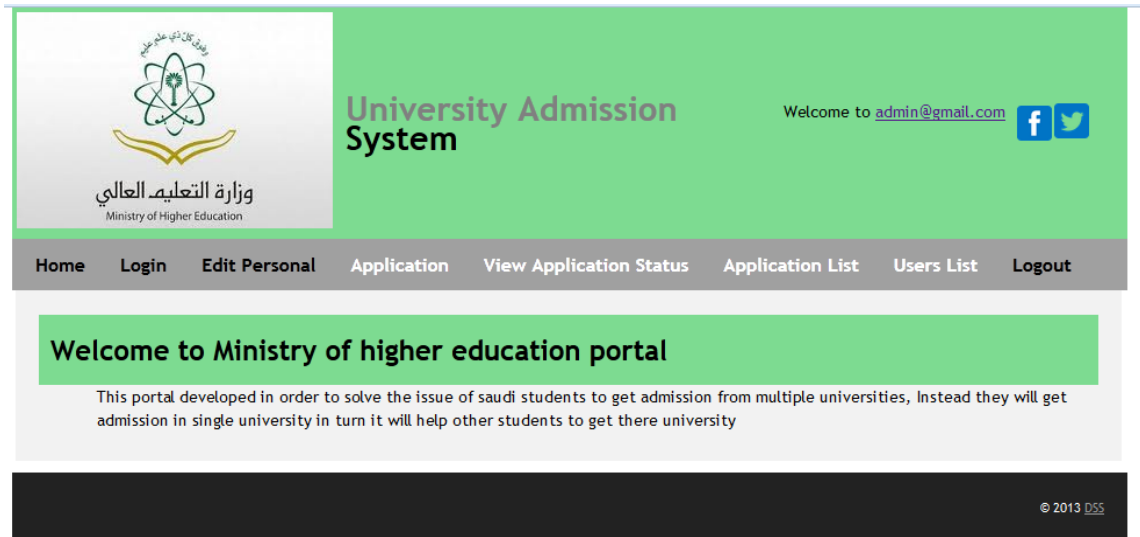
Form D 3 Ministry of Higher Education Portal

Case 1.1: If an employee or administrator logs in, they will gain access to some other features, like the Application List from the following screen.



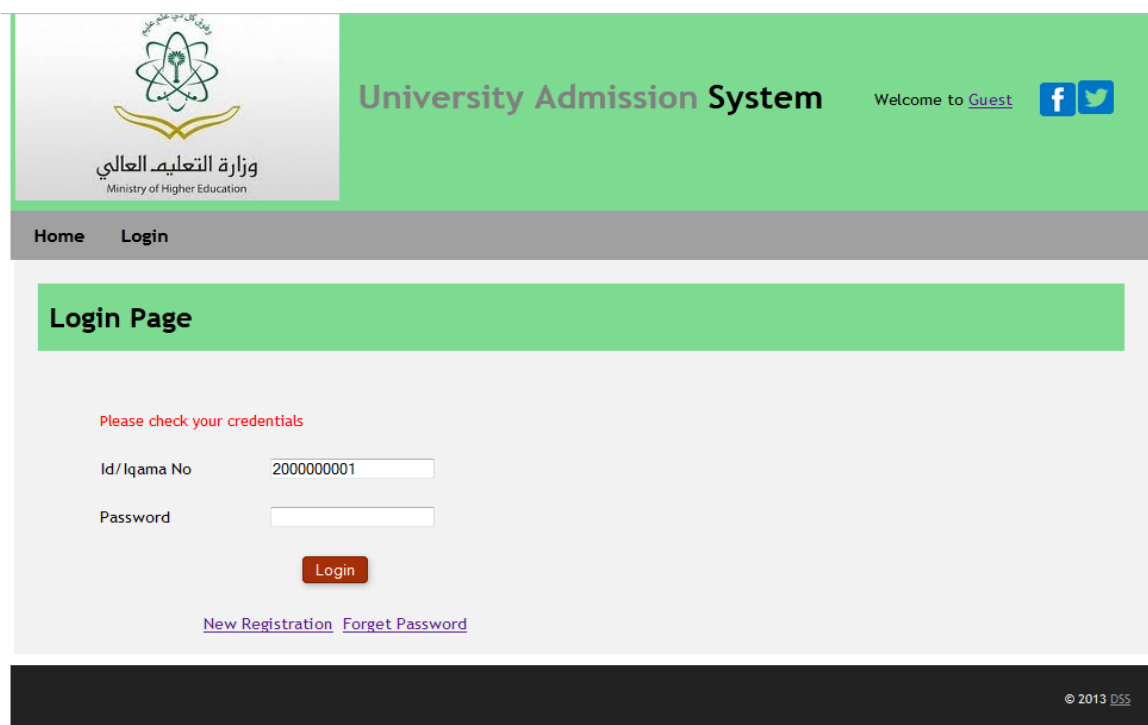
Form D 4 Ministry of Higher Education Portal

Case 1.2: If an administrator logs in, he (or she) will get access to some other features like Application List and User List from the following screen.



Form D 5 Ministry of Higher Education Portal

Case 2: If the validation fails, the user is prompted with this screen. Then, he (or she) needs to check his (or her) user name and / or password, as shown in the following screen.



Form D 6 Login Page

Case 3: If the user forgets his (or her) password, then he (or she) is taken to another screen where he (or she) can enter his or her email and retrieve his (or her) password, as shown in the following screen.



وزارة التعليم العالي
Ministry of Higher Education

University Admission System

Welcome to [Guest](#)



[Home](#) [Login](#)

Forget Password

Email Address

Submit

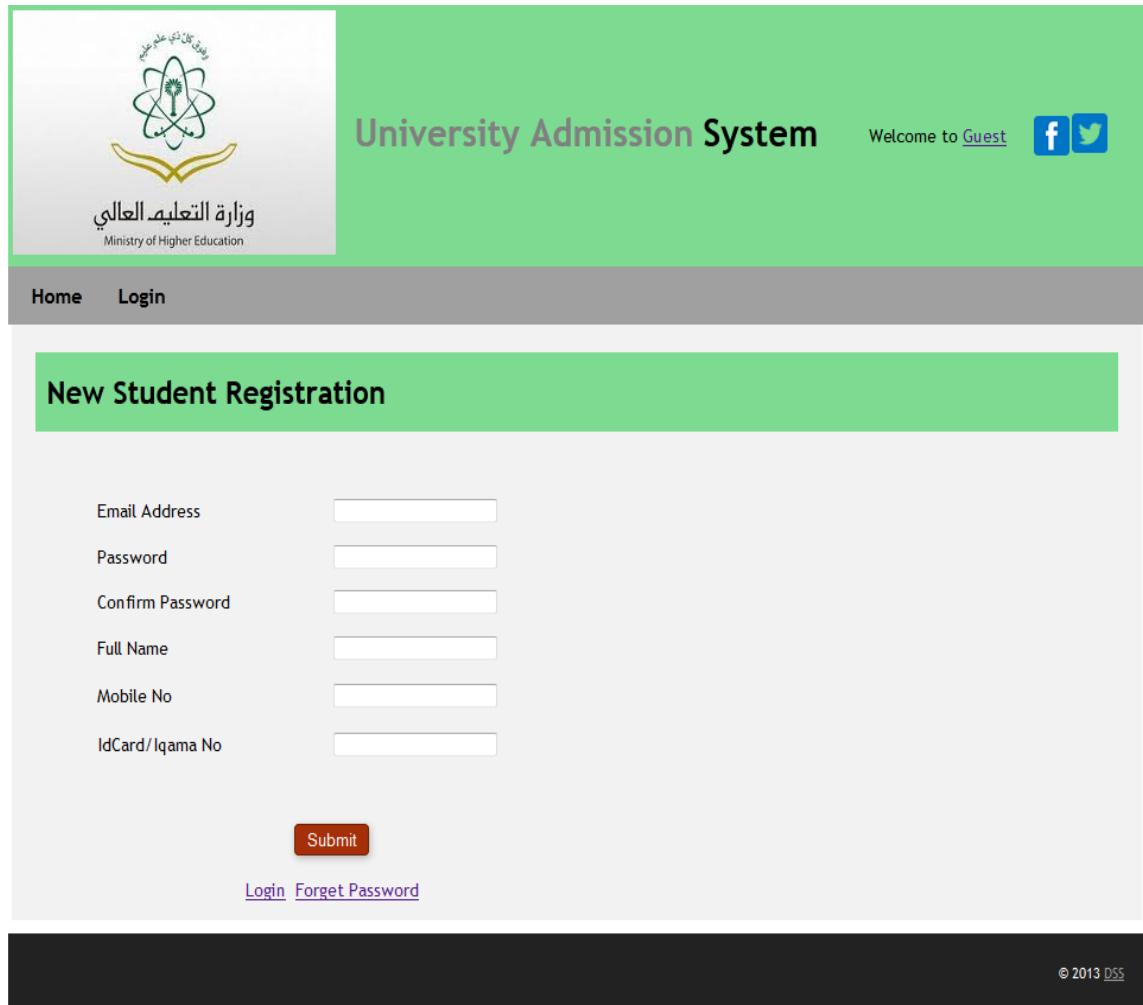
[New Registration](#) [Login](#)

© 2013 [DSS](#)

Form D 7 Forget Password

New Registration

If the login fails the user can register through this screen which has inputs like: Email, Password, Full Name, ID/ Iqama No. & Mobile No, as shown in the following screen.



The screenshot displays the 'New Student Registration' page of the University Admission System. The header features the Ministry of Higher Education logo and the text 'University Admission System' with a 'Welcome to Guest' message and social media icons for Facebook and Twitter. A navigation bar includes 'Home' and 'Login' links. The main content area is titled 'New Student Registration' and contains a registration form with the following fields: Email Address, Password, Confirm Password, Full Name, Mobile No, and IdCard/ Iqama No. A 'Submit' button is located below the form, and there are links for 'Login' and 'Forget Password'. The footer contains the copyright notice '© 2013 DSS'.

Form D 8 New Student Registration

If the email address is already registered then the user is prompted with the following screen:

The screenshot shows a web browser window with the URL localhost:64335/NewReg.aspx. The page header includes the logo of the Ministry of Higher Education and the text 'University Admission System'. Below the header, there is a navigation bar with 'Home' and 'Login' links. The main content area is titled 'New Student Registration' and contains a form with the following fields: Email Address (ahmed@gmail.com), Password, Confirm Password, Full Name (Ahmed Hamdan), Mobile No (0503343433), and IdCard / Iqama No (10003330009900). A red message 'You have already registered' is displayed above the form. A 'Submit' button is located below the form, and there are links for 'Login' and 'Forgot Password' at the bottom.

Form D 9 New Student Registration

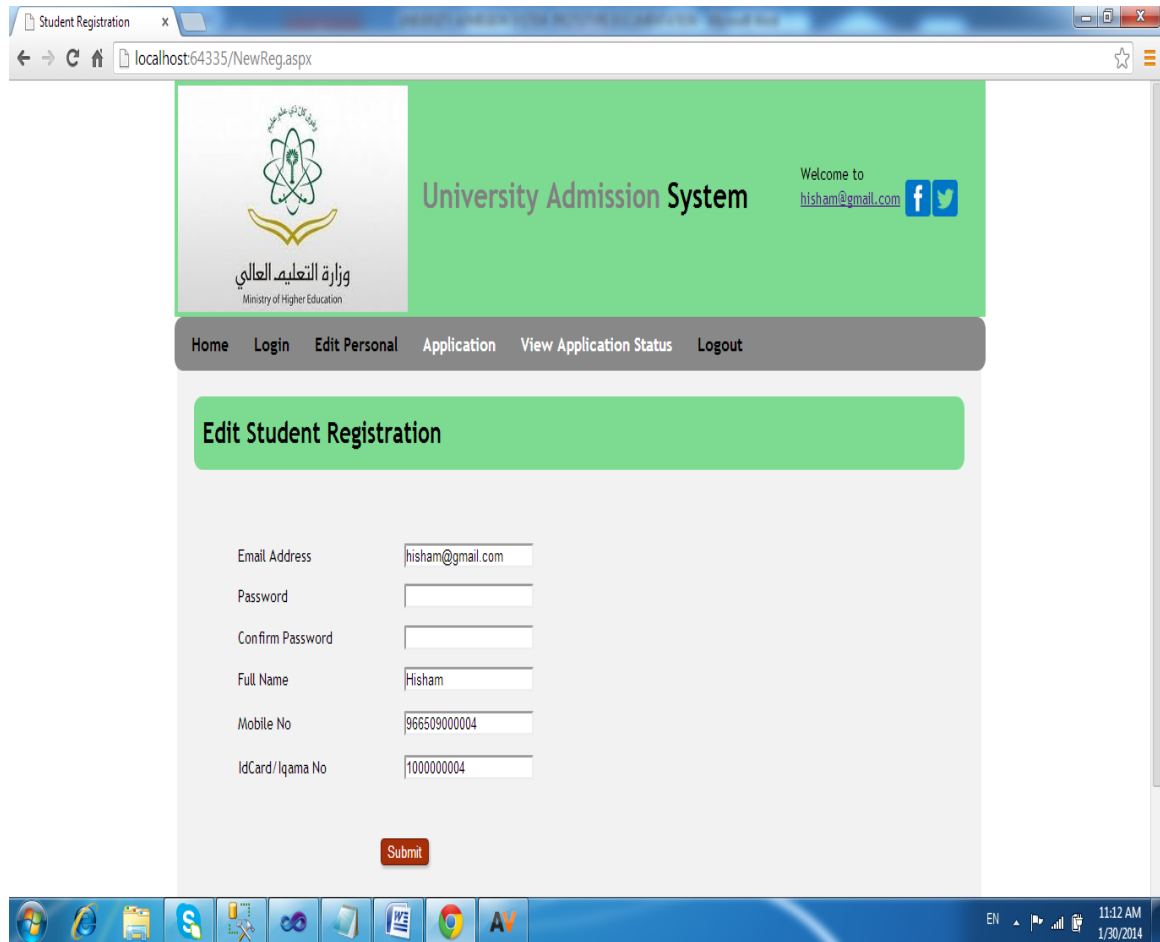
On successful registration the user is prompted with this screen:

The screenshot shows the same web browser window as in Form D 9. The registration form is now partially obscured by a white pop-up box with a red message 'Profile is Updated Successfully'. The 'Continue' button is visible within this pop-up. The form fields and the 'Submit' button are still visible behind the pop-up. The rest of the page layout, including the header and navigation bar, remains the same.

Form D 10 New Student Registration

Edit Registration

With edit registration, the user can edit their details and save their details at any time, as shown in the following screen.



The screenshot shows a web browser window with the URL `localhost:64335/NewReg.aspx`. The page header features the logo of the Ministry of Higher Education and the text "University Admission System". A navigation menu includes "Home", "Login", "Edit Personal", "Application", "View Application Status", and "Logout". The main content area is titled "Edit Student Registration" and contains a form with the following fields:

Email Address	<input type="text" value="hisham@gmail.com"/>
Password	<input type="password"/>
Confirm Password	<input type="password"/>
Full Name	<input type="text" value="Hisham"/>
Mobile No	<input type="text" value="966509000004"/>
IdCard/Iqama No	<input type="text" value="1000000004"/>

A "Submit" button is located below the form fields. The Windows taskbar at the bottom shows the system time as 11:12 AM on 1/30/2014.

Form D 11 Edit Registration

Application form

The application form has the option for the user to enter his (or her) administrative region, application type, grade (inside or outside KSA), GAT, SAAT, and Tantamount. On entering the values, the stage is calculated and displayed to the user.

Case 1: If the user is Saudi and from KSA. Then grade inside KSA, GAT, and SAAT can be taken as inputs via the following screen.

The screenshot shows a web browser window with the URL `localhost:64335/ApplicationForm.aspx`. The page header includes the logo of the Ministry of Higher Education (وزارة التعليم العالي) and a navigation menu with links: Home, Login, Edit Personal, Application, View Application Status, and Logout. The main content area is titled 'Application Form' and is labeled 'Stage 3'. It contains the following form elements:

- 'Select Administrative Region' dropdown menu with 'Riyadh Region' selected.
- 'Applicant Type' radio buttons: Saudi, Non Saudi.
- 'Grade' radio buttons: Grade Inside KSA, Grade Outside KSA.
- Input fields for scores:
 - 'Grade Inside KSA': 25
 - 'GAT (Score)': 90
 - 'SAAT (Score)': 45.3
- A red 'Submit' button.

The footer of the page contains the copyright notice '© 2013 DSS'. The Windows taskbar at the bottom shows the system clock as 11:38 AM on 1/30/2014.

Form D 12 Application Form for Saudi inside KSA

Case 2: If the user is Saudi but from a university outside KSA. Then grades outside KSA and Tantamount can be taken as inputs via the following screen.

The screenshot shows a web browser window with the URL `localhost:64335/ApplicationForm.aspx`. The page header includes the logo of the Ministry of Higher Education (وزارة التعليم العالي) and a navigation menu with links: Home, Login, Edit Personal, Application, View Application Status, and Logout. The main content area is titled 'Application Form' and is divided into 'Stage 1'. The form contains the following fields and options:

- Select Administrative Region:** A dropdown menu currently showing 'Riyadh Region'.
- Applicant Type:** Radio buttons for 'Saudi' (selected) and 'Non Saudi'.
- Grade Location:** Radio buttons for 'Grade Inside KSA' and 'Grade Outside KSA'.
- TANTAMOUNT:** A text input field containing the value '90'.
- Grade Outside KSA:** A text input field containing the value '100'.

A 'Submit' button is located at the bottom of the form. The footer of the page displays '© 2013 OSS'. The Windows taskbar at the bottom shows the system tray with the date '1/30/2014' and time '11:39 AM'.

Form D 13 Application Form for Saudi outside KSA

Case 3 If the user is non-Saudi and then GAT and SAAT can be taken as inputs and stages calculated via the following screen.

The screenshot shows a web browser window displaying the 'Application Form' page for the Ministry of Higher Education. The page is titled 'Application Form' and is labeled as 'Stage 3'. It features a navigation menu with options: Home, Login, Edit Personal, Application, View Application Status, and Logout. The main content area includes a dropdown menu for 'Select Administrative Region' set to 'Riyadh Region', a radio button for 'Applicant Type' with 'Non Saudi' selected, and two input fields for 'GAT (Score)' and 'SAAT (Score)', both containing the value '30'. A 'Submit' button is located below the input fields. The footer of the page contains the copyright notice '© 2013 DSJ'. The Windows taskbar at the bottom shows the system tray with the date '1/30/2014' and time '11:40 AM'.

Form D 14 Application Form for non-Saudi

View Application Status

Here, the user is given an option to view his application information like his status, stage and other information which was given as inputs when applying, as shown in the following screen.

The screenshot shows a web browser window with the URL `localhost:64335/ViewAppStatus.aspx`. The page header includes the Ministry of Higher Education logo and the text "University Admission System". A navigation menu contains links for Home, Login, Edit Personal, Application, View Application Status, and Logout. The main content area is titled "View Application Status" and displays the following information:

Applicant Code	8004
Administrative Region	Qasim Region
Applicant Type	Saudi
Applicant Status	Pending
Stage	Stage3
TANTAMOUNT	54
Grade Outside KSA	52

The Windows taskbar at the bottom shows the system time as 11:43 AM on 1/30/2014.

Form D 15 Application Information

Get application list

Here, all the applicant lists are displayed in a grid view. This enables a consolidated view to see all the applicants enrolled, their status, type, region and code. There is also a hyperlink to view each applicant's details individually, as shown in the following screen.



Home Login Edit Personal Application View Application Status Application List Users List Logout

Application List

AppCode	Status	Type	Region	
8001	Accepted	Saudi	Riyadh Region	View
8002	Accepted	Saudi	Makkah Region	View
8003	Accepted	Saudi	Madinah Region	View
8004	Pending	Saudi	Qasim Region	View
8005	Rejected	Saudi	Eastern Region	View
8007	Rejected	Non Saudi	Tabouk Region	View
				View

Form D 16 Application List

Get user list

The complete Users List for this system can also be viewed only by the administrative staff. See the following form:



The screenshot shows the header of the University Admission System. On the left is the logo of the Ministry of Higher Education, featuring a stylized atom and an open book, with the text "وزارة التعليم العالي" and "Ministry of Higher Education" below it. To the right of the logo, the text "University Admission System" is displayed in a large font. Further right, there is a welcome message "Welcome to admin@gmail.com" and social media icons for Facebook and Twitter. At the bottom of the header is a navigation menu with the following items: Home, Login, Edit Personal, Application, View Application Status, Application List, Users List, and Logout.

Users List

Code	Name	Email	Mobile	Id	Role
1	admin	admin@gmail.com	966509000008	1000	Admin
2	employee	employee@gmail.com	966509000009	2000	Employee

© 2013 [DSS](#)

Form D 17 User List

To create an account, you should fill the following form:

The screenshot shows a web browser window titled "Registration" with a "Home" button. The main heading is "Sign Up". On the right, there is the logo of the Ministry of Higher Education (وزارة التعليم العالي) and the text "Ministry of Higher Education". The registration form contains the following fields and options:

- First Name: Fahd
- Middle Name: Saud
- Last Name: Al-Zamel
- Date of Birth: 22 Apr 1990
- ID: F11
- Password: Fahd129
- Re-Password: Fahd129
- Gender: Male
- Nationality: Saudi
- Address: Olayast, Riyadh, KSA
- Mobile Number: 0531926359
- Specialization: Science Art
- I accept all the terms and agreements of Ministry of Higher Education

At the bottom, there is a "Register" button, a "Then [Login](#)" link, and a "Cancel" button. A "Create" dialog box with an "OK" button is overlaid on the right side of the form.

Form D 18 Full Sign up Form

To enter requests users are required to sign in to the Ministry of Higher Education website. They then have to select if they are Saudi or non-Saudi. If they chose Saudi, they then need to select if they obtained their grade from inside KSA or outside KSA. Then, they are asked to fill out their requests according to their grade. If the grade is 90% or higher, they will be in the first stage. If the grade is 75% to less than 90%, they will be in the second stage. If the grade is 60% to less than 75%, they will be in the third stage. This is illustrated in the following forms:

Form D 19 Entering School, GAT, & SAAT Scores (Saudi Case)

Form D 20 Entering Requests (Saudi Case)

Open Homepage

Success

Saudi Non-Saudi

Enter Your School grade,GAT, and SAAT scores :

School Grade :

GAT:

SAAT:

My profile

Hi, Fahd Al-Zamel

[Sign out](#)

[View all requests](#) [View profile](#)

[Enter Your Requests](#)

Form D 21 Entering School, GAT, & SAAT Scores (non-Saudi case)

Requets

Enter Your Requests [Exit](#)

1) Faculty of <input type="text"/>	University of <input type="text"/>	11) Faculty of <input type="text"/>	University of <input type="text"/>
2) Faculty of <input type="text"/>	University of <input type="text"/>	12) Faculty of <input type="text"/>	University of <input type="text"/>
3) Faculty of <input type="text"/>	University of <input type="text"/>	13) Faculty of <input type="text"/>	University of <input type="text"/>
4) Faculty of <input type="text"/>	University of <input type="text"/>	14) Faculty of <input type="text"/>	University of <input type="text"/>
5) Faculty of <input type="text"/>	University of <input type="text"/>	15) Faculty of <input type="text"/>	University of <input type="text"/>
6) Faculty of <input type="text"/>	University of <input type="text"/>	16) Faculty of <input type="text"/>	University of <input type="text"/>
7) Faculty of <input type="text"/>	University of <input type="text"/>	17) Faculty of <input type="text"/>	University of <input type="text"/>
8) Faculty of <input type="text"/>	University of <input type="text"/>	18) Faculty of <input type="text"/>	University of <input type="text"/>
9) Faculty of <input type="text"/>	University of <input type="text"/>	19) Faculty of <input type="text"/>	University of <input type="text"/>
10) Faculty of <input type="text"/>	University of <input type="text"/>	20) Faculty of <input type="text"/>	University of <input type="text"/>

[Back](#) [Save](#) [Submit](#)

EaeNiEEEEEE...

Form D 22 Entering Requests (non-Saudi case)

Form requests will be as seen as shown on the following form:

The screenshot shows a window titled "My Requests" with a table of data. The table has four columns: Faculty, Department, University, and Location. The first row contains "Faculty of Medicine", "University of King Saud", and "King Saud". The second row contains "Faculty of Engineering", "University of King Saud", and "King Saud". The remaining 17 rows all contain "Faculty of" in the Faculty column, "University of" in the University column, and "University of" in the Location column. There are "Back" and "Edit" buttons at the bottom right of the window.

Faculty	Department	University	Location
Faculty of Medicine		University of King Saud	King Saud
Faculty of Engineering		University of King Saud	King Saud
Faculty of		University of	University of
Faculty of		University of	University of
Faculty of		University of	University of
Faculty of		University of	University of
Faculty of		University of	University of
Faculty of		University of	University of
Faculty of		University of	University of
Faculty of		University of	University of
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Faculty of		University of	University of
Faculty of		University of	University of
Faculty of		University of	University of
Faculty of		University of	University of

Form D 23 Examples of Requests

Appendix E

A questionnaire for evaluating a prototype of the proposed admission system in Saudi universities

Dear student

The aim of this questionnaire is to evaluate a prototype of the proposed admission system in Saudi universities. This questionnaire will be made with new students in governmental university in Saudi Arabia. The prototype of the proposed admission system in Saudi universities will be distributed to the sample.

Part (1): The Evaluation

Please complete the following table by placing a tick (✓) in the box which best describes your opinion regarding the evaluation of the proposed admission system:

Commonly Agreed Indicators	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
1- The proposed admission system is comprehensive					
2- The proposed admission system is flexible					
3- The proposed admission system is easy to use					
4- The proposed admission system is relevant					
5- The proposed admission system is reliable					
6- The proposed admission system is comparable					
7- The proposed admission system is costly					
8- The proposed admission system is complex					

Part (2): Suggestions:

What are your suggestions for developing the proposed admission system in Saudi universities?

THANK YOU VERY MUCH