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Multidimensional Evaluation Approach for an e-Government website: a case study of e-Government in Saudi Arabia

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A Doctoral Thesis
Submitted in partial fulfilment of the requirement for the award of Doctor of Philosophy

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Abstract

This study investigates the refinement of an evaluation framework for e-Government websites. The aim of the research was to determine how an existing evaluation framework, which recommends the use of multiple usability techniques, could be used to obtain usability data that would indicate how to improve e-Government websites and satisfy users' needs. The framework describes how common techniques, such as heuristic testing and user testing, can be used with the emerging discipline of web analytics to provide a comprehensive and detailed view of users' interactions on e-Government websites. The original framework was refined in the light of the findings and the refined framework should facilitate the improvement of e-Government websites depending on users' demands and interactions.

The work involved implementing the original multi-dimensional framework in e-Government websites in Saudi Arabia. A case study method was used over two implementations. In the former implementation, the evaluation methods consisted of heuristic evaluation followed by usability testing then web analytic tools. However, in the later implementation, refinements to the evaluation framework were proposed and the order of methods was amended: web analytics was used first, followed by heuristic evaluation then usability testing. The framework recommends specific usability methods for evaluating specific issues.

The conclusions of this study illustrate the potential benefits of using a multidimensional evaluation framework for e-Government websites and it was found that each usability method had its own particular benefits and limitations. The research concludes by illustrating the potential usefulness of the designed evaluation framework in raising awareness of usability methods for evaluating e-Government websites in Saudi Arabia.

Keywords: e-Government website evaluation, usability studies, web analytics, heuristic evaluation, usability testing.

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Chapter One: Introduction

This chapter contains the background to the research. The chapter starts by offering some background into the evaluation of e-Government websites in Sections 1.1. Section 1.2 illustrates the research problems including those concerning e-Government websites, usability evaluations approaches, and web analytics. Section 1.3 introduces the outline of the research proposal, including the aim and objectives of the research. This is followed by the structure of the thesis in Section 1.4.

1.1 Background

Providing government services via the Internet has become general practice on a worldwide basis. The processes of electronic government is commonly described as e-Government. Many initiatives have led to new services being made available through online e-Government websites. However, many problems have emerged for users of these new services. An effective and efficient way of evaluating e-Government websites which, in turn, would encourage more people to use online services, is an important issue that will help improve the quality and levels of adoption of such services. Employing a range of different usability methods in the building, development and maintenance of government websites, particularly from a user perspective, may greatly aid the effectiveness of such sites and the services they offer.

The handling and assessment of e-Government websites has been the subject of previous practical research and a number of researchers have developed evaluation frameworks for e-Government (Wood et al., 2003; Thompson et al., 2003; Gupta, 2007). However new evaluation approaches are continually evolving; thus, the aim of this research is to build on earlier work and investigate whether a multidimensional evaluation framework, consisting of heuristic evaluation, user studies and web analytic tools, can be defined and used to manage effectively the evaluation of e-Government websites.

The adaptation of a usability evaluation framework approach for use with e-Government sites is challenging for this research because web analytics technologies are often characterised as being a quantitative approach where as other usability

methods are often characterised as being qualitative. Although both of these approaches can be used to gain an indication of the usability of such websites, there is currently no consensus among researchers on the empirical definition of a usability evaluation framework that utilises the technology of web analytics; this is evaluated in this research.

A five-stage process has been devised to meet the aims of this research. In the first phase, this research sought to define, within an e-Government context, state-of-the-art practice, as well as explaining the need to evaluate such websites. In order to achieve this, the research defined important aspects in the development of e-Government websites and showed that usability is an essential component in improving existing e-Government sites. This phase included offering definitions of a set of usability methods that can be used to assess e-Government websites. These definitions covered quantitative and qualitative usability approaches, as defined in the literature: e.g. interviews, heuristic evaluation, usability testing and analyses of traffic data (Thompson et al., 2003). A later phase in this research was to analyse the effectiveness of these approaches in order to build an effective usability evaluation framework. Specifically, this research developed a usability evaluation framework for e-Government websites that can help to improve such sites so that they can be used more efficiently.

The second phase of this research was an orientation stage to explore the state of e-Government in Saudi Arabia and the methods currently used to evaluate e-Government websites. In the third phase of this research, an evaluation framework was examined by undertaking a case study on one of the best government agencies in Saudi Arabia. In particular, the considered evaluation framework was examined on the Emirate of Makkah website where interviews, heuristic evaluation, usability testing and web analytic tools were used.

In the fourth phase, the evaluation framework was refined in order to obtain the most effective evaluation framework for e-Government websites. Then, in the fifth stage the refined framework was used to evaluate a new version of the Emirate of Makkah's website. The five-stage process can be seen in Figure 1.1 This approach ensured the development of a framework to enhance the management of e-Government websites

in order to produce continuous improvement. The main contribution of this research is therefore the production of a multidimensional usability framework for e-Government.

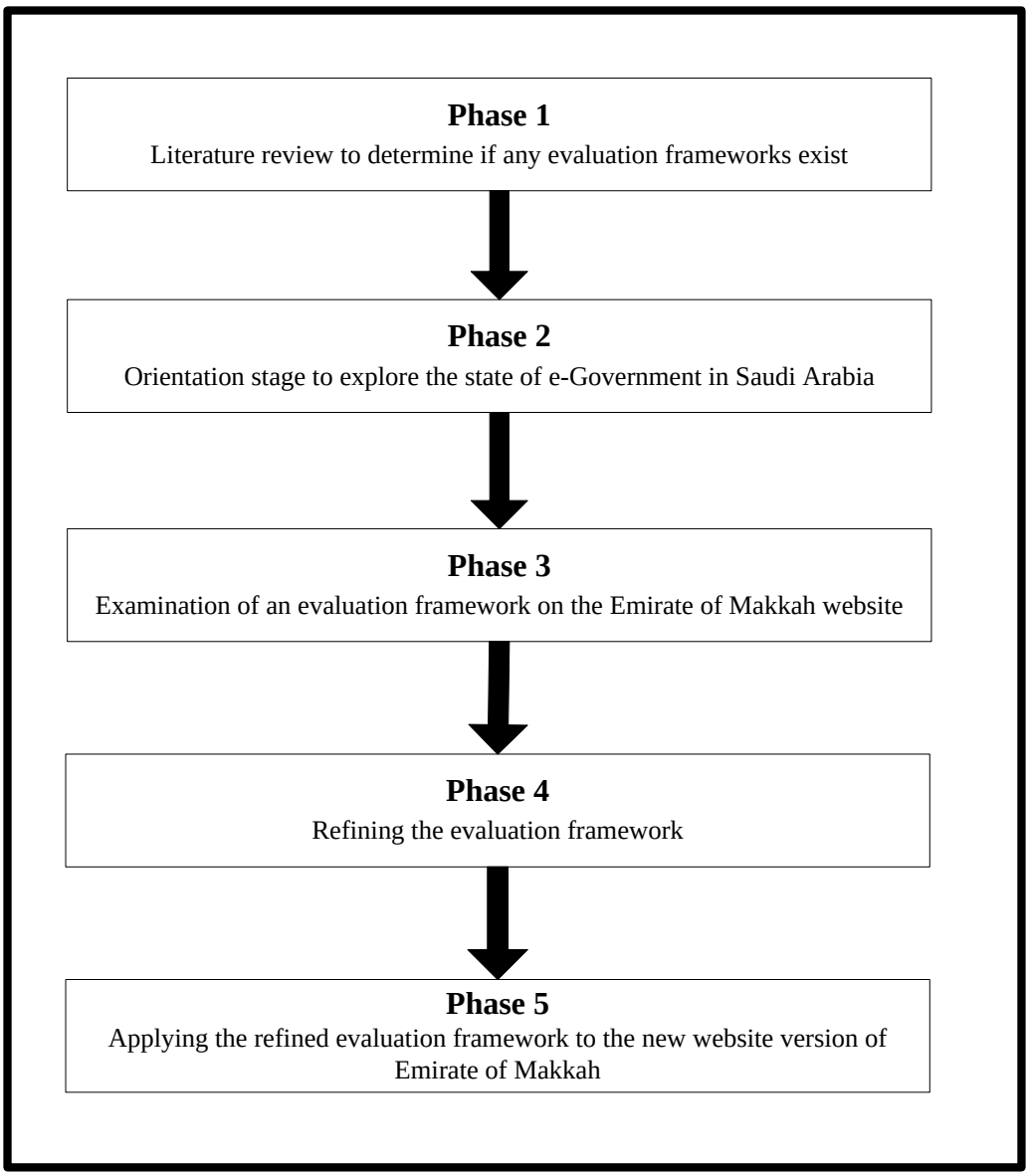


Figure 1.1: The overall research process

Following this process, the usefulness and usability of the refined framework was discussed with key stakeholders to determine the likelihood of its adoption in Saudi Arabia.

1.2 Research Problems and Directions

This section illustrates the research problems with regard to evaluating e-Government websites. In addition, the problems concerning web analytics are discussed and a way of using web analytics within an evaluation framework for e-Government websites is considered. Lastly, case studies, through which the evaluation framework can be studied, are introduced.

1.2.1 e-Government Problems

One of the most important issues when developing e-Government websites is to find ways of measuring the effectiveness of such sites in order to allow the services provided through them better to satisfy users' needs (Bertot and Jaeger, 2008; Esteves and Joseph, 2008). However, usability methods for such websites need to be evaluated in practice rather than just in theory, so that those government agencies that employ usability techniques in order to evaluate websites can be sure that the techniques they use are effective and reliable. In this regard, this research seeks to devise an assessment framework for e-Government websites. Various approaches have been used to reconcile the difficulties mentioned above in applying e-Government evaluation, such as those in Petricek et al. (2006), Soufi and Maguire (2007), and Jones et al. (2007). However, these evaluation methods are limited because, instead of establishing a theory based on a combination of qualitative and quantitative methods, several researchers have used a small number of usability methods to address particular research issues, as addressed by Wood et al. (2003) and Barnes and Vidgen (2006). Despite the benefits of these research strands, using only one or two qualitative methods to explain usage is insufficient, as emphasised by Wood et al. (2003) and Thompson et al. (2003). Moreover, the benefit of using several assessment methods is that it is possible to obtain more in-depth detail (Jaeger 2006b), as well as satisfying users' needs (Bertot et al., 2008).

Thus, building an evaluation framework should involve the employment of various usability methods that cover observations, as well as users' opinions and an analysis of traffic data. These differing methods are likely to yield beneficial results and produce a usability evaluation of much greater depth, as noted by several researchers, including Wood et al. (2003), Thompson et al. (2003), and Jaeger (2006b). To this

end, it has been found that the approaches used by Thompson et al. (2003) and Wood et al. (2003) are likely to offer a comprehensive evaluation of e-Government websites.

However, although Thompson et al.'s (2003) framework has been used for further research, for example by Jaeger (2006b), it employs an outdated method for obtaining quantitative data by using log files; it does not consider more modern approaches such as page tagging (as described in Section 2.4). The challenge in devising an evaluation framework is to utilise emergent techniques in web analytics technology in order to generate a much more meaningful evaluation of e-Government websites. However, several challenging issues are evident when using web analytics technology. Firstly, the data traffic for web analytic tools can be obtained via different methods; nonetheless, log files and tagged pages are the most commonly used methods, and therefore it is important to identify which of these methods is useful for evaluating e-Government websites.

A related problem in applying emerging web analytic tools for the evaluation of e-Government websites is in choosing appropriate metrics that will provide accurate measures of the problems that may exist on a site. This is because web metrics are dependent on the kind of business being examined; thus, a new generation of web metrics is needed (Burby, 2007; Angel et al., 2006; Calero et al., 2004). One of the motivations for this research is to derive or adapt appropriate web metrics as an element in the assessment framework to evaluate e-Government websites. These web metrics will enable a much more meaningful analysis of e-Government websites to be achieved.

However, there are several drawbacks to web analytics, one of which is that it is insufficient to use only web analytic tools to measure and assess websites because users' behaviour and intentions may not be known (Kaushik, 2007c; Peterson, 2007b). One way to overcome this is by defining some form of usability approach that involves the users of websites. The importance of such an approach is to determine whether online services are usable and accessible; if not, then websites should be redeveloped so that more people are encouraged to use them. Nevertheless, it is important in such approaches to find a way to effectively manage the techniques used in the evaluation process as this will enable the evaluation process to become an

integral part of website development and will enable continual improvement in online services.

1.2.2 Motivation of the Research

The adaptation of usability methods and web analytics technology for website assessment can be problematic. This is because there are many restrictions, partly because there is a need for more financial resources to undertake such analysis, as emphasised by Petricek et al. (2006) and Lee et al. (2005), and this can be seen in the e-Government initiatives of developing countries. However, online e-Government services are widely used by thousands of people daily and, in developing countries where users may be less familiar with web-based interfaces, quality improvement should improve the uptake of these services.

In developing countries, there are intensive initiatives to implement public services online via e-Government. In accordance with worldwide trends in the application of e-Government, e-Government issues have already been included in the plans of the Gulf Cooperation Council (GCC) (Kostopoulos, 2003). So, all GCC countries are paying more attention to increasing their online services. In particular, in Saudi Arabia, as the largest country in this council, e-Government was one of the main objectives in the national IT plan project (Saudi Computer Society, 2001). In accordance with worldwide trends in the application of e-Government technology, e-Government issues have already been highlighted and implemented in Saudi Arabia (Al-Shehry, 2008; Hamner and Al-Qahtani, 2008). However, the problems that have been uncovered in e-Government websites in developed countries are also found in e-Government in Saudi Arabia. One such problem is the need to improve the quality of the given services and websites, which is a basic requirement of the IT plan of Saudi Arabia (MICT, 2007b). Accordingly, a motivation for this research is to use an example of a Saudi agency to examine the proposed evaluation framework. This agency should make significant progress towards introducing online services, as discussed in Section 1.5.

1.3 Research Proposal Outline

This section defines the research, which is to establish a multidimensional usability evaluation approach for e-Government websites, by providing research aims and objectives.

1.3.1 Research Questions and Aim

Based on the problems stated in the previous section, three main research questions were proposed:

1- What is the current state of e-Government in the Kingdom of Saudi Arabia?

2- Can a multidimensional usability evaluation framework for e-Government be used to provide insight into user interactions' with online services?

3- What measurements can each of the methods in the multidimensional usability evaluation framework provide?

4- How can the results produced from the multidimensional usability evaluation framework be used, such that the framework can be continually used to evaluate e-Government websites?

Based on these questions, the aim of this research is:

To develop an efficient multidimensional usability evaluation framework for e-Government websites that can be used to improve usability.

1.3.2 Research Objectives

In order to achieve the primary aim of this research, this section presents objectives that illustrate how a multidimensional usability evaluation framework might be developed to assess e-Government websites. The four stages involved in addressing this aim were:

1- To explore the opinions towards e-Government of government officials and web developers in Saudi Arabia, and examine methods by which e-Government websites are evaluated. This research investigated the Yesser programme, which is an organisation that has been created to control the development of e-Government in Saudi Arabia. Moreover, the opinions of officials from two more Saudi agencies were explored: Jeddah Council, which is in Jeddah, the second biggest city in Saudi Arabia; and the Institute of Public Administration in Riyadh, which serves government employees.

2- To evaluate the e-Government website of the Emirate of Makkah. This investigation was based on a usability evaluation framework derived from the methodologies designed by Thompson et al. (2003). During the investigation, the methods of Thompson et al. (2003) were augmented by using web analytic tools.

3- To consider how Thompson's (2003) methods might be adapted and combined with web analytic tools to produce a new comprehensive usability evaluation framework. This objective involved: comparing results produced using qualitative methods with outcomes from web analytics, determining which web metrics could semantically explain data traffic on e-Government websites, and seeking to extend and merge the results produced by web analytics with those produced using qualitative usability methods: e.g. heuristic and observational studies. This enabled Thompson's framework to be refined and made so it could be used to provide ongoing improvements in e-Government services.

4- To apply the refined usability evaluation framework produced from the data collected from the Emirate of Makkah to a new version of the Emirate of Makkah website with the intention of ascertaining the effectiveness of the refined framework. This method of considering the developed framework was able to provide verification of the methodologies used in this research to assess e-Government websites.

1.4 Overview of Saudi Arabia

The Kingdom of Saudi Arabia is located in the south-eastern region of the Asian continent. It occupies 830,000 square miles (Ministry of Foreign Affairs, 2006).

According to the Central Department of Statistics and Information in Saudi Arabia (2008) the total population is 23,980,838 with an annual increase of 5.74%, while the latest population estimate for 2010, is 27,136,977 (Central Department of Statistics and Information in Saudi Arabia, 2010). The number of people aged below 15 years is 32.5% whereas the age group from 15 to 64 years old accounts for 64.7% of the population. This is one of the fastest growing populations in the world and thus the government faces challenges in serving them. Thus, there is growing interest in Saudi Arabia in the implementation of e-Government.

A number of early initiatives were developed in certain agencies to apply e-Government in Saudi Arabia before the emergence of the national plan. For example, the Emirate of Makkah website was one of the first agencies to be available online during 2001. The Emirate of Makkah is an administrative branch of the Ministry of the Interior and is supposed to serve about six million people. The number of Saudi ministries with an online presence has increased from 61% in 2003, as noted by Abanumy et al. (2005), such that today all ministries now have an online presence (United Nations, 2008). Moreover, the rank of Saudi Arabia in implementing e-Government has improved significantly since the United Nations report in 2005; in 2008 it was ranked 70, an improvement of ten places (United Nations, 2008) and a recent United Nations report (2010) showed that Saudi Arabia was ranked number 58, which shows a continuous improvement.

However, the problems with e-Government websites described in previous sections are also found in e-Government in Saudi Arabia. For example, the following problems exist: weakness in the funding of projects and achieving the required infrastructure; a lack of skilled employees; a lack of cyber-literacy (Kostopoulos, 2003); and complex government procedures required to apply e-Government technology (Abanumy et al., 2005). Some of these problems differ from the problems experienced in developed countries as several researchers such as Abanumy et al. (2005), Kostopoulos (2003), and Soufi and Maguire (2007) have identified. So, this research focuses on the

Emirate of Makkah, which has already achieved noticeable progress, having achieved the Digital Excellence Award (*eAward*)[1] three times: in 2005, 2006 and in 2007.

1.5 The Structure of the Thesis

The research contains the following chapters:

- Chapter Two: Literature Review

  This chapter presents current e-Government technology and explains the context of such services and their motivations. It includes the initiatives that were implemented to apply e-Government. Furthermore, the existing evaluation approaches that were developed within this area are presented and evaluated, especially those that are regarded as having adopted a comprehensive approach to assess e-Government websites. Moreover, the key characteristics that are needed for empirical study, and which can be applied in this research, are provided together with an exploration of e-Government in Saudi Arabia, which is the case study in this research. Furthermore, the chapter presents the benefits of web analytic tools, and the different approaches to obtain traffic data. Moreover, some existing web metrics are introduced.
- Chapter Three: Research Methods

  This chapter identifies and provides details of the research philosophy that was followed in this research. In addition, this chapter explains the methodology and tools that were employed to achieve the research objectives.
- Chapter Four: Analysis of Documents and Interviews. This chapter gives the results of the analysis of the documents and interviews that were conducted during the field study in Saudi Arabia.
- Chapter Five: Heuristic Evaluation Analysis. This chapter discusses the findings of the heuristic evaluation that was carried out by three evaluators on the Emirate of Makkah and Jeddah Council websites.
- Chapter Six: Usability Testing Analysis. This chapter discusses the usability test results produced by users of the Emirate of Makkah website.

[1] Digital Excellence Award (*eAward*): is an annual prize that given to the best government agencies in Saudi Arabia.

- Chapter Seven: Web Analytic Analysis. This chapter discusses the results from the web analytics approach which was applied to the Emirate of Makkah website. It explains the findings of the web analytic tools as they relate to the design of the website as part of the development of a multi-dimensional evaluation framework for evaluating e-Government websites.
- Chapter Eight: Refinement of the Evaluation Framework. The aim of this chapter is to discuss the results obtained from the first implementation of the evaluation framework, i.e. the results from Chapters 4, 5, 6 and 7 and outline refinements to the framework that improve its usefulness and efficiency.
- Chapter Nine: Second Implementation and application of the Refined Evaluation Framework. The aim of this chapter is to apply the refined evaluation framework outlined in the previous chapter. This chapter discusses the significance and efficiency of the revised approaches.
- Chapter Ten: Discussion. This chapter provides a discussion of the results obtained from applying the refined evaluation framework for e-Government websites. This also illustrates the results of this research within the literature.
- Chapter Eleven: Conclusion and Recommendations. This chapter summarises the results achieved in this research. Moreover, it considers the limitations found in this research and the recommendations for further work.

Chapter Two: Literature Review

2.1 Introduction

The evolution of web technology has influenced the supply of government services and there are now many e-Government initiatives that provide a variety of online services that are available worldwide. This chapter outlines the state-of-the-art in e-Government in relation to the different approaches that have been developed to evaluate such websites, as well as their relation to defining a method to improve the services provided through these websites.

This chapter is divided into seven sections. Section 2.2 states the objectives and benefits of e-Government phenomena. Section 2.3 provides a discussion about the need to evaluate e-Government websites as well as the approaches that have been proposed to assist in such evaluation. Section 2.4 expands the information concerning e-Government in Saudi Arabia in order to initiate the case study of this research. Section 2.5 illustrates some of the usability methods that are used to evaluate e-Government websites, this includes presenting web analytics as a potential method, as well as two qualitative usability methods: heuristic evaluation and usability testing. Section 2.6 reflects on the previous sections and introduces the need for a new multidimensional evaluation framework built on several usability methods. Section 2.7 contains a summary of this chapter.

2.2 e-Government

e-Government is considered to be an online facility to deliver government services, as described in the literature (Esteves and Joseph, 2008; Bekkers. and Homburg, 2007; Yildiz, 2007; Gupta, 2007; Commission of the European Communities, 2005; United Nations, 2005). Numerous benefits have emerged from deploying Internet-based services for both government and citizens. For example, it allows citizens to access services without undue intervention from government bureaucracy: i.e. it simplifies the transactions (Chau et al., 2007; The White House, 2007); this is known as being ‘client-centric’. In addition, citizens can benefit from easier and quicker information and services without the need to be present in person, or even by utilising such

services over the phone (Cullen, 2007; Chau et al., 2007; Yildiz, 2007). Furthermore, governments, as well as citizens, can enjoy benefits including the improvement of both productivity and efficiency which helps meet the goals of national development plans. Consequently, e-Government can enable improvements to be made in the efficiency, transparency, responsibility and effectiveness of public government (United Nations, 2005; Yildiz, 2007). Moreover, a further potential benefit of e-Government is that electronically-delivered services and information will reduce the cost of providing services and thus improve the quality of life of citizens (Gupta, 2007; Commission of the European Communities, 2002; Yildiz, 2007). Consequently, the objectives of e-Government are, nationally, to serve its citizens and internationally to state the cultural, business and political aims of the country (Kostopoulos, 2003). Implementing e-Government applications have been the focus of initiatives in many countries worldwide since the emergence of the World Wide Web in the early 1990s (Yildiz, 2007). Furthermore, such implementation became a principal demand of regional governmental organisations such as the European Union. The following sections explore e-Government initiatives. These are then linked to issues regarding the implementation of this phenomenon but, in particular, those themes and techniques that can be used to evaluate such web-based Internet applications. Initially, existing e-Government models are presented, and this is followed by an explanation of the main components of these initiatives.

2.2.1 e-Government Models

The development of e-Government has passed through several stages, and relationships exist between and within these different stages. Layne and Lee (2001) identified four staged models for developing fully functional integrated e-Government to provide government services online. These four models were:

1- Cataloguing existing work to be made available online.
2- A transaction stage which enables citizens to conduct transactions online.
3- A vertical integration stage which involves the integration of related functions and services within a local agency.
4- A horizontal integration stage which results in the integration of the existing services and functions for all government agencies.

Figure 2.1 illustrates the model. This architecture has been widely accepted by researchers (Reddick 2005; Akman 2005).

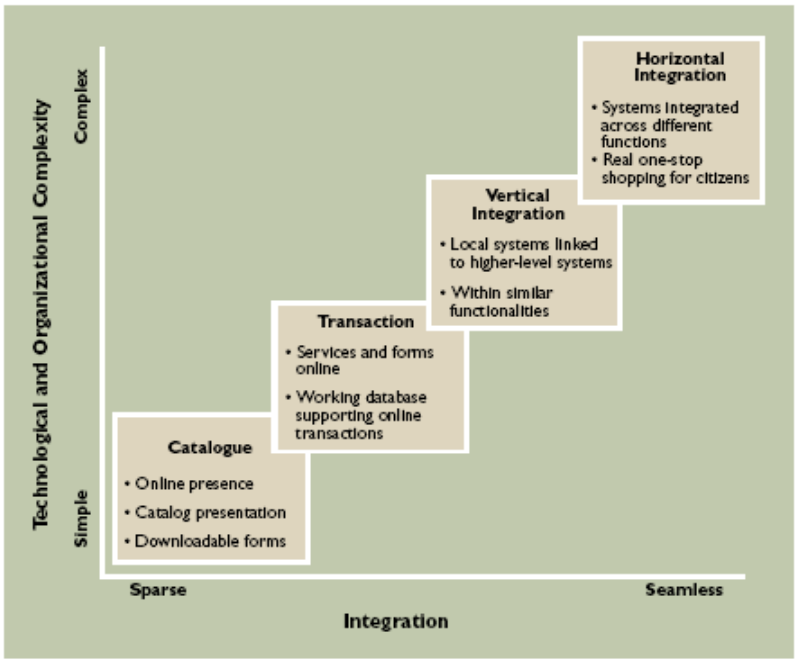


Figure 2.1: The development of e-Government in four-stage models from Layne and Lee (2001)

However, in this model, there is no mention of how to evaluate e-Government services or even the methods that might be used to assess stakeholders' experiences in order to improve such services. For implementation of e-Government initiatives, Lee et al. (2005), Yildiz (2007), and Chau et al. (2007) developed three categories:

1-Public services serving citizens: this is known as Government to Citizens (G2C).

2-Services to businesses, termed Government to Business (G2B).

3-The integration between government agencies in the Government to Government (G2G) category.

There are significant initiatives involving e-Government technology. The contents of these initiatives can be divided into four main branches, as presented in the following subsections:

2.2.2 ICT Infrastructure

Fundamentally, the Internet technology infrastructure is the main building block in e-Government and all initiatives have emphasised the need to expand Internet services in order to be able to deliver government services. For example, e-Government was included in the initial European Union (EU) plan in 2002 (Commission of the European Communities, 2002) and as a demand from the National Audit Office in the UK (2002), where it focused on improving the Internet infrastructure to allow citizens to use electronic services more efficiently, thus increasing the benefits in both social and economic spheres (Lee et al., 2005). Moreover, the plan published by the European Union (Commission of the European Communities, 2005) focused on broad objectives that included the need to establish more informative websites, to increase electronic services and hence build the required amount of trust and confidence in these services. These improvements need a sufficient Internet infrastructure capable of handling this volume of work and it was felt that improvements in the Internet infrastructure will help to provide better public services (Lee et al., 2005). However, this infrastructure should be built on a secure and robust electronic infrastructure that is able to provide the necessary support for e-Government websites (Government of Canada, 2005; Lee et al., 2005).

2.2.3 Legislative Framework

E-Government services are supported by a framework of policies and laws. This framework enables governments to satisfy, in legal terms, the strategic plans for e-Government and will also support citizens when using these online services. The need for such support has been highlighted in e-Government initiatives (Lee et al., 2005; National Audit Office, 2003) as well as in the literature, as, for example, in the report of the Waseda University Institute of e-Government (Obi, 2007).

Hence, there is a clear need to develop laws to support policy initiatives and there are distinct laws in several countries that have been enacted to support such policies. For example, as Lee et al. (2005) state, in the US, certain laws have been established since the mid-1990s to support the use of the Internet, which provides a basis for e-Government. A significant law is the 2002 Act covering the "*Accessibility, usability, and preservation of government information*" (US Government, 2002). This

influenced the direction of e-Government initiatives to be wide in scope and enhanced the efficiency of services with respect to security and privacy issues. Similarly, in Europe, there is also a certain amount of legislative support for electronic services. For instance, the Commission of the European Communities (2002) advised member states to adopt the necessary legislation to improve access to a variety of networks and to demonstrate political leadership. However, it has been found that there is still a need for further legislation among the EU member states because of different legislative structures and foundations, especially among new members (Lee et al., 2005). In addition, in this regard, there is legislation from 2003 in the European Parliament to "ensure that users have a right to privacy" (Europa, 2006); this should encourage citizens to trust government websites.

2.2.4 General Portal

It has been suggested that online services should be provided via a unique portal that can be easily accessed by all members of the public; all government services could be obtained via this portal (Garcia et al. 2005; Lee et al., 2005). This would enable government agencies to work together more efficiently and would provide a one-stop (portal) service to both businesses and citizens (Lee et al., 2005; National Audit Office, 2002). For example, the Canadian initiative (Government in Canada, 2005) requested that e-Government should be provided as a one-stop service to allow citizens to apply quickly for government services. In addition, this type of portal should allow data to be shared between government agencies which will potentially offer horizontal improvement for all agencies (Lee et al., 2005). In the UK, there is a portal to serve citizens called Directgov (Directgov, 2008) and another portal called BusinessLink for businesses in the UK (BusinessLink, 2007).

2.2.5 e-Government Management

The one-stop portal in e-Government, in general, needs a responsible control structure that monitors, analyses and controls e-Government websites; this has been stated in many initiatives. For example, in the US, as Wood et al. (2003) stated, there is the Federal Enterprise Architecture (FEA) whereas, in the UK, Govtalk was responsible for the development of e-Government from 2002; this was then moved to the Cabinet

Office in 2005. These organisations are responsible for administering and improving the development of e-Government.

2.2.6 Progress Evaluation

In some e-Government initiatives, the evaluation of web-based Internet applications has been highlighted. Some initiatives, such as that in the US (The White House, 2006), Canada (Government in Canada, 2005) and in the UK (National Audit Office, 2007, 2006), have mentioned the importance of the quality assurance of services. In particular, in order to achieve a client-centric principle and to support the development of e-Government, there is a need to share the experiences of related stakeholders: i.e. citizens, businesses and politicians. This can improve the relationships between the government and the public by making the interactions between citizens and government agencies more efficient, easier and smoother (National Audit Office, 2007; Lee et al., 2005). This evaluation should, as defined in research (Government in Canada, 2005; Lee et al., 2005), identify a way to ensure accessibility to such services for all citizens, ensure that the quality of information is effectively managed, and ensure that security and privacy are safeguarded. These components can be used to examine and revise government strategies and to produce continuous improvements in the available online services (National Audit Office, 2006; Lee et al., 2005).

However, early initiatives did not properly satisfy these demands. For example, the US initiatives, as Lee et al. (2005) illustrated, mainly focused on the internal efficiency and effectiveness of operations. This demand, however, requires the development of services and projects to be continuously monitored and ways of solving the problems to be identified, as recommended by the National Audit Office in the UK (National Audit Office, 2006, 2007).

This is one of the most significant problems facing e-Government initiatives. In particular, there is a failure to define an appropriate approach for evaluating the adoption of e-Government and there is no standard for evaluating e-Government initiatives (Esteves and Joseph, 2008; p.121). This deficiency can be seen in two different ways within the development of e-Government:

1- There are problems regarding the inadequate sharing of results produced from e-Government with its leadership (Lee et al., 2005; Esteves and Joseph, 2008). Thus, reviews of e-Government ignore decision-making processes and focus mainly on analysing the outputs, while linking to the process is really necessary (Lee et al., 2005; Yildiz, 2007).
2- There is greater need to improve the quality of information that is provided by determining stakeholders' expectations of e-Government (Gupta, 2007; National Audit Office, 2007).

As a result, continuous evaluation is necessary to satisfy the demands of citizens, as well as the demands of government. These needs were reported by Gupta (2007), and by Esteves and Joseph (2008), who identified a need for a comprehensive assessment framework that would involve all entities in the e-Government area. For example, Gupta's framework (2007) identified assessment for an e-Government project, which could be summarised as follows:

1- Considering the perspectives of stakeholders and their feedback.
2- Identifying the expectations of the organisation.
3- Identifying the benefits of e-Government projects.
4- Analysing the results of historical data by designing appropriate indicators for such assessments.
5- Identifying ways to involve the enablers in such a project assessment, to push the improvement of assessment and to apply these improvements.

Esteves and Joseph (2008, p.123) identified a detailed framework of comprehensive assessment which clearly involves all entities in the e-Government area. This framework includes three main components, as can be seen in Figure 2.2:

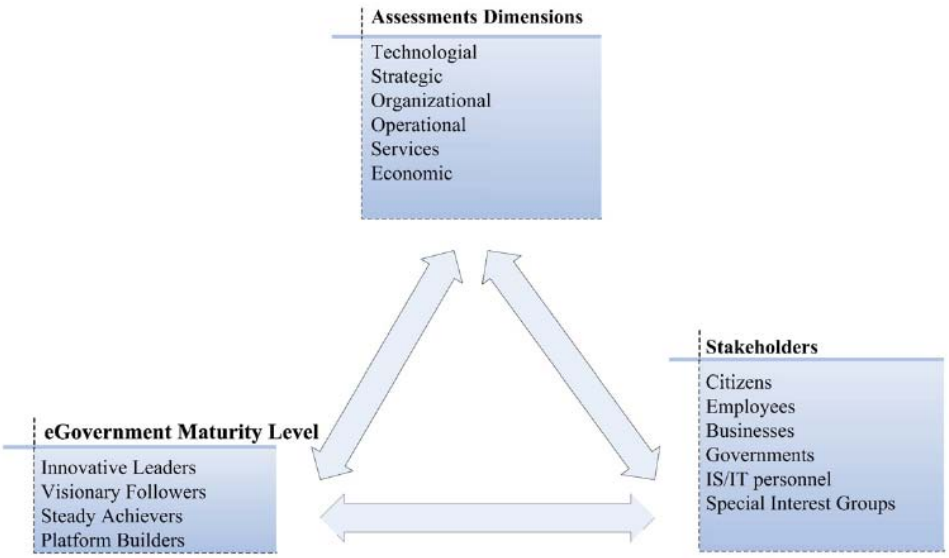


Figure 2.2: e-Government assessment framework (Esteves and Joseph, 2008, p.123)

This assessment framework considers more of the details of elements in e-Government that affect the development of the services provided. Nevertheless, an analysis of historical data is not considered in this framework so the approach taken by Gupta (2007) seems to adopt a more logical framework for the application and implementation of e-Government. Therefore, it might be that a combination of both approaches (i.e. Gupta, 2007; Esteves and Joseph, 2008) could achieve a more comprehensive assessment for e-Government. However, neither approach has been described in any detail and, in particular, there is little detail on how to obtain users' opinions.

2.2.7 Initiatives: Results and Discussion

The results of the intensive work behind e-Government can be seen in several successful implementations for the provision of online government services, as well as in the expanding use of information technology. Several evaluation methods have been used to rank e-Government websites worldwide (United Nations, 2004, 2005, 2008; Obi, 2007) and each of these has its own criteria for evaluation. For example, the recent United Nations surveys (United Nations, 2004, 2005, 2008) examined the availability of free access, quality of information, and the amount of services providing basic social services. Waseda University Institute's report on e-Government (Obi, 2007) offered more detail, including the availability of services and the delivery

time of information, the design of home pages, the ability to interconnect management with the technology, the priorities of the e-Government plan, promotion activities, the legal framework, and an evaluation system.

However, there are several challenges facing e-Government development and a considerable amount of research has addressed these challenges. As emphasised by several researchers, such as Petricek et al. (2006, p.669) and Lee et al. (2005), e-Government needs political support and more financial resources to accelerate the processes to implement these services. In particular, it was found that management support was a significant factor that influenced the acceptance of e-Government by the citizenry (Titah and Bark, 2005). Furthermore, there is a necessity to engage government leadership as an important part of these web-based Internet applications (Lee et al., 2005; National Audit Office, 2007).

Generally, there is a need to measure the effectiveness of management strategies and citizens' behaviour in terms of how these might affect the utilisation and adoption of e-Government (Titah and Bark, 2005; Gupta , 2007; Esteves and Joseph, 2008). For example, it is useful to know what activities citizens would like to perform online (Chau et al., 2007), whether citizens can use online services efficiently, and whether these can be accessed quickly. In addition, there is a need to verify that the services are accurately provided (Soufi and Maguire, 2007; Gupta, 2007). In particular, there is a need to examine whether the content satisfies users' demands (Soufi and Maguire, 2007) or if more interaction with citizens is needed (Petricek et al., 2006). This demand for a comprehensive assessment of online government services has been identified by some researchers, such as Gupta (2007) and Esteves and Joseph (2008). However, such research simply proposed frameworks, without outlining the internal procedures required to examine usage. In other words, usability methods such as heuristics and usability testing are mentioned as solutions without the design of a particular version to carry out such evaluations.

Thus, there is an essential need to pay more attention to citizens' experiences and behaviour on e-Government websites, as well as linking these demands with the processes within e-Government. In addition, there is a need to develop an approach that will transfer citizens' data between government agencies more efficiently (The

White House, 2007; National Audit Office, 2007). This can be represented in the horizontal and vertical integrations between government agencies that would facilitate the ability of citizens to enter their data once and re-use it for other services. This would then make it easier to apply to any service as personal data would be shared. However, this process requires the organisation to respect citizens' privacy which is still a point of debate. This issue is explored in the next section.

2.2.8 Privacy and Security in e-Government

It is accepted that privacy in e-Government websites needs to be protected; in addition, the issue of security is of paramount importance to government web developers. However, researchers have found problems regarding this issue. This section examines privacy and security issues in e-Government websites in order to explore the open questions that can be fulfilled by using different types of approach to evaluate e-Government.

2.2.8.1 Government Security

The growth of e-Government applications is pushing planners and politicians to introduce legislation especially for e-Government, as shown earlier in this section. However, as government information becomes more widely available, there is a possibility that the published information is used in such a way that might harm national security, as well as risking citizens' security. This might facilitate attacks from terrorists (Chau et al., 2007; Europea, 2006); e.g. searches on government websites can provide important details which might be used by terrorists (Chau et al., 2007). Therefore, there is a need to investigate users' behaviour on e-Government websites to avoid such circumstances. One solution is to identify the query characteristics used by stakeholders; this could help in discovering some of the unique behaviour that might facilitate any attack (Schwartz, 2003; Nemati et al., 2003; Chau et al., 2007). In addition, exploring search patterns could allow more enhancements to be made to government websites. For example, this could provide data to help reorganise the web site and monitor the usage (Chau et al., 2007).

As the concept of security is important for government, the privacy of citizens is also important and needs to be respected. The next section discusses this concept in order to develop a balance between issues of security and privacy.

2.2.8.2 Citizens' Privacy

Information collected via e-Government websites may raise issues about the way information is maintained, stored and retrieved. Privacy-related issues and concerns are a critical challenge for the successful implementation of e-Government, as some authors have pointed out, including McCarthy and Yates (2010), Cullen (2007), and Reilly and Cullen (2006).

The privacy of personal information is protected by several widely accepted international protocols that consider this aspect (UNDP, 2007). Furthermore, these rights have been respected in the initiatives emerging from information systems worldwide. In particular, building the trust of citizens in such websites has become a key principle in several developed countries. For example, it is included in New Zealand's e-Government strategy (Cullen, 2007), the United States' Act (US Government, 2002), and the European Union (Europa, 2006). These encourage governments to preserve the privacy of citizens when they apply for services online.

However, there has been a noticeable increase in the level of public concern about privacy in e-Government (Cullen, 2007). This is because people provide personal data when asked but lack knowledge about the way such personal data are maintained and accessed, which may cause data protection legislation to be breached. For example, the personal details of families who were receiving child benefit in the UK during 2007 were lost; this data contained the bank details of 25 million people (BBC News Channel, 2007). Moreover, the medical details of more than six thousand prisoners and ex-prisoners were lost on a memory stick and, despite the fact that the data were encrypted, the password was written on the lost memory stick (BBC News Channel, 2009).

One problem in this area is that the existing implementation of e-Government websites may not properly satisfy or fully respect the privacy of citizens: i.e. it may

not protect citizens' data sufficiently to avoid any possibility of such data being sold (Layne and Lee, 2001). Moreover, it is important to ensure that information about citizens is handled properly and is used only for the purpose for which it is intended (Chau et al., 2007). This shows clearly the need to establish serious management procedures to protect personal data and to reassure potential users of e-government websites that these procedures are implemented. However, it is thought that privacy is not an absolute right (US Government, 2002; Cullen, 2007; Europa, 2006). This is because, in individual cases, it might be in the interest of the public for the government that represents them to investigate such personal data (Cullen, 2007). So, the problem might be to find a way of promoting a balance between the government's needs and citizens' privacy (Nemati et al., 2003). Nonetheless, this need for balance has been difficult to quantify and define (Cullen, 2007).

Similarly, as Cullen (2007) pointed out, two factors have been commonly raised in this area in particular: government rules to protect the privacy of citizens and the responsibility of government to handle any lapses of privacy should they occur. This shows that the notion of privacy is related to the management of websites rather than being a technical issue. Thus, governments should look to develop and promote their privacy policies more precisely and should develop strict rules to protect any violations of privacy.

2.3 E-Government Evaluation

As shown in preceding sections, several researchers have identified the need to improve the services provided via e-Government websites. In the e-Government field, as in other fields, evaluation is important for several reasons. For example, without evaluation, costs may increase and, if there is too much complexity in its implementation, the entire e-Government project may become unmanageable (Esteves and Joseph, 2008, p.124). Also, it is important to accept that improvements to existing e-Government websites are always necessary (National Audit Office, 2006, 2007). Researchers have identified a number of acceptable ways for carrying out such assessments that should be considered in developing e-Government websites. This section addresses issues in this area and attempts to describe an adequate method of evaluating e-Government.

2.3.1 Usability Evaluation in e-Government

A number of researchers have studied the evaluation of e-Government websites and have highlighted the usability issues required to improve such phenomena. A variety of usability methods have been utilised but some e-Government evaluation studies have used only a few evaluation methods. For example, Soufi and Maguire (2007) used heuristic evaluation to conduct usability assessments of e-Government websites. Moreover, the heuristic evaluation method showed up poor search facilities and too many navigation options from the home page.

Other research, by Jones et al. (2007), used an interview method for evaluating e-Government websites. The findings indicated that high-level management need to take responsibility for e-Government evaluation to improve outcomes and performance. Moreover, this research also showed that the evaluation can be conducted at the design as well as the operational stage. The need for continual evaluation during the life of an e-Government project was also indicated. However, the interview samples came only from government staff; citizens did not participate. The opinions of users, which could have helped improve the services that were provided, thus helping to solve user problems and hence encourage people to use such online services, were not sought. Furthermore, evaluations from a government perspective might not satisfy the main purposes of e-Government which include, for example, transparency and efficiency in the services provided for citizens and businesses, as explained in Section 2.2.

Thus, the opinions of users are of critical importance in improving e-Government online services. This requires carrying out an analysis of how users interact with online services by using qualitative methodologies, as several authors have emphasised already, including Thompson et al. (2003), Wood et al. (2003) and Barnes and Vidgen (2006). In this field, Lee and Cho (2007) used usability testing methods to indicate some usability problems. By using such tests, it was found that there are often periods of waiting between transactional stages; also there are often too many steps to complete some tasks. Moreover, older people often experience difficulties and achieve lower success rates when usability tests carried out in the lab have been

examined during post-test interviews. However, using a quantitative approach to explain usage was not included by Lee and Cho (2007).

Some researchers, such as Petricek et al. (2006), have addressed the use of quantitative evaluation of e-Government websites and have defined particular measurement parameters that might be adopted. In particular, Petricek et al. (2006) analysed the web and link structure of e-Government websites and developed web metrics to measure such features. This included a way of examining log files for search characteristics so that information is more visible to search engines and more easily accessible for citizens using such websites. These principles, in terms of search and usability functions, can be used for a variety of improvements, especially when redesigning websites, as a yardstick to measure their effectiveness (Soufi and Maguire, 2007; Petricek et al., 2006).

However, there are several difficulties in applying these principles. One of these, as Petricek et al. (2006) and Reilly and Cullen (2006) report, is that e-Government websites can be very large; thus it can be difficult to define the extent of e-Government. Nevertheless, these difficulties can be overcome by applying two rules: firstly, by applying a quantitative approach such as web analytics, which can be applied to any number of websites and which is done automatically (as will be explained later in this chapter); and, secondly, strategic plans should clearly develop the important services that should be included in e-Government. Therefore, using quantitative measurements in web analytics can provide meaningful data that may help to improve the current e-Government offerings. However, the majority of research conducted in e-Government evaluation has ignored the use of quantitative methods. Furthermore, quantitative measurements on their own, as Petricek et al. (2006) advised, are often insufficient; they can be improved by adding a qualitative approach: e.g. opinion surveys or heuristics. This could provide a measure of the efficiency of e-Government. Barnes and Vidgen (2006) used a triangulation approach that combined the results of questionnaires and feedback from users to obtain quantitative results.

However, using just a few evaluative methods may produce incomplete and misleading results, as discussed by Wood et al. (2003) and Barnes and Vidgen (2006).

Also, using more usability methods helps to define problems "that other methods of testing missed" (Wood et al., 2003) and the methods can also be compared with others to produce much more effective evaluation strategies.

Thus, building an evaluation framework for e-Government websites that contains a variety of usability methods (i.e. quantitative and qualitative) can achieve beneficial results and produce much more in-depth evaluation, as some researchers have highlighted, including Wood et al. (2003) and Thompson et al. (2003); this will be seen in the next section.

2.3.2 Multidimensional Evaluation Approaches

Some research has considered methods of involving both qualitative and quantitative approaches in order to evaluate the usability of e-Government websites. Authors have used different terms to describe their evaluation approaches. For example, Wood et al. (2003) used a 'comprehensive evaluation' approach, whereas Thompson et al. (2003) used a 'multidimensional' approach. The National Audit Office (2007) identified a number of methods to investigate website effectiveness but, whatever the name, there are potentially many methodologies that can be used to assess e-Government websites. The methodologies found in the literature indicate two avenues of research: to investigate the government provision of information and services through its websites, and to investigate the public use of these websites (The National Audit Office, 2007). Each of these avenues of research has used common methodologies. For instance, interviews have been used with users, developers and government employees; also, surveys, focus groups, and user experiments are common methodologies used for this purpose.

In the past, the National Audit Office (2007) have used quite old quantitative technology as represented by the web crawling method, which explored the use of search engines to visit websites. This tool is limited in comparison with web analytics which provides much more in-depth information, as will be seen later in this chapter. Also, more useful usability methods have been employed by Wood et al. (2003) and Thompson et al. (2003). These include: heuristic evaluation and log file analysis, as can be seen in Figure 2.3.

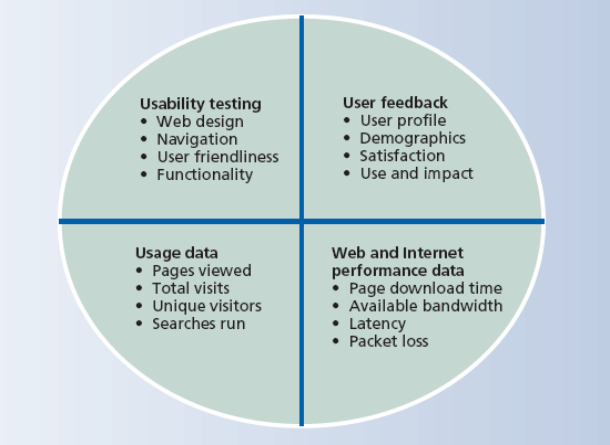


Figure 2.3: Web framework: a multidimensional approach (Wood et al., 2003)

Thompson et al. (2003) described in more detail aspects required to perform such a comprehensive evaluation. These are as follows:

1. Preparation phase for usability assessment. This includes the review of users' needs and usability issues (defining potential problem areas), defining the project outline and scope (i.e. cost, user needs, basic evaluation methods), and identifying which tasks and users to assess in this evaluation.
2. Usability evaluation. This comprises three concepts:

   1- Usability metrics, which include interviews, focus groups, user feedback, questionnaires, and log analysis.

   2- User testing, which includes formal empirical observations, contractive interactions, and the think-aloud approach.

   3- Expert analysis, which includes heuristic evaluation and the evaluation of the environment: i.e. the test environment.

Thompson's model includes a comprehensive multidimensional evaluation model which can be applied and which also offers recursive evaluation. Thompson's multidirectional approach should result in a comprehensive evaluation of e-Government websites, producing more effective results and therefore helping to provide meaningful online services.

However, subsequent research has not followed precisely the comprehensive evaluation approach mentioned above. For example, Jaeger (2006a, 2006b) conducted

an evaluation of e-Government websites for ease of access and used only a subset of qualitative methods from the Thompson et al. (2003) approach. These were: expert testing, policy analysis, user testing and a webmaster questionnaire. Moreover, Jaeger (2006b) included a method called automated testing which uses an automated tool designed to measure accessibility. This gives an indication that not all the components suggested by Thompson et al. (2003) need to be implemented.

Moreover, it is clearly more challenging in any empirical study to use the principles from both models: those of Thompson et al. (2003) and Wood et al. (2003). In particular, it is useful for research to identify or examine appropriate web metrics specifically for e-Government websites. More important, however, is the lack of use of quantitative measurements in such evaluations. As a result, using a web analytics tool with such evaluative approaches possibly achieves a more in-depth evaluation for e-Government websites, as will be illustrated later in this chapter.

2.4 Saudi Arabian Plans for e-Government

In developing countries, there are intensive initiatives to implement public services online via e-Government. So, in this section, e-Government in the Kingdom of Saudi Arabia is described in order to provide a knowledge base for understanding the case study in this research. This includes information about e-Government initiatives in the Kingdom; the existing situation regarding these initiatives is also introduced in this section. Finally, the limitations of e-Government are discussed.

2.4.1 e-Government Initiatives

As shown in Section 1.4, there is a growing interest in implementing e-Government in Saudi Arabia. This has been supported by the supreme Royal Decree number 7/B/33181, issued on 7th September 2003, which included a directive to the Ministry of Communications and Information Technology (MCIT) to formulate a plan for introducing government services and transactions online (Yesser, 2007b). This was used to allocate the development of e-Government to a special organisation called the Yesser Programme which was to specify the standard and the degree of control of

such applications (Yesser, 2008a). The objectives of Yesser in applying e-Government in Saudi Arabia are:

- To introduce the required information in a timely and highly accurate way.
- To introduce better and more easy-to-use services for citizens and businesses.
- To improve the public sector's efficiency and productivity.
- To increase the government return on investment (ROI).

In line with the literature, these objectives are similar to those in industrial countries such as the UK (The Comptroller and Auditor General, 2002), where the objectives are to utilise the new technology to provide greater convenience, faster delivery, improved efficiency and better accessibility. However, the vision of e-Government in Saudi Arabia may be viewed as over-ambitious considering the fact that several critical issues need to be addressed carefully before such very optimistic goals can be achieved, as addressed in Al-Shehry‘s work (2008).

To apply e-Government in Saudi Arabia, Yesser programme had a five-year plan and was supported by about 1.33 billion US dollars. Thus, the wide aim for the Yesser programme was that: "By the end of 2010, everyone in the Kingdom will be able to enjoy - from anywhere and at any time – world-class government services offered in a seamless, user-friendly and secure way by utilizing a variety of electronic means" (MCIT, 2007a). Moreover, it was planned to increase the existing website services to have more than 150 online services by 2010 (Yesser, 2007b). So, Yesser helps government agencies by: developing procedures to implement IT, giving advice, using consultants, and having a budget to apply e-Government.

As a result of this plan, a special portal, considered to be for all government agencies in Saudi Arabia, has been created. It is called www.saudi.gov.sa. Also, many other web sites, such as the Jeddah Council website, have been implemented within the project for a variety of purposes (Yesser, 2008b). In addition, an annual prize is given to the best government agencies in Saudi Arabia; this is called the Digital Excellence Award (*eAward*) and it encourages the development of good web sites (MCIT, 2007b). The 2007 award was given to the Emirate of Makkah which achieved first rank status; Makkah Council, on the other hand, was ranked second. Jeddah council also achieved the award in 2008 (MCIT, 2008a). As a result of Yesser, the number of

Saudi ministries with an online presence has significantly increased, as stated in Section 1.5.

However, the problems with e-Government websites described in previous sections are also found in e-Government in Saudi Arabia. For example, the following problems exist: weakness in the funding of such projects and in achieving the required infrastructure; a lack of skilled employees; a lack of cyber literacy; and the long government procedures involved in deploying e-Government technology (Abanumy et al., 2005; Kostopoulos, 2003; Soufi and Maguire, 2007). The infrastructure in Saudi Arabia as a developing country is an important issue so the next section explains the background to Internet services in Saudi Arabia.

2.4.2 Internet service

Internet services started in Saudi Arabia at the end of 1998 with delivery through normal telephone lines (Al-Zoman, 2002). According to MCIT (2008), there was a noticeable increase in the number of Internet users: from one million in 2001 to 5.4 million by the end of 2007. This represents a current penetration rate of 22% among the population and an average annual growth rate of 32%, as can be seen in Figure 2.4. This growth is a result of a reduction in the price of computers and communications, together with a growing knowledge of the benefits of the Internet.

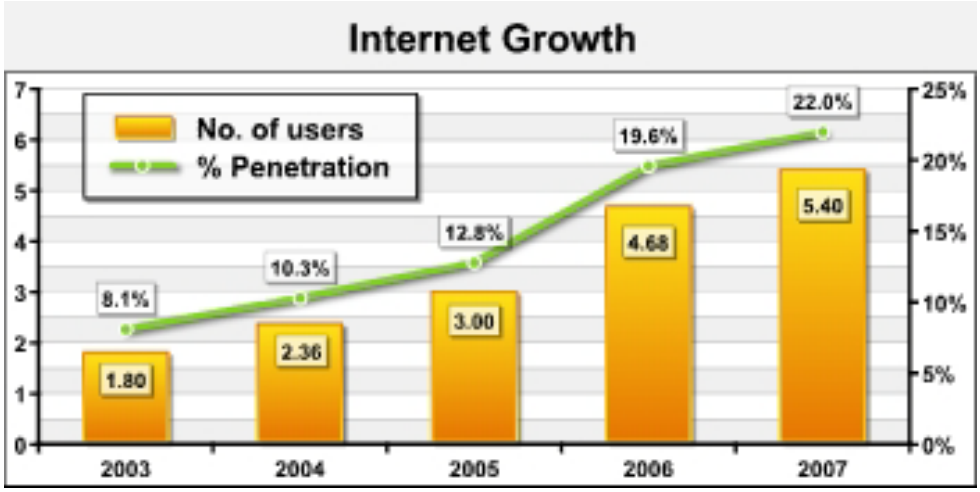


Figure 2.4: Internet growth in the Kingdom of Saudi Arabia (MICT, 2008b)

On the other hand, broadband communication services grew from 14,000 in 2001 to more than 623,000 by the end of 2007 (MCIT, 2008b). This is a growth rate of 90% in the six year period and can be seen in Figure 2.5.

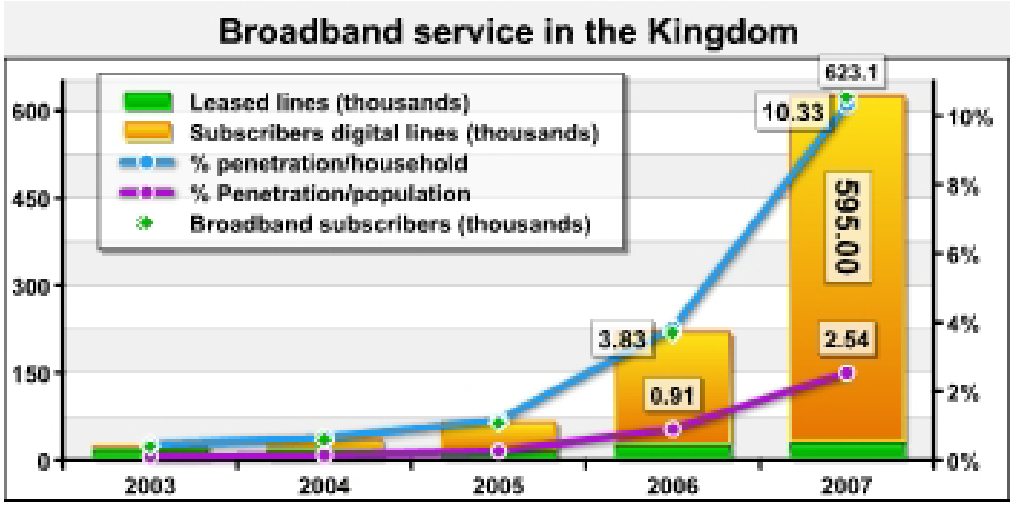


Figure 2.5: Broadband service in the Kingdom of Saudi Arabia (MICT, 2008b)

Despite this growth, the penetration rate is low compared to developed countries and other countries similar to Saudi Arabia; this may affect the usage of Internet services. The penetration rate of broadband services is about 2.5% of the population and 10.3% of households (MCIT, 2008b). This relatively low level of penetration is a critical challenge facing the IT sector in the Kingdom. So, the Saudi government has adopted two approaches towards spreading broadband communication services in Saudi Arabia. The first involves the opening of competition in the land phone sector and the second concerns new companies launching their services on a commercial basis (MCIT, 2008b; United Nations, 2008).

The penetration rate of broadband services in Saudi Arabia is about 2.5% of the population and 10.3% of households (MCIT, 2008b). This relatively low level of penetration is a critical challenge facing the IT sector in the Kingdom. On the other hand, 56% of all UK households had broadband Internet access in 2008, an increase from 51% in 2007. Moreover, of the UK households with Internet access, 68% had a broadband connection in 2008 (Office for National Statistics, 2008). The gap in broadband services between Saudi Arabia and the UK can be seen in Figure 2.2. Interestingly, in the UK, two Megabytes is the broadband speed target, as stated in the

Digital Britain report (DERR, 2009), whereas, in Saudi Arabia, a target has not yet been defined. As a result, it is important in Saudi Arabia to reduce the digital divide in this area. The noticeably slow rate of broadband adoption in Saudi Arabia must be highlighted, especially in the light of the high rate of population growth in the Kingdom, which stands at 3.94% per annum (CIA, 2008a); this will increase the need for broadband services.

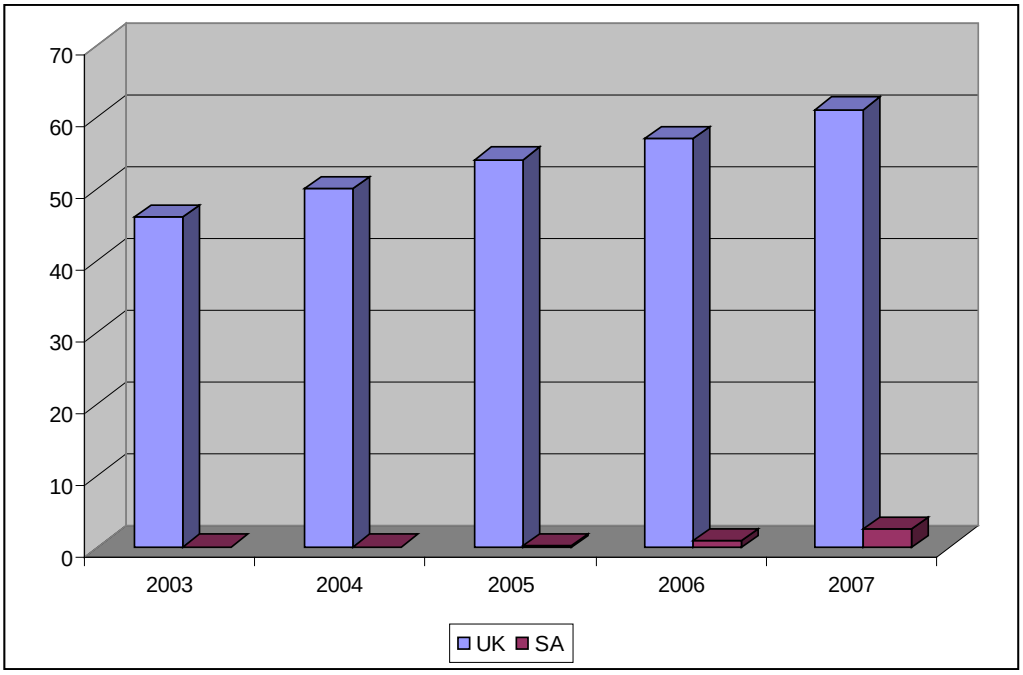


Figure 4.2: The Gap in Broadband Services between Saudi Arabia and the UK

The problem in this area is that plans to enhance broadband services are not included in the national plan for e-Government in Saudi Arabia. However, in all initiatives in industrial countries, such as the UK, Canada and the USA, the wide broadband infrastructure was one of the basic building blocks of the e-Government initiatives. In relation to the aims of this project, it is clear that any evaluation framework needs to appreciate the penetration levels of fast networks and ensure that the needs of the entire population are being addressed by e-Government services.

Furthermore, finding ways to evaluate e-Government websites in order to improve them is very important. This has been highlighted in IT plans in Saudi Arabia (MCIT, 2007b), as illustrated in the next section.

2.4.3 e-Government limitations in Saudi Arabia

This section provides the factors influencing the developing of e-Government in Saudi Arabia. It covers the structure of government in the Kingdom of Saudi Arabia, as well as the lack of investment in e-Government.

2.4.3.1 Government Structure in the Kingdom of Saudi Arabia

The basic structure of government in Saudi Arabia is the monarchy, where the King is the head of a council of ministers. This council has control of 21 government ministries in addition to 27 other government organisations. This structure influences the roles of government departments and agencies in Saudi Arabia and this is one of the most important issues that may influence any development agenda or process. This is because the structure of government agencies in Saudi Arabia is highly hierarchical.

The Gartner report (Yesser, 2007a), the e-Government consultant in Saudi Arabia, addressed the relationship between this hierarchical government structure in Saudi Arabia and the development of e-Government. In particular, it shows that most bureaucratic processes are built around a hierarchical structure and highlights the existence of a paper trail. In addition, the government structure in Saudi Arabia does not foster the use of metrics or an accountability culture due to the distinctive way that authority is allocated within government; these factors lead to different priorities in e-Government investments (Yesser, 2007a). So, it is recommended that the current processes in government agencies should be redesigned to adapt to an e-Government system. However, this issue is a time-consuming process which could have a major impact on ICT project deadlines. One problem that stems from this situation in Saudi Arabia is that a national ICT plan was started in about 1998, as can be seen in Figure 4.1. Then the Royal Decree was issued in 2005 to establish an e-Government strategy. This actually shows that a long time was taken to establish e-Government in Saudi Arabia; it was also late in starting, in contrast to the UK where the first e-Government strategy was produced in April 2000 (Cabinet Office, 2005). A related problem can be seen in that the plan in the UK (Cabinet Office, 2000) was designed as a general view

for the 21st century whereas, in Saudi Arabia, the plan is short-term (for 5 years only); this will then be updated and renewed in the next 5 year period.

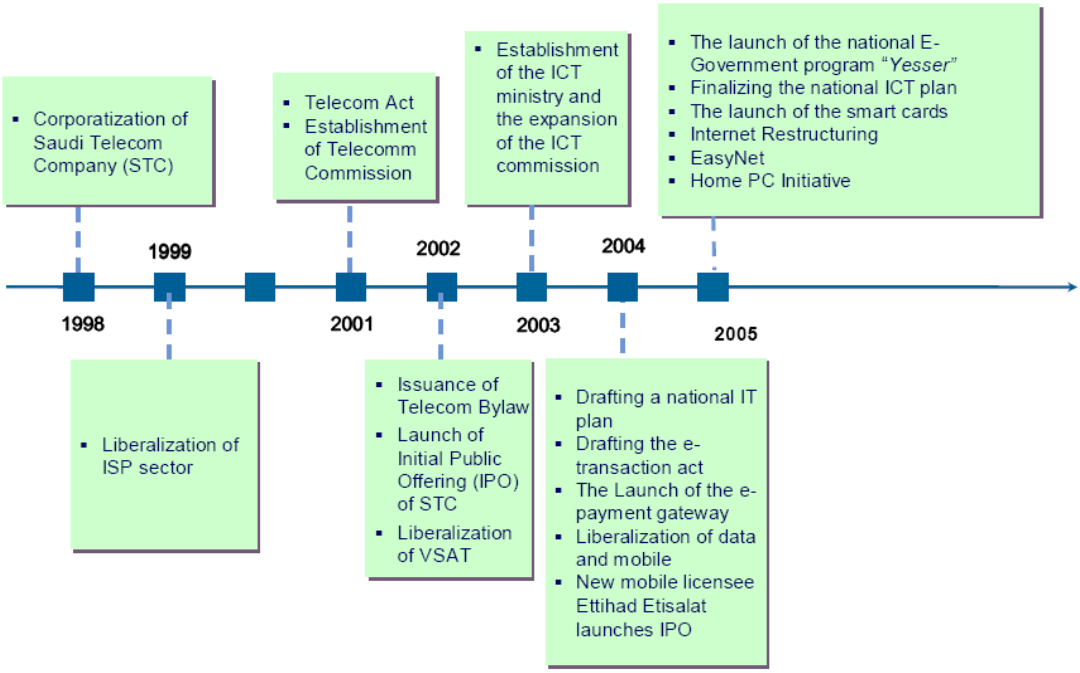


Figure 4.1: Progress on National ICT Planning up to 2005 (Saudi Computer Society, 2001)

This structure is very different from those in federal and centralised countries. For example, in the United Kingdom, the government structure consists of central and local government and this structure has reduced the amount of bureaucracy in managing the work of government (Griffin and Halpin, 2005). In line with the literature, it was found that the structure of government agencies in Saudi Arabia is in need of changes in terms of their management and their structure in order to accelerate the development of e-Government (Al-Shehry et al., 2008).

Thus, the implementation of e-Government is wide-ranging and fast-growing in the UK in contrast with Saudi Arabia. The delay in applying e-Government in Saudi Arabia can be related to two issues: the amount of investment in ICT and the Internet infrastructure. The following sections discuss these issues.

2.4.3.2 Investment in e-Government

Research into spending on e-Government has shown that there is a need for massive investment in ICT in the public sector. However, prior to the national plan for e-Government in Saudi Arabia, the level of investment in this area was low, as Al-Shehry et al. (2008) found. Moreover, there is a noticeable gap between Saudi Arabia's expenditure on current e-Government projects and that of other leading countries in the world.

A clear example of this is found by considering the Gross Domestic Product (GDP) index. In Saudi Arabia, the GDP in 2006 was $376 billion (CIA, 2008a; Ministry of Finance, 2008) while the e-Government budget confirmed in 2006 for the 5 year plan was $1.33 billion: i.e. for one year this figure was $266 million, which is equal to 0.07 of their GDP. However, in the UK, GDP is estimated to be £2.773 trillion (CIA, 2008b) and in 2007 the UK spent, only on IT where e-Government is considered as a main expenditure, £13.234 billion (Cabinet Office, 2007, p. 47) which is equal to 0.48% of their GDP. This can be said to be clear evidence that there is a lack of the required investment in e-Government development in Saudi Arabia.

Actually, significant investments in this field will help to improve the level of ICT in the public sector in Saudi Arabia. This is an important factor that will have an impact on the development, as well as accelerating the implementation, of electronic services. Consequently, it should be recognised that there is an essential need to increase the budget for ICT so as to accelerate the development of e-Government. It is against this backdrop of an apparent under funding of e-government that any evaluation framework needs to sit. The costs of implementing the framework may clearly influence its acceptability.

2.4.4 e-Government Evaluation in Saudi Arabia

The existing approach used to evaluate e-Government websites by the Yesser Programme (2006b) has been to obtain users' feedback through e-mails and feedback forms, and by developing web metrics especially to monitor the traffic on websites. These web metrics, which should provide easy-to-understand reports on website usage, are:

1- Number of unique visitors

2- Repeat visitor frequency
3- Pages with the most number of hits (top 5)
4- Pages with the least number of hits (bottom 5)
5- Most downloaded files (top 3)
6- Least downloaded files (bottom 3)
7- Visitor distribution: i.e. which countries and domains most visitors come from
8- Session length analysis
9- Top 5 referring search engines
10- Web-server error reports
11- Bandwidth utilisation report.

However, these web metrics are limited in terms of evaluating e-Government websites and new web metrics should be able to produce more meaningful information, as will be shown in the next chapter. Moreover, users' opinions can be obtained using more formal means such as observation methods, as shown in Section 2.4.1. Furthermore, there is no clear comprehensive assessment framework to identify ways of improving the development of e-Government. Thus, it is challenging to design an approach that can be used to evaluate such websites by using both quantitative and qualitative methods.

2.5 Usability Methods

In human/computer interactions, usability engineering has become an important issue. In this regard the evaluation of user behaviour on the web has become an important factor (Wixon and Wilson, 1997, p.654) and has been under investigation for some time. Websites have proliferated rapidly for a variety of reasons over the last ten years. As these websites have grown in use and complexity and there is an ever growing need to investigate users' experiences of them. In particular, there is a need to improve existing websites, as well as to improve services by analysing the behaviour of users at these websites; this is also applicable to e-Government websites.

There are two principal ways to investigate users' experiences: by using either qualitative or quantitative approaches. In the former approach, several methods exist including usability testing (Dumas and Redish, 1999; Lindgaard and Chattratichart,

2007) and heuristic evaluation (Hvannberg et al., 2007). There are also qualitative methods which use feedback from customers, customer interviews, and direct customer feedback through online channels (i.e. offline and online customer surveys), as noted by several authors including Kaushik (2007c, p.14) and Information Technology Services (2008). In the quantitative approaches, one significant approach is found in analysing data traffic, as several authors including Peterson (2004, p.6) and Kaushik (2007c, p.10) have pointed out. This includes using web metrics to explain the data traffic, e.g. page counters and monitoring online search practices; these are found in web analytic tools. The next section explains the use of web analytics tools as a quantitative approach to help investigate users' behaviour.

This section presents and investigates three usability methods. These are web analytics, heuristic evaluation and usability testing methods. All of these usability methods are explained in relation to e-Government websites.

2.5.1 Web Analytics

As a result of rapidly growing technology and related websites, there is a need to increase the return of investment (ROI) of websites (Sterne, 2002, p.23). In particular, there is a need to know what users have found interesting on a website and to find ways of encouraging them to return (Peterson, 2004, p.5; Kaushik, 2007c, p.6; Sterne, 2002, p.107). This can be found from the actual behaviour of users on a website: e.g. the number of visitors, repeated users and 'amendment' users. Also, there is a need to undertake evaluation without interrupting the users: in other words, to accumulate data and carry out the analysis unobtrusively (Peterson, 2004, p.6; Kaushik, 2007c, p.10). Thus, web analytics emerges as a potential solution to the problems noted above.

Web analytics is described as an approach to discover the usage characteristics of a website in order to understand the users' experiences (Calero et al., 2004; Dhyani et al., 2002; Peterson, 2004, p.5; Tyler and Ledford, 2006). So, by using web analytics results, it is possible to explore the interactions of customers with the contents of a website; these results can be used to help improve websites (Peterson, 2004, p.6). Nowadays, web analytics is used in a number of fields but mainly for online business.

Web analytics is performed by analysing the web traffic data that come from the different ways in which clickstreams are generated and stored. The next section explains the resources available to collect data for web analytics purposes.

2.5.1.1 Web Analytics Data

In web analytics there are several approaches that can be used to collect web traffic data. Analysing data from log files was the initial approach taken and this is still used. Other approaches have been used for a short period of time but many are now obsolete. For example, network data collection was used to identify certain metrics, e.g. stop and reload buttons and time to load pages, but it is not always possible to measure these metrics accurately (Peterson, 2004, p.23). There is also a lack of support for it from web analytics vendors. However, one approach, tagged pages, has proved to be very popular, so the following subsections explain the log files and tagged pages approaches in order to indicate their value and the current extent of their usage.

2.5.1.1.1 Log Files (Server-side traffic data collection)

The log files approach is a standard way of storing clickstream data (Peterson, 2004, p.18; Sterne, 2002, p. 70; Cook et al., 2007). This approach enables the data stored in server log files to be accessed and analysed. Server log files can provide a variety of data including: IP address, user name, date and time, method of request, and resources being requested (Peterson, 2004, p.19). There are several formats for log files, each of which includes required fields (e.g. IP) and may also include optional fields (e.g. referring sites). One of these definitions can be seen in a combined log file format (Apache, 2008) as follows:

LogFormat "%h %l %u %t \"%r\" %>s %b \"%{Referer}i\" \"%{User-agent}i\"" combined CustomLog log/acces_log combined

The following is an example of a log file entry in combined log format

127.0.0.1 - frank [10/Oct/2000:13:55:36 -0700] "GET /apache_pb.gif HTTP/1.0" 200 2326 "http://www.example.com/start.html" "Mozilla/4.08 [en] (Win98; I ;Nav)"

where each part of this log entry can be seen in Table 2.1:

Prefix used	Description
127.0.0.1 (%h):	The IP address of the client (remote host)
- (%*l*)	The RFC 413 identity of the client (as determined by identd). In this case '–' indicates that this information is not available.
frank (%u)	This is the user id of the person requesting the data
[10/Oct/2000:13:55:36 -0700] (%t)	Date and time
"GET /apache_pb.gif HTTP/1.0" (\"%r\")	The request line from the client is given in double quotes
: 200 (%>s)	The status code that the server sends back to the client; e.g. 200 indicates a successful request, 404 indicates file not found
2326 (%b)	The size in bytes of the object returned to the client
"http://www.example.com/start.html" (\"%{Referer}i\")	The site from which the client has been referred (in this case this is the page that links to or includes /apache_pb.gif).
"Mozilla/4.08 [en] (Win98; I ;Nav)" (\"%{User-agent}i\")	The User-Agent HTTP request header offers the identification of information that the client browser reports about itself.

Table 2.1: Log file entry description (Apache, 2008)

The use of this approach has many advantages, as some authors (e.g. Peterson, 2004, p.22; Kaushik, 2007c, p. 26; Unica Corporation, 2007; Scientific Computers Ltd, 2007) have discussed. There is no problem concerning the ownership of the data and historical data are available (Unica Corporation, 2007). Consequently, it is possible to store the clickstream data directly into a database and to use SQL for analysis, as Peterson (2004, p.22) suggests. However, this process is resource intensive due to the

very large files that are generated, therefore, data ideally should be collected over specific time intervals, as Peterson (2004, p.23) indicates. Also, in this area there is a problem in the time required to generate reports; this includes transferring the log files into a suitable location where the analysis can take place. In particular, there is a problem with retrieving the log files because of ISP restrictions when using specific analysis tools (Kaushik, 2007c, p. 37, Peterson, 2004, p.23).

In the log files approach, as Peterson (2004, p.22) and Unica Corporation (2007) identified, it is possible to collect web data in depth so that it is possible to keep track of non html files, e.g. PDF files. This approach includes the facility to measure page views even if the user clicks back or uses a stop button; in other words, it has the ability to determine if the download is complete. This feature is useful as it helps to show when users terminate their enquiry: i.e. push a stop button. More benefits accrue from the ability to investigate the search terms used to locate a referring website (as outlined in the *%{Referer}i* field in Table 2.1).

Furthermore, the log files approach has the capability to measure traffic from robots and spiders, which can be used to measure the effect of search engines (Peterson, 2006). This is a useful technique to observe and study search engines and gives similar results to web crawling software used for e-Government websites, as mentioned in the preceding section. However, this kind of data needs to be separated from the normal traffic due to the extensive access by search engine robots (Peterson, 2004, p.22).

The log files method can also be used to monitor page delivery performance (Unica Corporation, 2007) and also to capture web server errors (Scientific Computers Ltd, 2007). Lastly, as several authors have pointed out, including Peterson (2004, p.23) and Kaushik (2007c, p.27), in contrast to the page tagging approach described in the following section when using this method, there is no need to add additional JavaScript tracking code to every page as the data are already stored in log files in the servers.

However, the main disadvantage of using the log files approach concerns a caching problem where data are non-updatable (Kaushik, 2007c, p. 37, Peterson, 2004, p.23;

Sterne, 2002 p. 70). This is because, when pages are retrieved, they can be served from ISP servers or user browser caches rather than the requested website (Peterson, 2004, p.24; Sterne, 2002, p.73). This can lead to an under-counting of the number of pages accessed. In addition, due to extensive use of firewalls and dynamic IP assignment, it can become difficult to identify uniquely the users by their IP address; this may lead to inaccurate assessments of the number of unique or returning users. Although there is an ongoing project in Wikipedia (Fildes, 2007) that has found a way to uniquely identify IP addresses, there is as yet no published work that explains a method for recognising a distinct IP. Also, there are related but less serious problems mainly due to the lack of standardisation of server formats: i.e. each server has it is own format (WebAbacus, 2007). Lastly, in the log files approach, it can be expensive to employ experts to analyse the log files or to produce the necessary software to undertake the analysis (Peterson, 2004, p.26).

As a result, the log files approach can be useful for specific applications that focus on the need to incorporate historical data, such as those in service applications when users visit the web site infrequently. Also, there is a need for the log file approach when the ownership of data is extremely important. A clear example of such an application might be an e-Government website where the privacy of data is extremely important, as mentioned in Section 2.3.Therefore the log files approach enables the collection and use of data to be monitored while being sensitive to any privacy issues. However, this approach has less support and experts in web analytics prefer using the tagged pages approach. This is explained in the next subsection.

2.5.1.1.2 Tagged Pages (Client-side traffic data collection)

It has been noticed that the log files approach does not widely provide ‘client-side’ information where more useful data can be obtained. For instance, there is a need to monitor particular events on the site, e.g. cart and order confirmation (Kaushik, 2007c, p. 32). So there is a crucial need to find another approach to provide such a feature. This information can be identified by tagged pages. Tagged pages uses JavaScript to report what users do on a website. It is often a completely outsourced service (i.e. it uses a third party) to collect data and conduct the analysis (Peterson, 2004, p.30; Kaushik, 2007c, p. 30).

There are many benefits of this approach, as identified by a number of authors, including Peterson (2004, p.30), Kaushik (2007c, p.30), the Unica Corporation (2007), and Scientific Computers Ltd (2007). Fundamentally, the approach widely offers client-side information so extra information and metrics can be obtained: for example, it can measure shopping cart activities. This feature is useful in that the JavaScript code has the ability to execute every time a page is loaded into a browser (rather than every time a page is served), which avoids the caching problem mentioned before with the log files approach. Accordingly, it provides reports in real time more effectively than the log files approach (Peterson, 2004, p.33). Also, there is less need to obtain analytical software and it avoids the management of log files so it costs less (Kaushik, 2007c, p.32). Furthermore, the accuracy of tagged pages with regard to discounting search engines access is much greater than with log files because search engines do not execute the JavaScript code (Duckett, 2007; Peterson, 2004, p.33).

Nevertheless, the tagged pages approach has several problems. This approach is totally dependent on JavaScript and cookies and these technologies might be disabled by users (Peterson, 2004, p. 34; Kaushik, 2007c, p.33). There is also a privacy issue because businesses can access the users' data remotely and often without their knowledge (Kaushik, 2007c, p.32). Moreover, there is the problem of who owns the data, it is often the provider of the web analytics tool rather than the owner of the web pages that are being analysed (Duckett, 2007). The tagged pages method is mainly useful for online businesses because it has the benefit of low cost. However, in other fields, where operations are managed internally, because their data are strictly confidential (such as in e-Government), they may prefer to carry out such work in-house. So, the ownership of data is an essential point and cannot be ignored.

Moreover, there are other less serious problems, as Peterson (2004, p.36) and Kaushik (2007c, p.33) pointed out. For example, there is a noticeable increase in the download time of tagged pages: in other words, there are performance issues. A further drawback is that although software exists that can help to insert and update the tagged pages, it is still a time-consuming process to ensure that all pages are correctly tagged (Peterson, 2004, p.36). Also, there is a problem identifying non-html files, e.g. PDF files. Lastly, there is limited flexibility in the available reporting formats (Peterson,

2004, p.36; Kaushik, 2007c) in terms of the analysis being restricted to predefined reports provided by the web analytics tool.

As shown above, both approaches, log files and tag pages, have problems. Although the tagged pages approach seems useful for collecting data, it is not suitable for all website applications. This is because both the ownership and the history of such data, is a significant feature of a considerable number of websites. One solution to this problem can be found in the new hybrid approach to data collection as explained in the next subsection.

2.5.1.1.3 Hybrid Solution

As explained before, some problems associated with using the log files approach were overcome mainly by using the tagged pages approach which offered the availability of client information without caching problems. However, other problems have emerged with tagged pages as presented above. Consequently, it has become important to derive a new approach to collect data; this can be found in the hybrid approach.

This approach merges the benefits of both log files and tagged pages as the most popular approaches to collect data; thus the hybrid approach can enable the full potential of web analytics data to be realised (Duckett, 2007; Unica Corporation, 2007). This includes the ability to provide traffic data as well as client information.

Nevertheless, this mixing of both types of data is a problem since repeated results are then generated. For example, the results of a hybrid approach can be a double set of analysis data (Wilson, 2007). This problem needs to be resolved in order to avoid undue repetition. Also, the hybrid approach costs more due to the duality of the approaches; this requires experts to manage it. Furthermore, there is lack of expert support so few web analytics providers support this way of collecting data, including Unica (2007), SCL Analytics (2007), SageMetrics (2007), Speed-trap (2007), WebAbacus (2007), and WebLog Expert(2009). However, those providers are mid-market vendors, in contrast to the main providers in the web analytics field, as identified by Kaushik (2007c, p.5); these main vendors include WebTrends, Cometrics, Visual Sciences and Omniture.

Thus, the hybrid approach may not be appropriate for all businesses in all fields. For example, for online businesses, cost is an important issue and the hybrid approach is expensive. However, the hybrid approach can be used for specific web applications, in particular, those websites that provide services to clients, such as e-Government websites. These data collection methods are used to analyse web sites quantitatively through sets of web metrics. The following section explains these metrics.

2.5.1.2. Web Metrics

In this section two kinds of web metrics are presented: basic web metrics and advanced web metrics. Furthermore, the limitations that exist in using web metrics in order to evaluate e-Government websites are addressed.

2.5.1.2.1 Basic Web Metrics

Burby et al. (2006, 2007) categorised web metrics into three basic kinds: count, ratio and dimension metrics.

1- Count metrics are an elementary measurement of an event on any website. In this area, several metrics have been identified (Burby et al., 2006). These include metrics such as: clicks, visitors, new visitors, unique visitors, sessions or visits, page views, visit duration.

2- Ratio metrics are a percentage measure: e.g. bounce rate (the percentage of single-page visits or visits in which the person left the site from the landing page), page views per visit, conversion rate (the total number of outcomes (leads, orders) divided by the number of unique visitors) (Kaushik, 2007c).

3- Dimension metrics, as identified in Burby et al. (2007), involve using source data to define different kinds of counts or segments. This includes referrer, entry page, landing page and exit page. Dimension metrics are a way of adding conditions to metrics – e.g. the conversion rate from visitors who arrived via a search engine in comparison to those who did not.

The above metrics are useful but more advanced web metrics have been identified and used by other researchers as explained in the next subsection.

2.5.1.2.2 Advanced Web Metrics

This kind of web metric is classified as a key performance indicator (KPI) by several authors (e.g. Burby et al., 2007; Peterson, 2004, p.208) and involves the addition of a temporal dimension in web metrics by comparing the results over each period of time. This can allow businesses to monitor the change in efficiency and effectiveness of their websites during a timeframe. However, defining the KPIs is dependent on the business: each business has its own requirements that need different key descriptions and a number of metrics have been defined for different purposes.

This phenomenon has been widely exploited in online businesses and there are numerous types of web metric. For example, process measurement, as defined by Peterson (Peterson, 2004, p.69), includes the ability to study step by step the specific processes within a website; this involves the observed conversion and abandonment rates. These kinds of metric are useful as they help to identify when and where website visitors are not successful or abandon their transactions (Peterson, 2004, p.73; Kaushik, 2007c, p.113).

An important use of these kinds of web metric is for those applications that provide services for the public, in particular, e-Government applications on the web, as these attempt to provide information for citizens and businesses, as shown in Section 1.2. For example, researchers in e-Government have defined a limited number of web metrics, such as those used to identify search characteristics terms (Petricek et al. 2006), as illustrated in Section 2.4.1. These are also used to monitor activities and traffic on the site during holidays and the differences between human and automatic processes on the site (Gonccalves and Ramasco, 2008). Thus, it would be useful to find the most suitable advanced web metrics for use in evaluating e-Government sites.

2.5.1.2.3 Limitations of Web Metrics

With the kinds of web metric mentioned above, at least two problems can be identified. Firstly, there is a lack of standardisation in web analytics (Peterson, 2007b; Sen et al., 2006; Weischedel and Huizingh, 2006) so there are different terms to describe the same action. This situation is still prevalent even though the Web Analytics Association has identified standard definitions (Burby et al., 2007). This

problem may cause confusion and, because of the fast growth in applications on the web, this shows a need for standardisation.

Secondly, there is a problem with ambiguous terms still being used to describe the contents of web metrics (Enge, 2007). One such example is the definition of page views in pages that use Web 2.0 technology such as AJAX. In these cases the user can interact with the contents of a page for a long time and the content displayed on the page may change during the interaction (Enge, 2007). So, the use of such metrics is likely to produce ambiguous results.

These problems can cause limitations in the general use of web metrics and can limit the use of the many capabilities found in web analytic tools. In particular, the demands of each business are different and so there are different definitions to describe similar issues; thus, there is a need for web metrics to be standardised. So, any further implementation of web analytics should pay more attention to making sure that there are clear and well understood definitions of the terms that are used.

This lack of standardisation may be problematical for those websites that deliver online public services and which may need to design their own special metrics: e.g. to monitor the accessibility of websites, (Vigo et al. 2007). Thus, it is important to define appropriate web metrics, particularly for e-Government websites.

2.5.1.3. Problems of Web Analytics

Web analytics can be defined as a quantitative approach within usability engineering. This means that this approach explores web traffic data and then attempts to explain what is happening on the website. However, there are several problems associated with this area of web analytics.

Firstly, the existing output of the technology represented in web analytics is seen as a report, not as an analysis (Peterson, 2007b). The problem here is that the existing output does not offer any real insight into how the website is functioning (Burby, 2007). In particular, these reports produce primitive analyses that concentrate on traffic with performance data included, as several authors have identified (Kaushik

2007b, Burby 2007 and Peterson 2007b). Segmenting data for those interested in analysing the results in detail is not commonly applicable. The existing outputs do not constitute actionable reports as some authors, such as Kaushik (2007b) and Peterson (2007b), have mentioned and these are difficult to interpret for people who are not skilled in web analytics(Peterson 2007b). Thus, the metrics produced are not entirely satisfactory (Sterne, 2003). This is because, as Peterson (2007b) found, such reports are not based on specific business goals.

In addition to these problems, the existing web metrics are dependent on the kind of business: that is, they cannot be generalised. Moreover, it is clear that most web metrics are poorly defined and are not "empirically or theoretically validated" (Calero et al., 2004); in other words, there is a lack of information on when and how to apply metrics (Angel et al., 2006; Calero et al., 2004). Thus, it is difficult to measure the success of websites (Belanger et al., 2006).

There are various definitions of success for website evaluation. For example, Sterne (2003) pointed out that success can be achieved by designing actionable measurements for web analytics so that progressive improvements can be continually monitored. Other researchers have suggested that success is clearly linked to achieving the website's objectives (Belanger et al., 2006, Stolz et al., 2005) and this can be achieved, as Belanger et al. (2006) noted, by producing a relationship between a website's objectives and users' needs on the website: i.e. focussing on the needs of users. Stolz et al. (2006), on the other hand, recommended that success is the ability to apply users' needs to the continual improvement of the services provided.

Furthermore, there is a need for data analysis and a greater understanding of clickstream data, especially for strategic decision-making purposes (Hong, 2007; Sen et al., 2006). In particular, there is a need to involve the sponsor of the website in the process of analysis (Peterson, 2007b). As a consequence, there is a need to improve decision-making within any organisation that runs web analytic tools (Norguet et al., 2006). However, many related developments that utilise web analytics have failed in this regard (Sterne, 2003) because of the inefficient sharing of the analysis of the results within the organisation (Burby, 2007) due to difficulties in reading web analysis reports (Peterson, 2007b). There is also a demand, noted in several

publications, within formal institutions to develop a new generation of web analytics. For example, Dhyani et al. (2002) emphasised the need for new metrics to provide a deeper insight into the web as a whole, considering aspects such as usage characterisations in searches where the patterns of users can indicate the users' needs. Also, Calero et al. (2005) and Hong (2007) found that the existing web metrics are often used just for maintenance purposes, rather than for producing meaningful metrics on usage. Consequently, much greater analysis of users' interactions is required in order to improve website services, as Sen et al. (2006) and Norguet et al. (2006) highlighted.

In fact, there is a vital need to improve existing web analytic tools. In particular, there is a requirement to upgrade the existing technology within web analytics so that it is possible to examine whether the objectives of the website have been achieved. This is also related to knowing whether users have found what they are seeking. So, instead of just reporting the data traffic, it is essential to "focus on opportunities and recommendations", as suggested by Burby (2007). Such information can be used to produce a continuous connection with users (Belanger et al., 2006) and maintain an ongoing process of optimisation (Burby, 2007).

Researchers have emphasised the need to look for a method that recursively produces meaningful analysis when examining website objectives (Enge, 2007; Hong, 2007; Burby, 2007; Kaushik, 2007b). Within this area, two main approaches could be used in order to solve this problem:

1- Kaushik (2007a) suggested the concurrent use of additional metrics, such as data mining, where the patterns of customer use could be identified. However, this is still an approach that relies on traffic data without gathering any real opinions from users.

2- Improving the existing technology to produce a new generation of web analytics, i.e. Web analytics 2.0. The main objective of the new generation, as Kaushik (2007b) proposed, is as follows:

> […] "the analysis of qualitative and quantitative data from your website and the competition, to drive a continual improvement of the online experience that your customers, and potential customers have, which translates into your desired outcomes."

The second direction has been supported by many experts, such as Burby (2007) and Peterson (2007b), in the web analytics field. A combination of both quantitative and qualitative approaches can produce insightful analysis, as some experts, such as Peterson (2007a) and Kaushik (2007b), have stated. In particular, this combination can provide greater insight which, in turn, can be used to obtain meaningful information. In fact, the data resulting from web analytics is just one view of the data; this is an insufficient view for detailed analysis, as was explained previously. However, the opinions of end users are highly important in evaluating whether the strategies of any website have been satisfied. Thus, the merging of both approaches can provide useful data relating to web usability and for the purpose of web analysis.

However, this approach involves finding an appropriate set of techniques that can be used in order to make qualitative measurements. These should represent the actual opinions of users, as well as devising some experiments that explain how users interact with a website. This is similar to those in e-Government who use an evaluation approach, whereas a multidimensional approach was suggested in Section 2.4.2. So, the next section explores two of the best known usability methods: heuristic evaluation and usability testing. Then, this research designs a multidimensional usability evaluation approach that utilises web analytic tools as a quantitative approach, together with qualitative methods; this is discussed in the next section.

2.5.2 Heuristic Evaluation

Heuristic evaluation can be identified as an approach to evaluate the design of a given website in order to define any usability problems that may exist (Nielsen, 1993; Pickard, 2007, p.231). A heuristic approach has several features, as identified by a number of research studies. For example, Ahmed (2008), Hvannberg et al. (2007), and Ardito et al. (2006) illustrated that this approach enables evaluators to find obvious and clear problems within a limited period of time. This feature of the

heuristic approach is in contrast with usability testing, where a number of interface problems may be overlooked. This is because usability testing depends on the coverage of certain experimental tasks and not all potential tasks can be assessed; it also needs more resources and takes a longer period of time. So, heuristic evaluation is generally considered to be a low-cost approach compared with usability testing (Ahmed, 2008; Ardito et al., 2006). However, although the evaluators used in this approach are considered as sample users, they are not typical users for the target site. Thus, the results are suspect because they do not reflect actual users' opinions. Researchers, including Hvannberg et al. (2006) and Cockton et al., (2004) have used heuristic evaluation before usability testing to predict what usability problems there might be; they then used these findings to design the tasks for the usability testing.

Pickard (2007, p.231) and Ardito et al. (2006) noted that a heuristic evaluator should be an expert as this allows deeper inspection to be made of levels of compliance; such an expert will also have the knowledge to suggest improvements which will help the evaluation. In particular, the heuristic evaluators are required to have considerable experience in web design and also to have knowledge of usability engineering (Nielson, 1993). However, using several evaluators means that more results will be generated (Ahmed, 2008). Pickard (2007, p.233) considered that 3-5 evaluators was a reasonable number to identify any usability problems that might exist. Soufi and Maguire (2007), on the other hand, examined one government agency and used only one evaluator whereas Garcia et al. (2005) examined nine federal websites and compared user satisfaction among them. Seven evaluators participated in this exercise and so satisfaction was compared amongst all seven evaluators.

Heuristic evaluation is based on guidelines (i.e. heuristic principles) that evaluators use when they evaluate a site (Pickard, 2007, p.231; Brinck et al., 2002). Nielson's heuristic principles (1993, 2002) show the fundamentals of this approach and include ten principles which are:

- visibility of the system's status;
- match between the system and the real world;
- user control and freedom;
- consistency and standards;

- error prevention;
- recognition rather than recall;
- flexibility and efficiency of use;
- aesthetic and minimalist design;
- help for users to recognise and correct errors;
- help and documentation.

Researchers in e-Government have derived their own approach from Nielsen's heuristic evaluation, particularly for e-Government inspection. For example, Garcia et al. (2005) extended Nielsen's approach (2002) and derived six more related principles to cover the needs of an e-Government website. These are:

- accessibility;
- interoperability;
- security and privacy;
- information truth and precision;
- service agility;
- transparency.

Other research limited the number of heuristic principles. For example, Soufi and Maguire (2007), in their research, designed three levels of evaluation principles: effective page layout design and accessibility, required functions to meet users' goals, and suitable information architecture to support navigation.

Although Garcia et al. (2005) provided a basis for a heuristic evaluation to be undertaken, there were some omissions in their approach. For example, Garcia's principles did not contain details of the heuristic components which particularly need to be examined. More detailed heuristic aspects (that fall under the broad heading of each heuristic principle) are needed to help evaluators examine the websites under consideration and would help in identifying particular usability problems. This is an important issue in designing a heuristic checklist that would extend the inspection to find specific usability problems while avoiding any bias that might occur through evaluators not covering each heuristic principle in sufficient depth. This problem can be addressed by recourse to the literature in order to design an appropriate heuristic

checklist consisting of a number of components which make up each principle; this is illustrated in the next chapter.

2.5.3 Usability Testing Method

Observation methods have also been used in order to evaluate the usage of e-Government websites by citizens and businesses. Usability testing is a kind of observation approach that allows problems in the examined system to be evaluated and defined by using people to perform specific tests (Pickard, 2007, p.312; Dumas and Redish, 1999, p.209). In web design, this approach has been used to identify usability problems by giving users some tasks to perform and then observing them while they perform these tasks (Pickard, 2007, p.313; Nielsen and Loranger, 2006). There are several benefits to this approach. Firstly, it is considered to be a user-centred design approach that allows users to interact with a site and then examines the way that the system responds to their requests (Pickard, 2007, p.227). This allows the system under scrutiny to be evaluated more efficiently (Dumas and Redish, 1999, p.210). This approach has been used to examine websites and to define the problems that may exist. Some researchers have used this method in e-Government evaluation approaches including Lee and Cho (2007), and Wang(2005). Significant work in this area by Lee and Cho (2007) has shown that four aspects need to be addressed if this method is to be used. This research, with some adjustments, has followed aspects of Lee and Cho's (2007) approach, which include:

- **Designing the tasks**

  This is a critical issue in usability testing because it helps to identify usability problems in order to obtain the views, as well as the recommendations, of users on the examined site. An essential part of the usability testing method is in choosing appropriate tasks to be examined. This is because, if the wrong tasks are chosen, the major usability problems will not be uncovered (Nielsen, 2004). Research in this area has shown common aspects that need to be included. For example, Dumas and Redish (1999, p.160) suggested focusing on areas that may contain problems, whereas Nielsen (2004) advised looking for the events that motivate users to use the considered website. However, as indicated with the heuristic evaluation method mentioned above, some research advises utilising the results of heuristic evaluation to derive the tasks

for usability testing. In their evaluation of e-Government websites, Lee and Cho (2007) designed 14 tasks over 14 different websites.

- **Selecting users**

  Nielsen (1993) stated that 20 users is an optimum number for large projects. Twenty users typically provide wide usability indications due to "substantial individual differences in user performance" (Nielsen, 2006). Similarly, a large number of participants was used in previous usability testing research into e-Government websites. For example, Lee and Cho (2007) conducted tests with 51 users on 14 government sites. It is thought that a limited number of users cannot accurately describe usability problems since problems are randomly found (Lindgaard and Chattratichart, 2007). However, as this method is costly (Wood et al, 2003, p.24), an optimum number of sessions are required (Lindgaard and Chattratichart, 2007). Some researchers, such as Dumas and Redish (1999, p128), asserted that 6-12 users is a typical number, and a similar number has also been suggested by Nielsen (2000) who stated that 5 is a "magic" number of users, which can cover 80%-85% of usability problems, as can be seen in Figure 2.1.

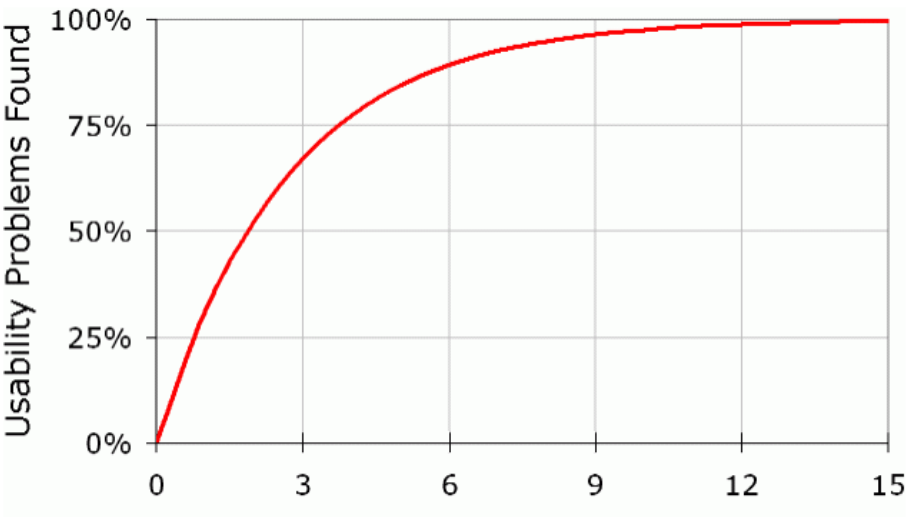


Figure 2.1: Number of test users (Nielsen, 2000)

- **Carrying out a pre-test questionnaire and post-test interviews**

  A pre-test questionnaire is a method of initiating usability testing (Nielsen, 1993; Dumas and Redish, 1999, p.209; Dumas and Loring, 2008). Pre-test questionnaires are useful to obtain users' initial impressions of the target website, together with their background information. Similarly, a post-test interview can be used to obtain recommendations, intentions for future use, comments regarding perceived usability, and indications of user awareness. Lee and Cho (2007) found that useful results could be gained from conducting a post-test interview. These include recommendations to others, intentions for future use, comments regarding perceived usability and indications of user awareness. Other research by Gerken et al. (2008) interviewed six users, which is very close to Nielsen's (2000) magic number.

- **Recording the interactions**

  A number of options to record the interactions of users exist, such as eye tracking, screen recording and the "think aloud protocol". In this area, however, the "think aloud protocol" is a commonly used option (Pickard, 2007, p.228; Dumas and Redish, 1999, p.224, Hornbaek, 2010, pp.107). In this protocol, the users talk aloud while carrying out the given tasks, this allows their feelings or attitudes to be expressed. A number of approaches can be used to carry out the recording. These include:

  - Using a video camera: Lee and Cho (2007) used two video cameras to record the intentions of users and to film the computer screen. However, no results were reported in their analysis after using this tool. Although the video camera method is still used (Dumas and Redish, 1999, p.224), some researchers have emphasised that there is no need for such tools to record user interactions because of the need to focus on the main usability problems; also the use of such tools increases the time required to analyse the recorded clips (Nielsen, 1993).
  - Employing recording software: this method allows the interactions of the user on the computer to be recorded. Nowadays, a variety of software tools (e.g. Camtasia Studio screen recorder software) are

available to record a user's interactions on screen and researchers have used such tools to record user interactions during usability tests (Krug, 2006, p.143). This research used Camtasia software to capture usability problems.

Although there are concerns about the think aloud protocol, e.g. the validity and usefulness of this approach (Ramey et al, 2006, Nørgaard and Hornbæk, 2006) it is still widely regarded as a useful method (Hornbaek, 2010).

2.6. Multidimensional Evaluation Framework for the Evaluation of e-Government Websites

The main ideas emerging from the preceding review in this chapter concern the need to assess the usage of e-Government websites from the point of view of the large number of potential initiatives that have been identified. In this area, it has been shown that users' interactions, as well as their opinions, are essential to improve e-Government websites, as discussed in Section 2.3.7. This approach has been used by other researchers in this area. However, existing evaluation approaches are not comprehensive in their methods and may not even include details of traffic data generated during user transactions, as illustrated in Section 2.3.2. The challenge in this area is to use qualitative approaches: e.g. usability methods, whilst exploring the data traffic of the target website, as discussed in Section 2.5.2. This can be achieved by using the multidimensional approach where several methods are used to evaluate e-Government websites, including using technology to expand the data traffic reported by web analytics packages. Accordingly , the main strategy that emerges in this research is to examine empirically the multidimensional approach using several usability methods. Specifically, this research develops an approach that can be suggested for the assessment of e-Government websites using a multidimensional approach while taking into account users' opinions of such websites. These issues drive this research in order to achieve a multidimensional usability evaluation approach for e-Government websites, as is discussed in the research direction section of the next chapter.

However, the adaptation of usability methods and web analytics technology for website assessment can be problematic. This is because there are many restrictions, partly because there is a need for more financial resources to achieve such an operation, as explained in Section 2.2.6, which can be seen in the e-Government initiatives in developing countries. Although e-Government online services are widely used by thousands of people daily and so it is thought that these should be of better quality, it is important to develop frameworks that are practical and that could feasibly be implemented given the restrictions of time and finance. This quality improvement might be achieved by using a multidimensional usability evaluation approach. Also, in developing countries such as Saudi Arabia, there is now much more interest in improving the quality of its e-Government websites. This research examines and applies a multidimensional evaluation approach to evaluate government agencies in Saudi Arabia.

2.7. Summary

This chapter has covered issues and problems concerning e-Government and has shown that there are significant initiatives required for the successful implementation of e-Government. It has also shown that a number of challenging issues face the implementation of such e-Government initiatives, some of which have been explored. These show that there are many financial and management procedures involved in implementing e-Government. There are also issues such as citizens' privacy which are related to management procedures; these need to be more clearly and precisely defined to protect the security of e-Government and to protect the privacy of citizens.

One of the most important issues in online government technology is the evaluation of e-Government websites that will ensure the protection of national services, as well as improving websites design, making them more accessible for users. This shows the need to develop a comprehensive strategy that reflects the real usage of online services, which can then be used to satisfy the objectives of e-Government. It has also been shown that within this area, the integration of both quantitative and qualitative approaches may produce more detailed views of how users interact with the different government web sites. Thus, this research attempts to integrate the evaluation approach of Thompson et al. (2003) to perform a comparative evaluation of e-

Government websites, which will go some way towards driving the continuous improvement of such sites. Furthermore, it has been shown that the implementation of e-Government in Saudi Arabia has made significant progress. Also, those agencies which have achieved the Digital Excellence Award are challenging samples which can be used as case studies to examine the evaluation framework.

Additionally, this chapter has covered some of the most well known usability methods. It started by illustrating the elements of web analytics, together with the motivation behind this technology. There are two main approaches to collect data for web analytics that have been explained here. However, a mixture of both approaches, the hybrid approach, offers the greatest benefits for such investigations of web usage and user behaviour. Also, it has been shown that various metrics have been defined within this area. However, as has been noted, these web metrics are incomplete because the existing web metrics have been designed for specific purposes and do not relate to the continuous improvement of websites; instead, they exist mainly for maintenance purposes. These problems have been addressed via various methods. In particular, there is a need for the greater representation of the opinions of users. This can be achieved by combining both a quantitative approach with an appropriate qualitative approach as this combination is able to represent the interactions of actual users. So, two qualitative usability methods, heuristic evaluation and usability testing, have been discussed. Within each method the components that need to be conducted have been addressed, and the related research for e-Government website evaluation has been presented.

Consequently, the combination of a quantitative approach, represented by web analytics, together with a qualitative approach, as represented by usability methodologies in e-Government in particular, is a driver for this research. The following chapter explores these issues in order to develop the research design; the research aims and objectives are also discussed.

Chapter Three: Research Methodology

3.1 Introduction

This section presents the research problem, the research design and the methodology that was followed. The research proposal concentrates on issues that have emerged in investigating e-Government website evaluation, specifically regarding the background and context for research into usability evaluations for e-Government websites. It is clear that e-Government needs to be evaluated from the viewpoint of the needs of users as their experiences of it are central to its success.

Section 3.2, briefly discusses the position of this type of research in order to fulfil its objectives; it also introduces a justification of the selected research philosophy, together with the research methodology, method and technique. In Section 3.3 a discussion of the research problems instigated in this study is offered. Section 3.2 discusses the data collection techniques that were used in this research, and section 3.4 contains a summary of this chapter.

3.2 Research Hierarchy

In research there are several views regarding research hierarchy: i.e. relationships between different stages of the research. For example, Saunders et al. (2003) used the idea of the “research onion” to represent the contents of research, as can be seen in Figure 3.1, while Pickard and Dixon (2004) offer less detail, as can be seen in Figure 3.2.

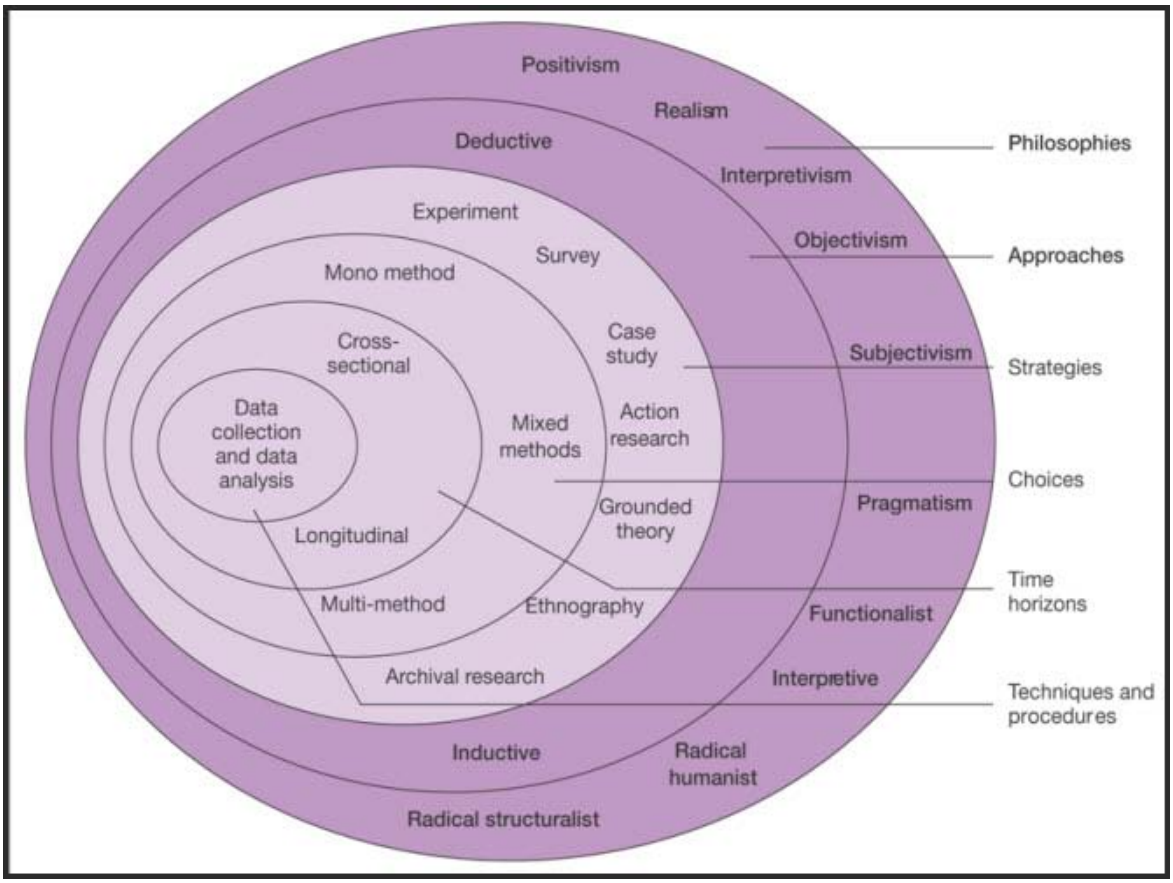


Figure 3.1: Research onion (Saunders et al., 2003)

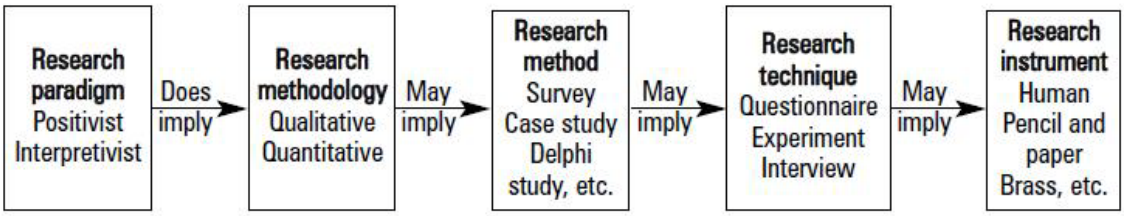


Figure 3.2: The research hierarchy (Pickard and Dixon, 2004)

Despite the different terminology used in both research hierarchies, similar levels of research hierarchy show obvious relationships that build research. For example, Saunders et al. (2003), as shown in Figure 3.1, encompasses a number of research paradigms under different philosophical titles, whereas Pickard and Dixon (2004) as shown in Figure 3.2, choose different titles (or research paradigms) for the same contents. The next section explains these research hierarchies in relation to the aim and objectives of this research identified in Chapter 1.

3.2.1 Research Philosophies

In research philosophy, a number of stances can be identified and, within these, three main stances are frequently used in Information Systems (IS): the ontological, epistemological and methodological stances (Lincoln and Guba, 1985, p. 109). These three stances were identified by Pickard (2008, p. 5) thus: "Ontology is the nature of reality, epistemology is the philosophy of how we can know the reality, and methodology is the practice of how we come to know the reality". Five main components are identified to cover the contents of research philosophy. These components will be outlined in the following sections.

3.2.2 Research Paradigms

A research paradigm is a way of thinking or a shared assumption about how to gain knowledge and carry out research (Oates, 2006, p.282). It is: "a basic set of beliefs that guide action" (Guba, 1990, p. 17). There are three major research paradigms in Information Systems: positivism, interpretivism and postpositivism (Pickard, 2008, p.5) while other researchers offer more research paradigms, as shown in Figure 3.1. Pickard (2008, p. xvi) notes: "positivist thinking is associated with quantitative research, interpretivist thinking with qualitative research and postpositivist thinking with dualism that attempts to include both methodologies". So the basis of research paradigms is in either positivist or interpretivist, thus:

Positivism: This paradigm involves applying an existing theory to develop hypotheses which are then examined and confirmed (Saunders et al., 2007, p. 103); in this process, variables, which are part of the hypotheses, are examined.

Interpretivism: This was considered to be a criticism of the positivist paradigm and is for examining insights into the social world; it investigates the differences between people. This is used to obtain a deep understanding of social actions and implies the interpretation of the social phenomena being investigated against the concepts from literature (Bryman, 2008).

Within these research paradigms, the interpretivistic paradigm is much related to the considered aims and objectives of this research, as identified in Sections 1.3 and 1.4.

This is because the research sets out to investigate the use of several usability methods to evaluate e-Government websites. Specifically, this study seeks to examine the use of a multidimensional usability evaluation framework for e-Government in order to achieve an insightful analysis into user interactions with online services. However, by using web analytic tools as a quantitative usability method, this research is seeking to examine the use of these tools to produce more effective evaluation for e-Government websites: thus, there are no predefined hypotheses regarding using these tools.

3.2.3 Research Approaches

Two wide research approaches can be defined: deductive and inductive approaches. The deductive approach demands that a research study develops a theory and a hypothesis; a research strategy is then designed to examine the hypothesis. On the other hand, the inductive approach involves collecting data and developing theory as a result of data analysis (Saunders et al., 2007, p. 117). For the positivism research paradigm, a deductive approach is employed whereas, in interpretivism, an inductive approach is usually used (Saunders, 2007). As this research is based on Thompson's (2003) evaluation framework for examining e-Government websites in Saudi Arabia in order to produce the most effective evaluation framework for e-Government websites, it uses an inductive research approach.

3.2.4 Research Methodology

Methodology does not essentially involve a specific research method (Pickard, 2008, p. xvi) because it depends on the issue being investigated. In particular, if the research investigates issues concerning "why" or "how", this would be qualitative approach; if, however, it is asking "how often" or "how many", this is a quantitative approach (Pickard, 2008, p. xvi). A qualitative methodology presumes social constructions of reality, whereas a quantitative methodology presupposes an objective reality of social facts (Gorman and Clayton, 2005, p.24).Thus , the research methodology is a bounded system built by the researcher to involve empirical study. This is found in the kind of research questions raised for each research project (Pickard, 2008, p. xvi) and therefore, because of the research questions formulated in Chapter 1, this research follows a qualitative approach.

3.2.5 Research Method

There are several research methods or strategies which adopt different approaches for collecting and analysing data: e.g. case studies, surveys, action research, etc. However, the case study method is the most commonly used in social science (Yin, 2009, p.5). The case study is a suitable strategy for the exploratory or preliminary stage of research (Shavelson and Townes, 2002; Yin, 2003, p.3). In other words, the case study method is appropriate for exploring situations in a particular society, as well as for exploring activities, processes and events (Creswell, 2009, p. 13, Yin, 2009, p.10). Furthermore, the case study method allows the use of a variety of methods depending on the specific needs of the situation (Denscombe, 2007, p. 37) and can be applied as a single or multiple studies (Yin, 2009, p. 61). A single case study is able to provide a rich description of primary data, as well as getting close to the phenomenon under scrutiny (Irani et al., 1999; Yin, 2003, p. 46); however, it is limited in terms of generalising the results. Multiple case studies, on the other hand, allow comparisons to be made (Bryman, 2008).

This research is based on the aim identified in Chapter One, which is to seek a way of developing and applying a user-centred multidimensional usability evaluation approach for e-Government websites; therefore a practical case study is undertaken with regard to e-Government in Saudi Arabia. In accordance with worldwide trends in the application of e-Government technology, e-Government issues have already been highlighted and implemented in Saudi Arabia. So, a motivation for this research is to use an example of Saudi agencies to examine the proposed evaluation framework; this agency is required to make significant progress regarding the introduction of online services.

Thus, this research uses a single case study to focus on the Emirate of Makkah as it has already achieved noticeable progress, having achieved the *eAward* several times, most recently in 2007. By using Peterson's tool (Peterson, 2007a) to examine the use of web analytic tools, it has been found that some web analytic tools have already been implemented the Emirate of Makkah and therefore this helps in applying the considered evaluation framework. This agency offers several online services for both citizens and businesses and therefore this research uses the evaluation framework of

Thompson et al. (2003) to collect the necessary data from the Emirate of Makkah to examine and refine the framework.

However, the case study method has some limitations, as identified in the literature. These includes, as Yin (2009, p. 14-15) illustrated:

- results cannot be generalised
- performing the research is time-consuming
- case study research can lack rigour.

In fact, the lack of the ability to generalise is possibly the greatest concern with regard to the case study method. Concerning this issue, Yin (2003, p. 32) noted that the mode of the case study's generalisation is "analytic generalisation in which a previously developed theory is used as a template with which to compare the empirical results of the case study". Moreover, Yin (2009, p. 15) added that: "case studies, like experiments, are generalizable to theoretical propositions and not to populations or universes".

In this research, the theory is based on the evaluation framework proposed by Thompson et al. (2003) which is thus the main vehicle of this research base. Additionally, it is planned in this research to perform further experiments following the basic usability methods (heuristic evaluation) in order to validate and cross-check the findings. Consequently, in this research, because of the difficulty in finding an appropriate government agency (because of the need to obtain access to web analytic tools which was thought to constitute an issue of confidentiality), only one agency was examined for all the methods. After an analysis of the results from the Emirate of Makkah was carried out, the evaluation framework was refined. Then, the refined approach was used to evaluate the new version of the Emirate of Makkah website. This approach allowed the limitation of examining only one government agency to be overcome.

To sum up, this research used usability methods, as described by Thompson et al. (2003), and then combined them with the results obtained from using web analytics, in order to define the users' interactions. This approach is encapsulated in the chosen

techniques which are described later in this chapter. The following section explains the research techniques used to achieve this research.

3.2.6 Research Techniques

There are three kinds of research technique: qualitative, quantitative and triangulation; the latter involves the use of both qualitative and quantitative approaches (Pickard, 2007). However, research techniques are based on the tool that will be used to collect the required data (Pickard, p. 167). This research employs the multidimensional usability framework designed by Thompson et al. (2003), as indicated in Section 2.3.2. The framework encompasses a variety of quantitative and qualitative methods that could be used to examine e-Government websites in the Kingdom of Saudi Arabia. Thompson et al. (2003) indicated that, in addition to analytic tools, a range of qualitative approaches can be used; for example, the authors discuss using focus groups and interviews, as well as heuristic and observational studies, in order to acquire qualitative feedback. For the purpose of this research, all the approaches cannot be carried out for reasons of time and cost. Furthermore, this research attempts to produce a more effective multidimensional framework that combines qualitative and quantitative methods; this may overcome the need to use some methods. For instance, only interviews, heuristic evaluation and observation studies will be employed to acquire users' perceptions of the usability of the websites. Moreover, the interviews will be implemented as part of a user lab test method: i.e. pre- and post-test interviews, as will be shown later. Consequently, instead of seeking new participants, those who have already participated in the study will be interviewed.

3.3 Data Collection

The data collections used in this research are discussed in three sections: the first is the orientation stage, used as a preliminary stage in investigating e-Government in Saudi Arabia. This is followed by two investigations of e-Government agencies in Saudi Arabia, using the selected usability framework. The first investigation is used to refine Thompson's framework and the second to evaluate whether the refined framework is effective.

3.3.1 Orientation Stage

This stage investigated the Yesser programme through in-depth, semi-structured interviews and a document analysis. Semi-structured interviews (Saunders et al., 2007; Creswell, 2004) were used as this approach allows for more exploration and flexibility. The interview questions can be seen in Appendix 1. In addition, Jeddah Council and the Institute of Public Administration were investigated more thoroughly to identify their existing and future plans, together with the methods they currently use to evaluate e-Government websites. Semi-structured interviews were carried out with the developers, and a document analysis was also conducted. This research concentrated on senior managers as well as technical staff in order to identify their approaches to improving websites in order to provide efficient online services; their methods for eliciting users' satisfaction are also investigated. The interviews covered important aspects that are required in the development of e-Government; in particular, they included: the current status of the e-Government project, the ways the websites are maintained, the current use of e-Government evaluation tools, the web metrics used, and planning for the future. Each of these aspects involved detailed questions which can be seen in Appendix 2. This research also investigated the documents and strategies used to develop the Emirate of Makkah website as well as the online services provided and the e-Government project in the Emirate of Makkah.

Interviews were carried out with the developers of the Emirate of Makkah e-Government website which helped to identify the problems that occurred while developing and implementing these services in the Emirate of Makkah, as well as the existing approaches that are being used to improve such websites. Jones et al. (2007), used a similar process to explore the evaluation of e-Government in the UK. They interviewed six senior e-Government stakeholders from three different government agencies. This research, to a certain extent, used the interview techniques employed in their study but concentrated on developers in order to identify their approach to improving websites and to providing efficient online services, as well as investigating their methods of assessing user satisfaction. Semi-structured interviews (Saunders et al., 2007; Creswell, 2004) were used as these offer a way of systematically acquiring qualitative data on specific topics; each section included between 3 and 18 questions. The interview questions can be found in Appendix 2.

During the interviews, participants were encouraged to answer questions and were given the chance to speak freely. Bias was reduced by the fact that the interviews were conducted from different e-Government agencies. There are several approaches that can be used to analyse interviews. In this research the Thematic Approach (Braun and Clarke, 2006; Tuckett, 2005) was used which consists of: transcribing interview data, organising the data obtained into meaningful groups, and generating initial codes. The rest of the phases comprise: searching for themes, reviewing and rearranging them, defining and naming them, and producing the report.

3.3.2 Employ Usability Methods

In this section, the usability methods used in the first implementation are illustrated. These methods are implemented in a specific order: i.e. heuristic evaluation is applied first, then usability testing, and then web analytics. This allows the relationships between the usability methods utilised in this research to be investigated.

3.3.2.1 Heuristic Evaluation

This study examines the design of the Emirate of Makkah website using heuristic evaluation techniques, as well as examining the site of another government agency in Saudi Arabia in order to allow comparisons to be made to highlight differences. It was discovered that Jeddah Council achieved the Digital Excellence Award in 2008; this indicates noticeable progress and therefore this site provided a suitable comparison with the Emirate of Makkah website.

In terms of the number of evaluators used in this stage of the research, it was shown in Section 2.5.2 that the number of evaluators depends on the number of websites being examined; in this research, a limited number of government agencies have been considered. Therefore, it was determined that the heuristic evaluation would be undertaken by three evaluators. Therefore, the researcher contacted several people who were thought able to satisfy such demands and three people met the requirements. All the evaluators had an MSc in computer science from the UK and had considerable experience in web design (8-10 years).

Heuristic evaluation is based on guidelines (i.e. heuristic principles). However, it has been found that there is a need to design an appropriate heuristic checklist consisting of a number of components which make up each principle, as explained Section 2.5.2. In this area it was found, as noted in Section 2.5.2, that Garcia et al. (2005) provides more principles that are relevant to covering the needs of an e-Government website. However, Garcia et al. (2005) provided only a basis for undertaking a heuristic evaluation; in other words, Garcia's principles did not contain details of the particular heuristic components which needed to be examined.

Some literature, such as Businesslink (2007), Brinck et al. (2002), Nielsen and Tahir (2002) and Pierotti (1995), and identified other heuristic concepts that can be used in addition to those mentioned in the work of Garcia et al. (2005). However, some heuristic features may be repeated since they may belong to several principles. This problem was overcome by customising the principles of Garcia et al. (2005) and combining the best of those mentioned above to give the principles listed in Table 3.1. Within each principle there is a potential number of questions that can be posed regarding the web design and so, for each question in the questionnaire, two answers were suggested:

- Yes: the heuristic is applied as stated in the question;
- No: the heuristic is applied but does not follow the design according to the question.

The heuristic checklist was reviewed by a specialist from Yesser and it was agreed that it covered what was required for the design of an e-Government website. However, a further analysis of the documents outlining the requirements for website design published by Yesser (2006b) found that five more heuristic questions were appropriate. These were:

- the structure and responsibilities of the main divisions;
- a chart to explain the senior management's organisation in the agency;
- a list of the available services;
- an explanation of the services to enable users to recognise the benefits and effects of applying for them;
- information about the planned projects of the agency.

As a result, the designed questionnaire was amended to include these extra heuristics under an additional "Precision of Information" principle. Thus, a detailed heuristic checklist was designed to extend the inspection to find particular usability problems and also to avoid the bias that might occur if not all the principles were covered by the evaluators. The complete heuristic checklist can be seen in Appendix 3.

ID	Principles	Description	Number of heuristic questions making up each principle
1	Consistency	Explains features of the websites to show their consistency with web standards.	11
2	Links and Navigation	The ability to allow users to navigate easily through appropriate links.	17
3	Helping Users	How effective the help system is in helping users use the site.	21
4	Features and Functions	Effective website features which enable users to interact with the government.	8
5	Data Entry Forms	Clear and simple data entry forms with a common structure and form throughout the website.	6
6	Visual Design	Users should not have to memorise information. Instructions should be accessible from any part of the website.	11
7	Accessibility for Visually Impaired Users	E-Government websites should be accessible to all citizens including those people with special needs.	3
8	Security and Privacy	Government sites should be secure against any attack and citizens' information must always be secure on any government database.	5
9	Precision of	Essential information should be precise and	9

ID	Principles	Description	Number of heuristic questions making up each principle
	Information	correct as inaccuracies may affect the citizen. The government has a responsibility to keep its websites up-to-date, accurate and properly maintained.	

Table 3.1: The adopted heuristic principles

3.3.2.2 Usability Testing Method

Observation methods were applied in order to evaluate the usage of e-Government websites by citizens and businesses. It was found that a significant work in this area by Lee and Cho (2007) showed that four aspects need to be addressed if this method is to be used, as explained in Section 2.5.3. This research, with some adjustments, has followed Lee and Cho's (2007) approach, which includes:

- **Designing the tasks**

  In their evaluation of e-Government websites, Lee and Cho (2007) designed 14 tasks for 14 different websites. However, in this research, analysis using the heuristic approach was first conducted to inspect the usability problems from the views of evaluators, this will help to define the major tasks that would uncover such problems; these subsequently to be verified by users.

- **Selecting users**

  As this method is costly, an optimum number of sessions are required, and some researchers have suggested that five is a "magic" number of users, as discussed in Section 2.5.3. In addition, because this research uses several different methodologies to examine usability problems, this approach overcomes the problem of having a limited number of users. Thus, five users from the target population of the Emirate of Makkah (EM) website were thought sufficient to conduct the testing. Only EM was selected because of its agreement to give access to its traffic data; Jeddah Council (JC), on the other hand, refused to grant access to its traffic data so JC was rejected for analysis

using this method. This is because the evaluation framework needs to apply the usability methods considered in the study in order to measure their efficiency and to discover usability problems.

The sampling population that participated in this research was carefully selected to represent the wide population. This is required in order to make inferences regarding the rest of the population based on the trial (Pickard, 2007). As usability testing is a qualitative method, purposive sampling was used. Purposive sampling involves two possible approaches: a-priori criteria sampling and snowball sampling (Pickard, 2007; Saunders, 2007). In the former approach, researchers define significant criteria that appear to influence the choice of the sample. In particular, three criteria were considered to be important for participants. These were: people working in either the public or private sectors, gender and current work position. In the latter approach (snowball sampling) the researcher makes initial contact with some participants and gives them a brief statement about the research and what they are needed for; they then invite others. For this research, a priori criteria sampling approach was used and ten invitations were sent by e-mail; six participants accepted the invitation to participate. However, one of the participants was unable to finish the given tasks because he came late and the laptops were booked only for a certain length of time. The details of the users sample are described in Section 6.2.

- **Carrying out pre- and post-test interviews**

  This research conducted a pre-test questionnaire to obtain users' initial impressions of the target website, together with their background information. This information helped to explain their interactions during the test. Furthermore, post-test interviews were performed. Lee and Cho (2007) found that useful results could be gained from conducting a post-test interview. These results include: recommendations to others, intentions for future use, comments regarding perceived usability and indications of user awareness. This research followed such an approach, using semi-structured interviews, to identify both the needs of citizens and businesses that used such websites. Gerken et al. (2008) interviewed six users, which is very close to the number

of participants (five) that the researcher invited to take part in the user lab tests on the Emirate of Makkah website. The pre-test questionnaire, users' tasks, and post-test interview questions can be found in Appendix 4.

- **Recording the interactions**

  There are two options to record the interactions of users, as indicated in Section 2.5.3. This research used the "Camtasia" recording software, to capture the usability problems, and a "think aloud protocol" was used to produce insightful results.

3.3.2.3 Web Analytic Tools

The current usage of web analytic tools that have been applied in the Emirate of Makkah was explored. This required gaining access to the Google Analytics tool used in the Emirate of Makkah and obtaining a copy of log files that covered a sufficient period of time for analysis. Furthermore, the software used in the Emirate of Makkah website had to be identified in order to analyse the log file and the features that are currently used. The web metrics defined by the Yesser (2006b), in addition to those web metrics addressed in the UK by Crown (2008), were also considered as a base for the website evaluation by using web analytic tools.

After the data were gathered, a number of web metrics were used to explore the interactions of users on the website. These included an exploration of performance during certain time periods. In particular, Key Performance indicators (KPI) were used to summarise the interactions of users on the website, as introduced in Section 2.5.1.2.2. KPIs involve the addition of a temporal dimension in web metrics by comparing results from each period of time. This allows businesses to monitor the efficiency and effectiveness of their websites over time. Furthermore, KPIs can also involve the combination of several web metrics to provide more useful data. This helps to identify the most useful set of web metrics for e-Government websites. However, the definition of a KPI is dependent on the business; in other words, each business has its own requirements that need different KPIs. Therefore, in the analysis using the web analytic tools, appropriate KPIs were presented, where possible, to

identify suitable measurements that can be used to measure the efficacy of web design in the EM site. These are discussed in Chapter Seven.

3.3.3 Refining the e-Government Evaluation Framework

The data produced from the above procedures was analysed and the problems that might cause users to abandon the online services were sought out, together with those problems faced by developers. A careful analysis of the usability issues uncovered by each of the methods (presented thoroughly in Chapter eight) enabled the researcher to refine Thompson's framework and create a more usable framework that would be appropriate for evaluating e-Government sites. This could then be used to address recurring problems, thus helping to improve the success of e-Government and to encourage users to use online services. In addition, merging the results produced by the different methods in the refined multidimensional framework should help in the on-going improvement of services. In particular, the research attempts to seek a way to implement such an evaluation process regularly to improve the effectiveness of e-Government websites.

This process will be described in later chapters, however, it is useful to point out that in order to examine the considered refinement, it was necessary to look at the how the amended multi-dimensional usability evaluation framework could be applied to assess e-Government websites. This included a consideration of whether the refined evaluation framework could provide a cost-effective, comprehensive usability evaluation framework.

The case study where the refined framework was applied was in the Emirate of Makkah, which published a new website version in June 2009, following the results of the initial multidimensional evaluation. The outputs of the heuristic evaluation and usability testing that were conducted in this research were partially used to suggest the new version and thus it was worthwhile applying the refined evaluation approach to the new version of this website. Lastly, the refined approach was designed to give a clear indication concerning the effectiveness of the methodologies that have been used to assess such e-Government websites.

3.4 Summary

To summarise, the research problems regarding the development of a multidimensional evaluation approach that can be applied to evaluate e-Government websites have been identified. In addition, this chapter has identified the aim of this research, which is to seek a way of developing and applying a user-centred multidimensional usability evaluation approach in e-Government websites.

To this end, the theoretical base of this research was considered and was then used with a web analytics tool as components in a usability multidimensional evaluation approach for e-Government websites. In this approach, users are considered to be a vital component of the research as their views impact the efficacy of websites. However, this evaluation needs to be developed for the iterative improvement of online services, without losing sight of users' needs. The methodology that was used to achieve the research objectives has been presented here and focuses particularly on examining an assessment approach for government agencies in Saudi Arabia. It has been shown that samples of government agencies in the Kingdom of Saudi Arabia were used as a case study for implementing the multidimensional usability assessment approach. The following chapters present an analysis of the results of the techniques used in the evaluations.

Chapter Four Analysis of Documents and Interviews

4.1 Introduction

This chapter presents the analysis of the documents and interviews conducted in Saudi Arabia. This will be used to investigate the present situation regarding implementing e-Government in Saudi Arabia; it also identifies the factors that affect the adoption of developments in e-Government. Furthermore, it discusses existing approaches to evaluating and improving the e-Government websites in Saudi Arabia.

The structure of this chapter is as follows: Section 4.2 offers detailed information concerning Yesser as an organisational body to specify the standards and the degree of control of e-Government in Saudi Arabia. Section 4.3 illustrates the implementation of e-Government in the selected e-Government agencies and investigates the factors influencing the implementation; a summary is located in Section 4.4.

4.2 Yesser Programme

4.2.1 Introduction

The wider aims of the Yesser programme were stated in Chapter 2; its objectives, in terms of applying e-Government in Saudi Arabia, were also addressed. Although Yesser has contributed to the development of e-Government in Saudi Arabia, interviewees raised a number of concerns regarding the role of Yesser in the development of e-Government. For example, one critical issue concerns redesigning existing work procedures in order to implement e-Government successfully. Yesser is facing challenges in solving this problem, as a member of the Yesser programme identified:

> *"The existing work procedures need to be redesigned to adapt to the concepts of e-Government, but we are facing difficulties and this will take a long time to achieve."*

This problem can be observed in different daily work activities in government agencies in Saudi Arabia. For example, a common demand in all the agencies in the Kingdom is for citizens' requests to be dealt with in person and for hard documents to be provided to complete the procedures; this conflicts with the demands of e-Government. One participant identified this problem by noting:

> *"It is a government agency; we still need to see the people in person to check their identity at least. It is a point that has not been covered well yet, but it is really required."*

This actually focuses on the need to evaluate and concentrate more on the existing procedures and on ways of overcoming the problems that may arise. In addition, the evaluation of the plan should be carefully constructed so any problems that may occur can be readily identified.

4.2.2 Definition of e-Government

e-Government in the Yesser programme is described as an effective and integrated utilisation of all information and communication technologies to ease and speed up transactions in government organisations (G2G), between government organisations and customers (G2C), and between government and business organisations (G2B) (Yesser, 2008b). In addition, the national strategy has a target to provide better services by the end of 2010. This includes providing the top 150 priority services at a world-class level of quality electronically (Yesser, 2007a) and also increasing internal efficiency and effectiveness by delivering government services electronically which, in turn, will contribute to the country's prosperity.

In line with trends in e-Government in the literature, this definition, as well as the national strategy, is not wide enough in terms of some important factors. For instance, it is mainly provided from the point of view of improving government efficiency with little regard for what users need. This is limited in contrast with the UK's definition of e-Government, which is:

> *"providing public access via the Internet to information about all the services offered by central Government departments and their agencies; and enabling*

the public to conduct and conclude transactions for all those services" (The Comptroller and Auditor General, 2002).

This can be seen in terms of two factors that are absent in the strategy in Saudi Arabia: the government processes and the users' perspective. These are discussed in the following sections.

4.2.3 Government Processes

This issue of government processes is actually one of the most important factors in applying e-Government applications. A participant addressed this issue by stating:

"The Government processes are one of the challenges facing Yesser. This is because e-Government is not a technological issue, it is basically the processes in government which need to be substantially redesigned to be able to achieve effective e-Government."

Also, another participant identified that:

"Much remains to be done, and many areas still retain traditional processes."

This problem was also addressed in the Gartner report (2007b) where the elements that needed to be considered as challenges facing e-Government in Saudi Arabia were stated. These issues are shown below in Figure 4.3.

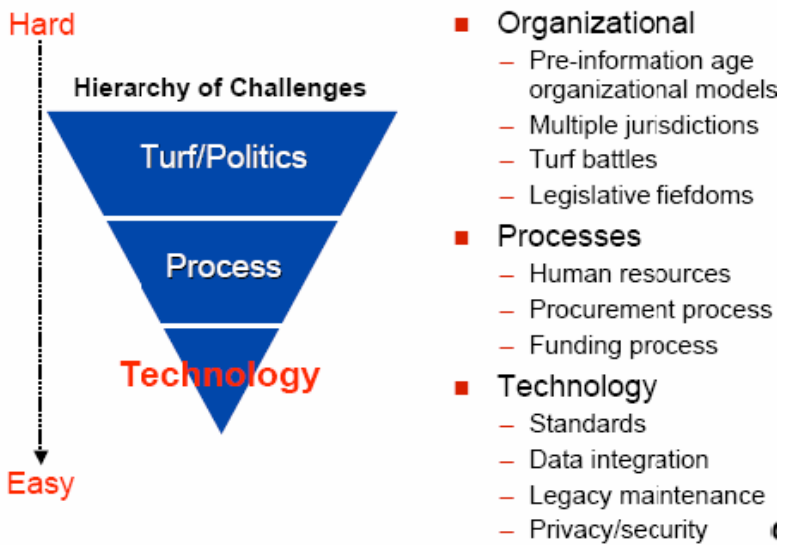


Figure 4.3: The E-Government Risk Pyramid (Yesser, 2007b)

These challenges are also identified in the literature. Al-Shehry et al. (2008) emphasised the importance of change management as an essential aspect of achieving a successful e-Government project. However, as Al-Shehry et al. (2008) suggested, change management, in terms of e-Government implementation, must be a part of each ministry's strategy to ensure the maximum success for this project.

Problems regarding government procedures can be seen also in the way that the Yesser programme is managing the development. For example, many participants from different government agencies who were interviewed confirmed that there is little or no relationship between the national e-Government projects considered by Yesser and the projects of other ministries. A participant in one agency mentioned this problem and said:

> *"We started before Yesser and we have achieved noticeable progress, but we are totally ignored in terms of any support provided by Yesser or any suggested development plan that can help us. They are focussing on those agencies that have made no progress with e-Government."*

It can be observed that Yesser's management needs some reconstruction, not just its tasks but also its structure, to make it more cooperative and to support fully and equally the government agencies in Saudi Arabia.

4.2.4 Users' Perspectives

In a developed country such as the UK, the e-Government framework has been designed and formulated around the concept of citizen-focused government, with central and local government working in partnership (Crown, 2002). This strategy has the potential to accelerate the implementation of e-Government in the UK in a way that expands the usage of online services. However, in Saudi Arabia, the focus in the strategy, as mentioned before, is on accelerating government procedures while the users' opinions regarding developing or enhancing e-Government services are ignored.

In line with the literature, it was found that the concept of professionalism is ambiguous in the public sector in Saudi Arabia (Al-Shehry et al, 2008). This problem

has been found in interviews: many participants believe that citizens should seek to obtain services and that, generally, the work style can be classified as work-oriented, which actually shows a gap in terms of bureaucracy. A group of participants defined the view of government in this way, as will be seen in the following section.

4.2.5 Progress of the Yesser Programme

Some noticeable accomplishments made by the Yesser programme up until the present day are:

1. The building of an e-Government national data centre that stores public data and allows all agencies to transfer their data securely.
2. Building a centralised government portal (www.saudi.gov.sa) to provide information on and access to government services and to offer electronic forms where available, with the ultimate objective of providing a single entry-point to all government services.
3. The introduction of technologically advanced smart card and e-passport systems. This is only an introduction; there are no reports to show what progress has been made in this area.
4. The drafting of an Electronic Transactions Act and e-crime Act in 2005; this was confirmed in 2008.
5. Numerous standards and documents that assist in applying e-Government have been created. One of these standards covers recommendations regarding the design of an e-Government website. However, this is just a start as the authorities are looking to implement a project concerning evaluating e-Government websites. A member of Yesser identified this need, as outlined below:

   "It is actually necessary to analyse the interactions of users on the e-Government websites, and we think it will help us in monitoring progress, but we do not have a clear vision of how to apply a website evaluation project and what the costs are for doing this."

   This shows clearly the need to apply this research project urgently due to the potential benefits that may be utilised to improve e-Government websites.

The timeline for the projects of the first national action plan are shown in Figure 4.4. In this figure, the priority projects are stated, together with the online services that will be available. However, no report exists to show the progress that has been made in terms of the existing work. In addition, there has been a delay in establishing the Yesser programme.

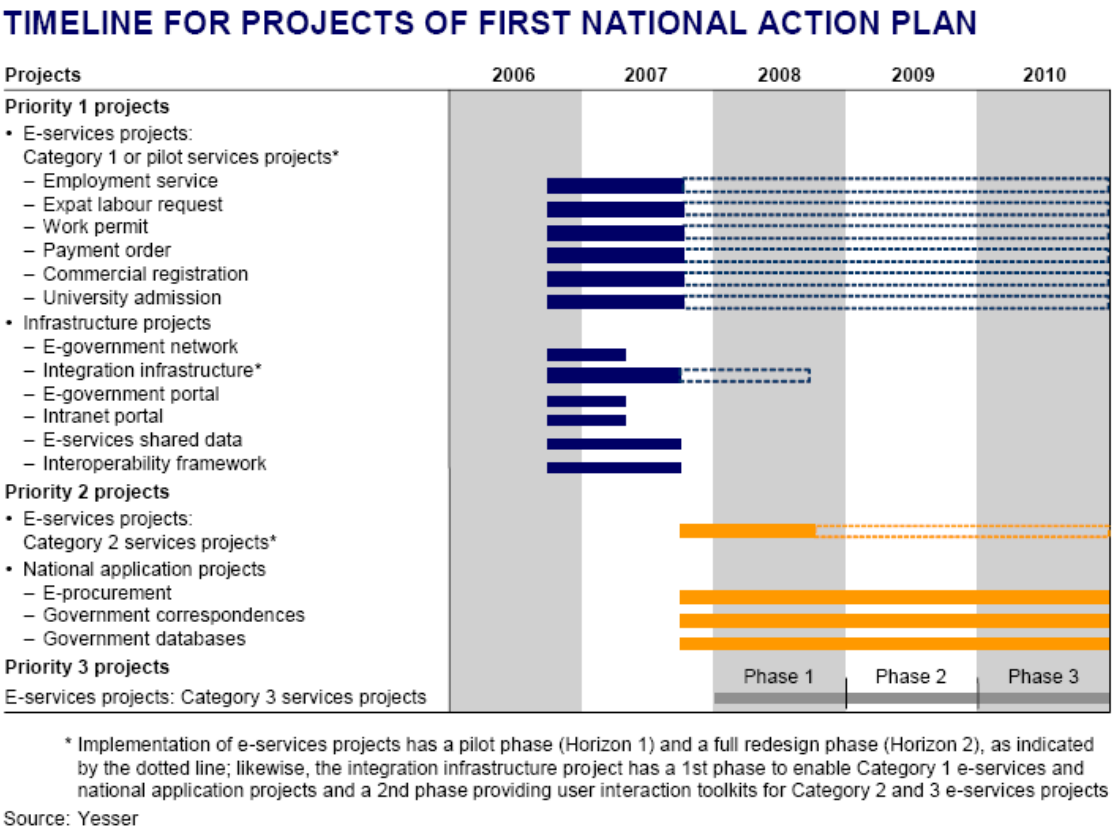


Figure 4.4: Timeline for Projects of the First National Action Plan in Saudi Arabia (Yesser, 2007b)

In line with the literature, the above points are similar to those found on a worldwide basis for the development of e-Government. For instance, in the UK there is a portal to serve citizens called Directgov (Directgov, 2008) and another portal called BusinessLink for businesses in the UK (BusinessLink, 2007). In addition, Govtalk states e-Government standards and the organisation responsible for it administers and improves the development of e-Government; this is similar to Yesser (note: Govtalk was moved to the Cabinet Office in 2005). However, in Saudi Arabia there is no specific portal for businesses whereas this architecture in the UK gives each part the

required attention and may help in applying e-Government to a wide range of people in society.

4.2.6 e-Government progress evaluation

As part of the Yesser programme, a questionnaire has been sent out annually to all government agencies, the questions are intended mainly to monitor the local work of each agency. The areas examined include the structure of e-Government, ICT infrastructure and the electronic services provided. Reports from this exercise are usually sent to the Ministry Council and the Shoura Council (i.e. the Parliamentary Council); these reports are not accessible to the public. However, in industrial countries, e-Government projects are monitored by public audit offices and more issues are covered than are mentioned above. For example, in the UK, the National Audit Office (2007) publishes annual reports to outline the progress of the implementation of e-Government. However it should be mentioned that these reports do not use new web analytics features as is shown later in this chapter.

On the other hand, Yesser members are not happy with the results of these reports:

> *"We are still looking for signs that more work has been achieved by each agency. Progress is still slow and it needs strong leadership in each agency to push on the work."*

These concerns have been highlighted in research on e-Government in Saudi Arabia. For instance, Al-Shehry et al. (2008) found the need for strong leadership within organisations in order to support the development. Lack of effective leadership is likely to result in an early failure of the e-Government initiative. This is also related to certain issues that emerged from the interviews conducted in the Emirate of Makkah, Jeddah Council and the IPA which are likely to affect leadership and also the performance of the IT staff in government agencies in Saudi Arabia. These issues are outlined below:

1- Some participants felt that only limited training was available to improve the efficiency of their work. One participant defined an example of this problem:

> *"In our agency there is no plan for training to fulfil the requirements of e-Government and the available training programmes provided in*

IPA, which are supposed to train us, do not help. Also, IPA sessions are held in another city and the extra money we are offered for this is very limited."

2- There is a failure to provide means of encouraging and motivating employees in order to make them feel a sense of satisfaction with their current position: i.e. there are no bonus or extra financial benefits for efficient work or good performance, as one participant identified:
"Look, if the employee does more work or learns new features by himself and applies them in his work, he will not gain any benefit from it. If they would like us to improve our work, we actually need to gain a real benefit from that."

3- The job description has not been up-dated to state in detail the skills that are required to help in developing e-Government. One participant stated that:
"I am doing my daily work as identified in my job description but the work required for applying e-Government has not been stated yet. I am in the government, not the private sector, and I think they will take a while to update the job description. But, to be honest, it is actually important."

The points noted above emphasise the need for a significant amount of work to be done in managing the government's work and, in particular, its staff. This is an important area that needs to be examined carefully and improved in order to gain the most effective work from staff.

4.3 e-Government implementation in examined agencies in Saudi Arabia

It has taken a long time to declare and implement national IT strategic planning within the government and this has influenced the implementation of e-Government in Saudi Arabia. This has lead to the uncoordinated deployment of IT resources and each government agency has its own initiatives for e-Government. Therefore, several individual attempts have been made to apply e-Government concepts in government agencies prior to the formation of the Yesser programme, such as:

- Emirate of Makkah (EM). The Emirate of Makkah is an administrative branch of the Ministry of the Interior; it is supposed to be a local website to serve the people who live in the Makkah region.
- Institute of Public Administration (IPA). This serves the government's employees as a national site and serves all the government employees in Saudi Arabia.

Several agencies benefited from the Yesser programme once it got underway, including Jeddah Council (JC) which is currently supported by Yesser; on the other hand, those agencies which began before the creation of Yesser, received little support. This section illustrates the interviews with the developers in order to investigate the progress of applying e-Government in these agencies.

4.3.1 Elements of e-Government initiatives

The Emirate of Makkah is one of the most successful e-Government websites in Saudi Arabia. It has achieved the Saudi e-Government Achievement Award (*eAward*) on three consecutive occasions, being ranked 3rd in 2005, 2nd in 2006, and 1st in 2007. EM's aim is to allow citizens in the Makkah region to make their requests to the Emirate in an effective and easy way. On the other hand, the aim of the IPA is to allow government employees (G2G) to make enquiries about their training programmes, such as if they have been accepted; no transactions are involved. IPA has limited objectives: it focuses on the present and has a query service in the later version; it does not have a wide view of the scope of e-Government.

However, in Jeddah Council (JC), there are well focused aims in its plans for electronic services. This is regarded as essential for communication and interaction between the Council and people and investors in Jeddah. This will allow citizens and businesses in Jeddah city to know about the services provided by the Council and to apply them online. However, this plan did not contain any details about the elements that had to be followed.

On the other hand, EM has wider elements in its plan including:

- Presence: to provide basic information about the ways of responding to any request.
- Interaction: it provides a variety of services using different electronic means (e.g. website, SMS service, IVM (telephone answering), self-service (information kiosk).
- Integrated operations: to have more online services to serve more users in the Makkah region.
- Transformation: it enables vertical integration with their branches. However, this is without any data transformation with other government agencies in Saudi Arabia: i.e. there are no horizontal integrations.

EM provides a variety of services. It was established in 2004 for different users including G2C, G2B and G2G. In G2C, five online services are provided. For G2B, there is only one service (advertising local tenders), and there is only one online service for G2G (queries to the Hajj committee). EM is in the middle of the second stage, as planned in its project, whereas IPA has no clear plan; it is thought that this is still at an early stage.

JC has a new version of its website with many online services. This appeared in September 2007. It provides seven online services for G2C, four for G2B (the Saudi Electricity Company, medical certificates, registration of engineering offices, dig permit systems) and two G2G (hospitals and the Saudi Electricity Company). JC was given a 1st rank by the *eAward* in 2008 as the best e-Government website in Saudi Arabia.

4.3.2 Improving and maintaining the sites

There are common concepts agreed by the examining agencies for maintaining and improving websites. Initially, government agencies are looking to keep sites working all the time, to keep the contents up to date, and to provide efficient online services. These issues are important to avoid any basic problems as identified by participants:

> *"It is important for us to maintain our site, to keep it up to date and avoid any problems that may occur. It is the government's voice and should be working in a clear and obvious way all the time."*

Maintenance is scheduled depending on the contents of the site. Generally, maintenance gives high priority to available news, the performance of the web server, and then to updating the online services. For example, JC focuses on maintaining news information daily and on keeping the news on the site up to date. The server's performance is examined weekly, while online services are maintained monthly. In contrast, the developers in EM perform maintenance on the news daily, while maintenance is carried out every three months on the servers, in addition to annual maintenance for all online services and web servers.

Within the maintenance, the number of visitors is recorded to monitor the load of the web server. Also, email and feedback forms are used to solve users' problems. This matches the existing approach to evaluate e-Government websites advised by the Yesser Programme (2006b).

More advanced techniques are used in JC where the users' views are thought of as important in the development of the site. JC has carried out usability testing at the design stage and this has been used to redesign some pages. Moreover, JC has its own forum to obtain users' views. A developer in JC addressed the importance of this point by saying:

> *"We made use of usability testing in the design stage. It was really useful and helped us to avoid some unexpected problems in the early stages but we have not carried out any more after implementation."*

This actually shows that more techniques are used by the agencies that are supported by Yesser (such as JC) whereas, in the remaining examined agencies (such as EM), the developers disagreed about taking the views of users into account. They believed that users' views were not significant in enhancing the provided services:

> *"We are not a commercial site and users have to use this channel of communication if they want the easiest way."*

It is interesting that agencies supported by Yesser have differing views to those that are directly supported by Yesser.

4.3.3 Factors influencing e-Government implementation

This section presents the factors that affect the implementation of e -government in Saudi Arabia. The factors that are discussed are: the available resources, Internet problems, web analytics knowledge, and the web metrics used.

4.3.3.1 Lack of resources

EM began its project to establish e-Government in 2002 with $2,666,666 to implement its five-year plan. It spent two years obtaining this amount in its budget with the site appearing finally in 2004. IPA, on the other hand, has continued to develop its site internally. In other words it has been developed locally because of problems finding a partner to work with, and the long procedures involved in selecting such a company. It has been noticed that both EM and IPA have a limited budget for their ICT departments which have delayed the implementation; thus, plans have taken a while to appear. The participants believe that the bureaucracy involved in lengthy government procedures are causing delays in their implementation.

> *"We are a government sector, and to get valuable support that can make changes in our work, we have to follow the long procedures required to obtain this support. It is vital that the procedures need to be much faster to accelerate the time it takes to obtain such support."*

However, the development at JC was supported by the Yesser programme to the tune of $12.8 million in 2007. This support has accelerated the progress made in developing the appearance of new services on their site. JC will thus have a massive number of online services, as mentioned in a previous section. More services are likely to be available online soon as about eight new online services are planned. However, participants in this agency believe that long procedures were involved in obtaining support from the Yesser programme (with procedures taking about one year).

"We spent about a year to get the support from Yesser. It is likely to take a long time and we have lost that time which could be used in a more efficient way."

However, the limited resources influence the use of free tools to analyse data traffic. All agencies are using free tools such as Google Analytics and WebLog Expert (free edition) for log file analysis and to analyse data traffic. This is a noticeable drawback which may cause limitations in understanding the benefits of these tools.

4.3.3.2 Internet problems

EM and JC are using other electronic means to allow users to access their services. This is because, as all participants have noted, not all users have access to the Internet, and the existing Internet services are unstable. The developers agreed about the lack of reasonable Internet services in Saudi Arabia, in particular, the lack of a widely available broadband service, and the lack of stability of the existing service:

> *"The development of the Internet does not match the development in Saudi Arabia. It is still unstable; one day it is working and another it is not working; it also has limited speed."*

To avoid this problem, JC and EM are providing their services through other means, such as SMS and the Kiosk system (the Kiosk system is a self-standing machine that gives out public information via computer screens). Figure 4.5 shows the number of queries that have been received by EM via different electronic means. This shows the effect of the low penetration rate of broadband services in Saudi Arabia; this needs urgent attention to improve the usage of e-Government.

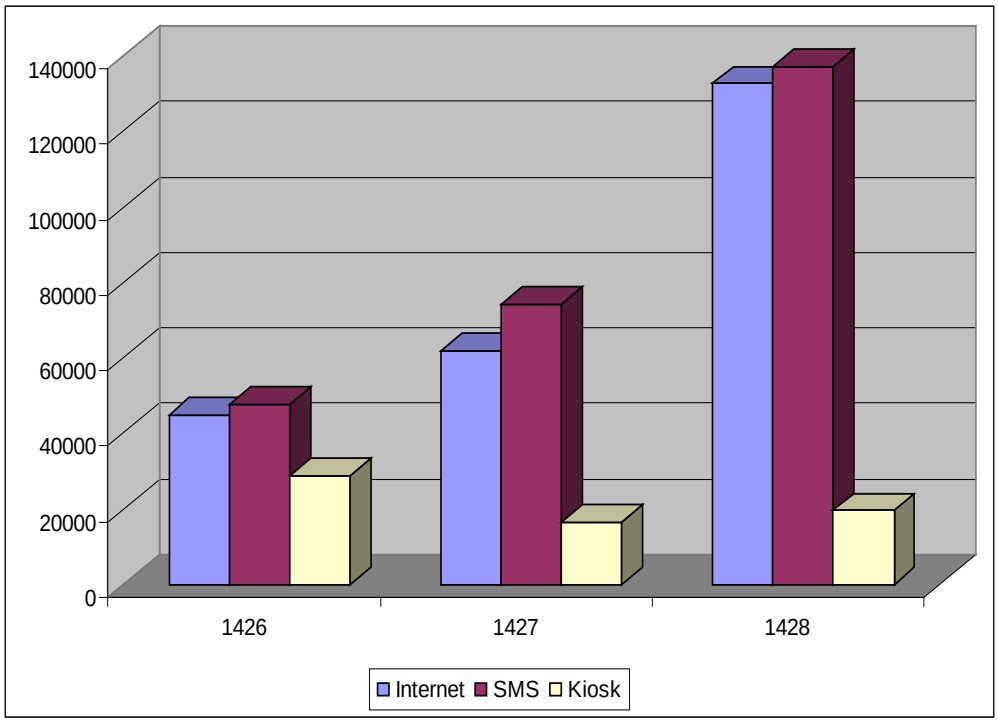


Figure 4.5: The growth of electronic approaches in providing government services in Saudi Arabia

4.3.3.3 Web Analytics knowledge

Developers in all the agencies that were investigated are using basic web metrics, without having any knowledge of some potential features available in analytic tools such as KPI metrics, using filters, and monitoring local searches. These features are essential in order to monitor the different trends on their websites. For example, all the examined sites serve citizens, businesses and their employees in the agency and it is important in this situation to extract the local traffic that comes from inside the agency from all the rest of the data traffic in order to identify the actual trends on the site.

Despite the above limitation, the participants felt that the output of the web analytics tool was useful for maintenance and to improve performance:

> *"Web analytic tools are a useful way of knowing the number of users on our site and where they come from but they are used just to identify the load on our site."*

This attitude shows that the participants expected more benefits from using web analytic tools. However, there is lack of knowledge of the potential features of web analytics due to the lack of specialists in such tools; the staff are too busy to learn as they have large workloads. This is shown by the fact that, in EM, the web analytic tools are the responsibility of the Network Administrator, and in IPA the Database Administrator is responsible for these tools. In JC, the head of ICT is responsible for managing them. So, allocating a qualified member to manage the analytic tools could be a way of obtaining the most benefit from these tools.

A related problem was found in the Saudi portal (www.saudi.org.sa), which is managed by Yesser. In this site, *Webtrends* is used as a tool to analyse traffic data. Twenty four million clicks were purchased in 2008, but this has now run out. The problem is that each element in any page in the Saudi portal, e.g. links and picture files, is counted as a "click", which is a way of measuring any interactions on the site. Consequently, any visitor that downloads a reasonable number of pages could use more than 100 clicks (as downloading only a handful of pages may actually download over 100 objects in total) and this number of clicks then needs to be paid for. The developers felt that this was expensive and offered limited metrics:

> *"These tools are too expensive and need specialists to manage and use them. But it might be useful to include them in our future plans."*

4.3.4 Web metrics

Yesser (2006b) has recommended that, instead of measuring success based on rankings in web service availability surveys, or in self-surveys, governments should focus on metrics that demonstrate operational efficiency. For this, the Yesser programme has defined a group of web metrics that may be used in future to monitor the traffic on websites. The purpose of these web metrics is to provide easy-to-understand reports on website usage. These web metrics can be seen in Table 4.1.

Despite the limited number of these web metrics, there is no further information about the benefits of such metrics and ways of enhancing the current website by using them. Moreover, there is no comprehensive assessment framework that involves using other

usability methods to identify ways of improving the development of e-Government websites. Gartner (2007b) recommends several measurements to determine the success of e-Government and some of them are related to the use of web metrics. This includes the need to identify the times of day when web channels are being used. This can then be used to examine the usage and can then be used to measure improvements in service delivery.

However, the tools needed to apply these metrics have not been defined and the potential benefits that can be obtained from these metrics have also not been identified in the Yesser programme. In addition, the advised metrics have not been implemented as yet and the Yesser programme is looking forward to utilising these metrics in the future:

> *"Web analytic tools can be useful to accelerate the time required to evaluate the website. We are looking forward to applying this technology in our future plan."*

In practical terms, there are common standard metrics that are used in all the government agencies examined here. These are:

- Number of visitors: These are used to ascertain the total number of visitors that have visited the site. These have been used to redesign some pages that have high levels of traffic into upper levels in order to be more accessible for users. Furthermore, they have been used to indicate the work of pages and pages that have been visited the most. These metrics have been used in different dimensions including the production of hourly, daily and monthly reports.
- Countries: These give the place that the users come from, thus indicating the popularity of the site worldwide, adding value to their reports. These metrics have been used to add more information about Saudi Arabia in only one agency that has noticed that traffic comes from other countries.
- IP address from log files: this metric is only used when a problem occurs.

However, in JC more metrics are used including:

- Different kinds of browser: these are used to solve the problem of users who are using different kinds of web browser.

- Search engines: This monitors the most frequently used search engines and refines the keywords to locate the site. This is carried out by refining the keywords' tag on the homepage.

The above web metrics are taken partially from those recommended by the Yesser programme (2006b) but not all the web metrics recommended by Yesser have been used in both EM and JC. This indicates that there is a possible lack of communication channels between Yesser and other agencies in Saudi Arabia so the results of using these metrics should be included in the annual questionnaire. However, in the UK (Crown, 2008), more web metrics have been identified as can be seen in Table 4.1.

UK – log analysis	**Saudi Arabia**
number of visits.	number of visitors.
number of unique users (visitors)	number of unique visitors.
page impressions (page views).	
error message counts (things that are not served successfully)	
most frequently visited pages	pages with most number of hits (top 5).
least frequently visited pages	pages with least number of hits (bottom 5)
top entry pages;	
top referring websites.	
visitor duration and traffic pattern	session length analysis. bandwidth utilization report.
visitor origin including which country, when it can be identified,	visitor distribution, i.e. which countries and domains are most of the visitors coming from?
visitor's IP address,	
visitors' technical preferences, such as browser type and version, and platform.	session length analysis.
successful requests	
unsuccessful requests;	

UK – log analysis	**Saudi Arabia**
traffic analysis focussing on peak times (to assess bandwidth requirements) and 'dead' times	web-server error report(s). bandwidth utilisation report.
	top 5 referring search engines.
	most downloaded files (top 3) least downloaded files (bottom 3)

Table 4.1: The web metrics considered in the UK and Saudi Arabia.

Crown (2008) gives an explanation of the benefits that can be obtained by using metrics such as unique-visits and page-impressions rather than simply number-of-hits. These include:

- monitoring current bandwidth use and attempting to project future requirements,
- archiving server logs to use for monitoring trends over time, which is a key part of using KPI-based metrics
- taking as much notice of error logs as of any other statistics,
- determining who is using the website the most.

Recommendations in Crown (2008) offer further details about using those outputs which are the most effective. These include:

- reviewing the navigation system: for example, identifying orphaned pages,
- identifying referring websites (the sites from which users arrive at a website),
- auditing the level of response to electronic forms,
- assessing the effectiveness of marketing/PR campaigns in bringing traffic to the website and providing information on users' platforms and browsers,
- identifying users' DNS domains and thus visits from abroad or from within government,
- identifying the most popular pages,
- traffic peaks and troughs against time of day and day of the week,
- average daily user load,
- which pages attract high traffic,
- which directories attract high traffic,

- which graphic files are acceptable in terms of size and download time,
- types of browser (user agents) being used.

Lastly, in the UK, the definition of required web metrics contains a clear statement of policy on the use of cookies: “It is acceptable to use HTTP cookies or session identities to track visitors' paths through the website (and this will be essential in e-transactional sites)” (Crown, 2008). However, in Yesser’s recommendations (Yesser, 2006b) there is no mention of a policy statement regarding the use of cookies.

In line with the literature, however, the reports on e-Government in the UK show that an old generation of tools is still being used to monitor the websites. For example, the reports presented by the National Audit Office (2007) used quite old quantitative technology, as represented in the web crawling method. This is a computer program that works on each agency’s site (26 websites); it counts the number of pages, documents and links that could be used to find the site. This tool is limited in terms of measuring the usability of the examined sites, in contrast to the potential benefits of a web analytics tool which would provide more in-depth information, as can be seen in Chapter 7. Furthermore, the National Audit Office (2007) is not using all the metrics mentioned in Crown (2007). Thus, this research will fill this gap and apply these metrics to e-Government in Saudi Arabia.

4.4 Summary

The implementation of e-Government in Saudi Arabia is at an early stage and several factors have caused there to be delays in making good progress towards e-Government. These factors are basically related to the hierarchical structure of the government in Saudi Arabia, which is very bureaucratic and in need of reform. In addition, there is limited financial support to help accelerate the implementation of e-Government in contrast to many developed countries. Furthermore, there is a lack of broadband services, which is a basic component in the worldwide trend for successful e-Government; this is being ignored in the strategies being adopted in the initiatives in Saudi Arabia.

Despite the limitations noted above, there are national initiatives and plans in Saudi Arabia, particularly in terms of applying e-Government, that follow the trend of e-Government development strategies in several ways. These include the development of the national portal, a national strategy to apply e-Government online services, and the creation of a responsible agency to support e-Government development. However, the strategies are not wide enough to cover the long-term vision for e-Government and the current staff in government agencies have not been given sufficient support to encourage them to participate positively in the development of e-Government; moreover, users' perceptions and needs are often being ignored.

In light of that, there is a misconception about the opinions of users of e-Government websites from the point of view of developers. This varies from the old fashioned idea of government work, where it is thought that users should blindly follow the government's procedures however they are designed, and where a few tentative steps are made to account for users' perceptions. This engagement with the users could be explained by the developers following some of the procedures from the Yesser programme which has several sections which attempt to take the users' opinions into account. Hence it is necessary to monitor the progress of government agencies to help refine the organisation of the implementation.

Lastly, it was found that a primitive usage of web metrics does exist in the government agencies examined in this study. Despite the metrics being defined by Yesser, there is a limited number of defined metrics, and the explanations of the ways they can be used to enhance the websites are limited. It has also been shown that, in the UK, e-Government has defined many web metrics. However, there is still a need for the practical application of the findings from these metrics. These metrics are examined practically in this research and are also explained in Chapter 7.

The next chapter (Chapter 5) presents the findings and analysis of the heuristic evaluation of the examined e-Government websites.

Chapter Five: Heuristic Evaluation Analysis

5.1 Introduction

This chapter presents an analysis of the heuristic evaluation approach that was conducted on two e-Government websites in the Kingdom of Saudi Arabia. It explains what usability problems were found in the design of websites as a part of developing a multi-dimensional evaluation framework for e-Government websites.

The structure of this chapter is as follows: Section 5.2 illustrates the methods used for selecting evaluators and the way that the heuristic evaluation was performed. Section 5.3 provides the analysis of the heuristic evaluation conducted by evaluators, introduced by offering an analysis of each heuristic principle. Section 5.4 identifies the overall results from the heuristic evaluation method, as well as providing the potential problems that can be used to derive the usability testing tasks; the summary is offered in Section 5.5.

5.2 Methods Used

Three evaluators that had a great deal of experience in web design as well as having knowledge of web usability were chosen, as indicated in Section 3.3.2.1. The designed questionnaire (Appendix 3) was given to these evaluators who were asked to perform their heuristic evaluation over two agencies' websites: Emirate of Makkah (EM) and Jeddah Council (JC). When completing the heuristic questionnaire, evaluators were asked to look for usability issues that could be seen as confused or complicated by users. Furthermore, evaluators were asked to write their suggestions on the front of each question, if possible. Each evaluator spent about two hours on each website answering the questions. After their independent evaluation, a discussion was conducted with each evaluator to reach agreement on the usability problems that emerged from their independent evaluations. Furthermore, potential problems that were found were also discussed.

5.3 Analysis of the Heuristic Evaluation

Research into heuristic evaluation approaches has used different ways of presenting results. Ahmed et al. (2006) divided their results into positive features and usability problems whereas Garcia et al. (2005) and Soufi and Maguire (2007) described only the usability problems in the interface design. Therefore, it seems useful, especially in this research, to offer both forms of presenting the results (i.e. positive features and usability problems) as this should help to point out the differences between those agencies in Saudi Arabia prior to the commencement of the Yesser programme and those that are currently supported by Yesser. Thus, the results will address both the positive aspects and usability problems on each heuristic principle that were discovered by the evaluations.

To provide some context, Figure 5.1 and Figure 5.2 show the homepage of the websites of EM and JC. The following sections discuss these websites in terms of the nine heuristic principles that were examined.

Figure 5.1: The website of Jeddah Council

Figure 5.2: The website of Emirate of Makkah

5.3.1 Consistency

This section explains features of the examined websites to show their consistency with web standards. Evaluators found that both sites had several positive features. It was possible to view both sites clearly given the screen resolution commonly used by users. This feature could be seen in the colour used in the logo, menu bars, headlines and fonts; all colours were derived from the logo's colour. Furthermore, graphics were used to present some features in both sites. Labels were used to describe texts and links which allowed users to access more information about the link. Moreover, headers were easily distinguishable and so were easily readable. This allows users to inspect with ease the contents of each group of commands.

The level of consistency noted above was also apparent in data entry forms; these were thought useful in enabling users to be more familiar with the contents. The command buttons (right and top menu) were given a consistent location, which was helpful. However, these buttons did not indicate which pages had been visited and which had not. This could be confusing for users in terms of the pages they had visited and it would be useful to include this feature.

Some heuristics were met by one agency only and these included:

- Consistent design was followed in all pages in JC whereas a few pages in EM did not consistently follow the main design. An example of this is that the right and top menu followed the trend in web design in both agencies as it was located in a prominent place (see Figures 5.1 and 5.2). However, in EM this did not apply to all pages as some pages had these important menus in an inappropriate location. For example, the page containing information about Makkah in EM, where the right menu was found at the bottom of the page (see Figure 5.3).
- The text and style of the JC site were readable and consistent throughout all the pages and the text justification was also consistent across all pages. However, in EM, a few pages did not follow the general consistency of the site.

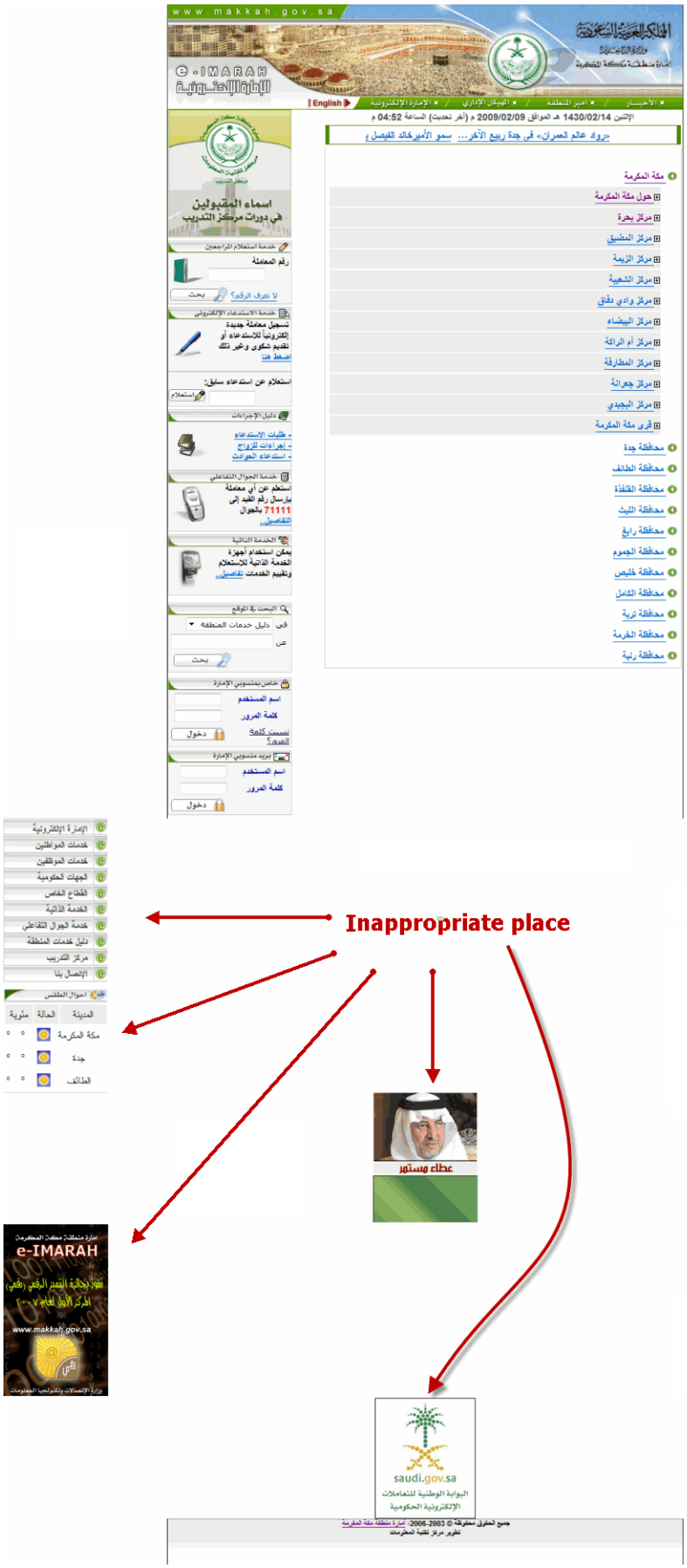


Figure 5.3: Inconsistent page layout found in EM

- All pages in JC were described by a relevant title whereas in EM not all the pages had an appropriate title.
- In JC, there was too much data on the homepage that might confuse users whereas EM was presented in concise way which is to be recommended.
- In EM the most important information, e.g. the online services, was placed in a noticeable position. However, JC focused mainly on activities for the council and the activities of the Mayor more than on online services.
- The explanations of the data entry forms in JC and EM were divided into sections with suitable titles describing the contents, as can be seen in Figures 5.4 and 5.5. However, in EM only, the data entry forms offered further explanation including the details of the required documents to be attached, as can be seen in Figure 5.5.

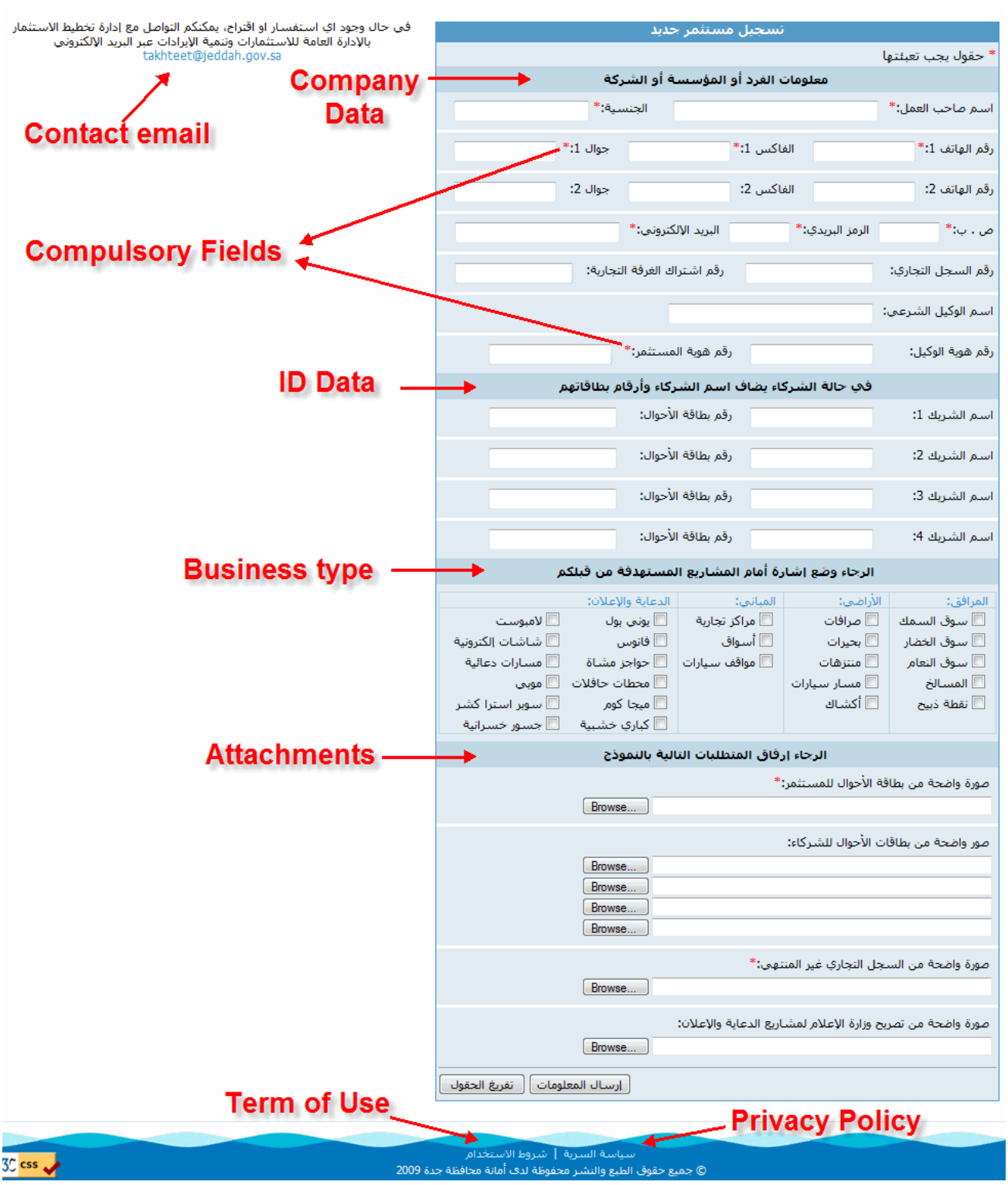


Figure 5.4: A sample of a data form in JC

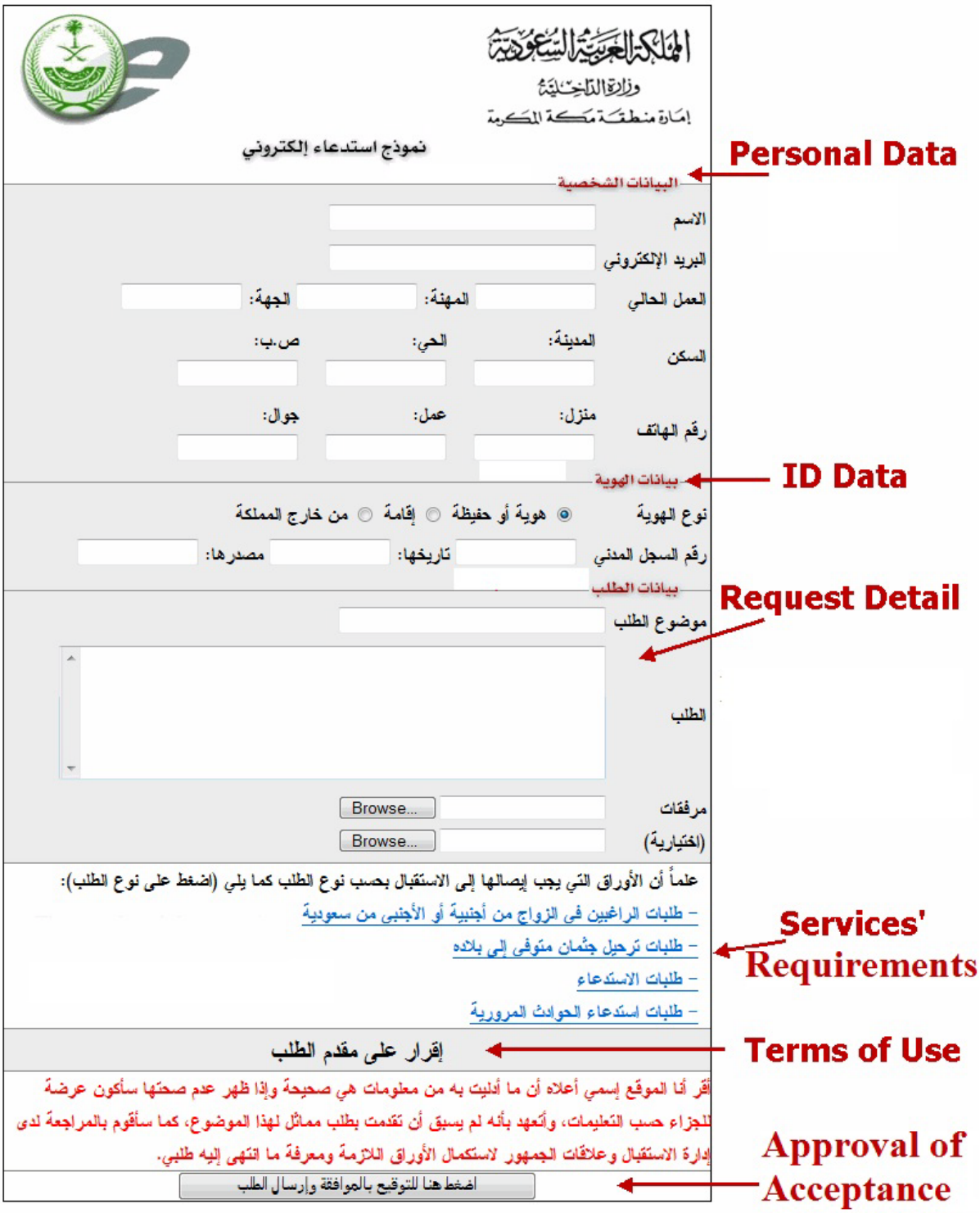


Figure 5.5: A sample of online form in EM

However, both sites lacked some features including:

- Both websites were not compatible with all web browsers. Evaluators examined both sites by using different browsers which included Internet Explorer, Firefox and Opera. It was found that some features, such as

command buttons in the right and top menu, only worked with Internet Explorer. This is an important issue since not all users have the same browser. It is worth noting that this heuristic could be examined by web metrics as this tool could report the kinds of browser used by visitors; this would probably allow the developers to examine this problem at an early stage.

- There was a noticeable focus on the news and activities of the head managers of both agencies. This might be appropriate for media reasons but the focus on electronic services was thus not the first priority in both of the examined sites. One evaluator illustrated this problem by stating:

  > *"Investment and public information should be before the administration links in JC. The same problem is also found in EM, where their focus is on the news more than services."*

5.3.2 Links and Navigation

This principle examined the websites under consideration regarding the ability to allow users always to navigate easily through appropriate links. It was found that in both of the examined websites, a few positive common heuristics were pointed out by evaluators. In particular, the navigation was placed in a noticeable position. In addition, the groups of links were mainly displayed on the right of the screen which is the most logical place for Arabic speakers. Furthermore, inquiry services were located in the homepage in EM whereas, in JC, two clicks were needed to reach this service; this is an acceptable number, however. Nonetheless, evaluators found that in EM this service was located in noticeable place but was not helpful, and one evaluator commented that:

> *"It is in a noticeable place, but it is not helpful."*

This is because there were two contiguous inquiry services which had the same name (one for manual and one for online services); this could confuse users.

Some heuristic features applied to one agency as was pointed out by evaluators. These included:

- The navigation area was placed in a noticeable position in EM so that it allowed users to use it easily. However, in JC, the top menu bar, although it

was in a noticeable position, was over the head of the page. One evaluator identified this problem and suggested the following solution:

> *"The right top menu should be under the header of all the pages in JC, as it is in EM."*

- The groups of links were displayed in the most logical way (i.e. on the right) in EM whereas, in JC, there were several groups of links in different places. One evaluator defined this problem as:

> *"The busy homepage in JC will not hold the concentration of users. It would be better to reduce it to allow users to concentrate on the main objective of the page."*

- Both sites had limited links to other government websites. There was only one link to the Saudi portal in EM whereas JC had three links: to the Saudi portal, to The Ministry of Municipal and Rural Affairs, and to the EM website. Despite the EM link, other links seemed suitable for the JC site since there was one for the national portal and another for the ministry to which JC belongs.
- The majority of links in the examined sites were working. However, while only one page link did not work in EM (the link to the English version of the EM site), several links in JC did not function. It might be helpful in this situation to use web metrics to check which pages receive the minimum number of visits in order to indicate such problems.
- Outbound links opened in a new page in JC whereas, in EM, these opened the same page. It is important for such links to open into a separate window in order to allow users to keep the existing site open.
- The link to the homepage was located at the bottom of each page in EM although some pages did not have this link. All pages should have a link to the homepage in an appropriate place that can be easily found by users. An example of a good place for such a link, i.e. located in the top right-hand corner of each page, was seen in JC where all pages had a link to the homepage.
- In EM, links did not clearly indicate what would happen: e.g. if a new page or file would download. Nonetheless, in JC, such a feature was available on all

the pages. A problem related to this was that colours were not used to indicate pages that had been visited. One evaluator advised that such links

"should be in a different colour."

The reason for that was to indicate clearly the visited links so users could easily know what links they had visited.

In addition, many problems in the navigation design of both JC and EM were found by evaluators. These included:

- Groups of links were not used to accelerate the navigation, for example, the most visited pages and most frequently downloaded files. Using such groups of links would speed up the navigation.
- There was no use of links within the body of the text. Including this would allow users to navigate the contents easily so it would be useful to have such a feature.
- There were no appropriate menu links to related information. This feature would allow users to navigate easily to related pages.
- Users have to scroll to find information and excessive vertical scrolling on each page was not avoided.
- Repeated links were found in the homepage of both sites, which is considered weak design.

5.3.3 Helping Users

A government website should enable users to discover and perform tasks with ease on the site. It should also help users to recognise error messages, which should be provided in easily understandable terms that will help users to solve problems they might encounter.

Evaluators found that both websites provided a search facility to allow users to search the contents of the site but it was noted that a ranking of search results was only available in JC. Furthermore, evaluators found that the search facility was limited in a number of ways in both examined sites. This can be seen by the fact that, when searches were carried out, the results did not accurately reflect the topic; these were

simply a link or a group of links without appropriate descriptions. In addition, other features were not available. These included:

- No advanced search capabilities were available although this feature is important to allow users to seek exactly the information they require.
- Searches were available only in the Arabic language, not in any others.
- Commonly used search terms were not provided.

In both sites users were able to find more information regarding contact information for each agency. Furthermore, the sites allowed users to enter their queries in feedback form and receive the results through a variety of options including by telephone, by mobile or by e-mail. However, a contact e-mail was found only on the contact information page in EM whereas, in JC, more pages, such as online forms, included this feature, as can be seen in Figure 5.4. The existence of this heuristic on all pages would help users to access the facility quickly rather than return to the homepage to seek this service.

Other features were only applicable to JC and these included:

- JC provided a specific page for frequently asked questions (FAQ) which offered useful information. However, the information provided was not presented appropriately. For instance, users needed to seek questions related to the problem to find an answer as these were not grouped and there was not even an appropriate group of links to access particular questions.
- The JC site only allowed users to download documents but required users to navigate more than three clicks to reach this service. This problem was defined by one evaluator as follows:

  "But there is no direct way to go there."

  Accordingly , it would be useful to allow users to reach these documents via a shortcut, such as a group of the most frequently downloaded documents.
- A site map was provided in JC that would allow users to explore the links in the JC site.
- The compulsory fields in the data entry form were indicated only in the JC site, as can be seen in Figure 5.4.

- In JC and EM, the fields were divided into sections and each section contained the title of the data that had to be entered, as can be seen in Figure 5.4, but in EM the titles were written in an inappropriate way: i.e. it was difficult to recognise the text as a title due to the colour used, as can be seen in Figure 5.6.
- Error messages on data entry forms appeared at the head of the form in both sites. These contained labels of the same field together with, in JC, a short explanation in red of where the problem had occurred. In EM, the label of where the error had occurred was only highlighted in red. It would be useful for such messages to appear at the front of each particular field where a problem occurred, as suggested by one evaluator:

  > *"Error messages should appear next to the field where the problem occurred."*

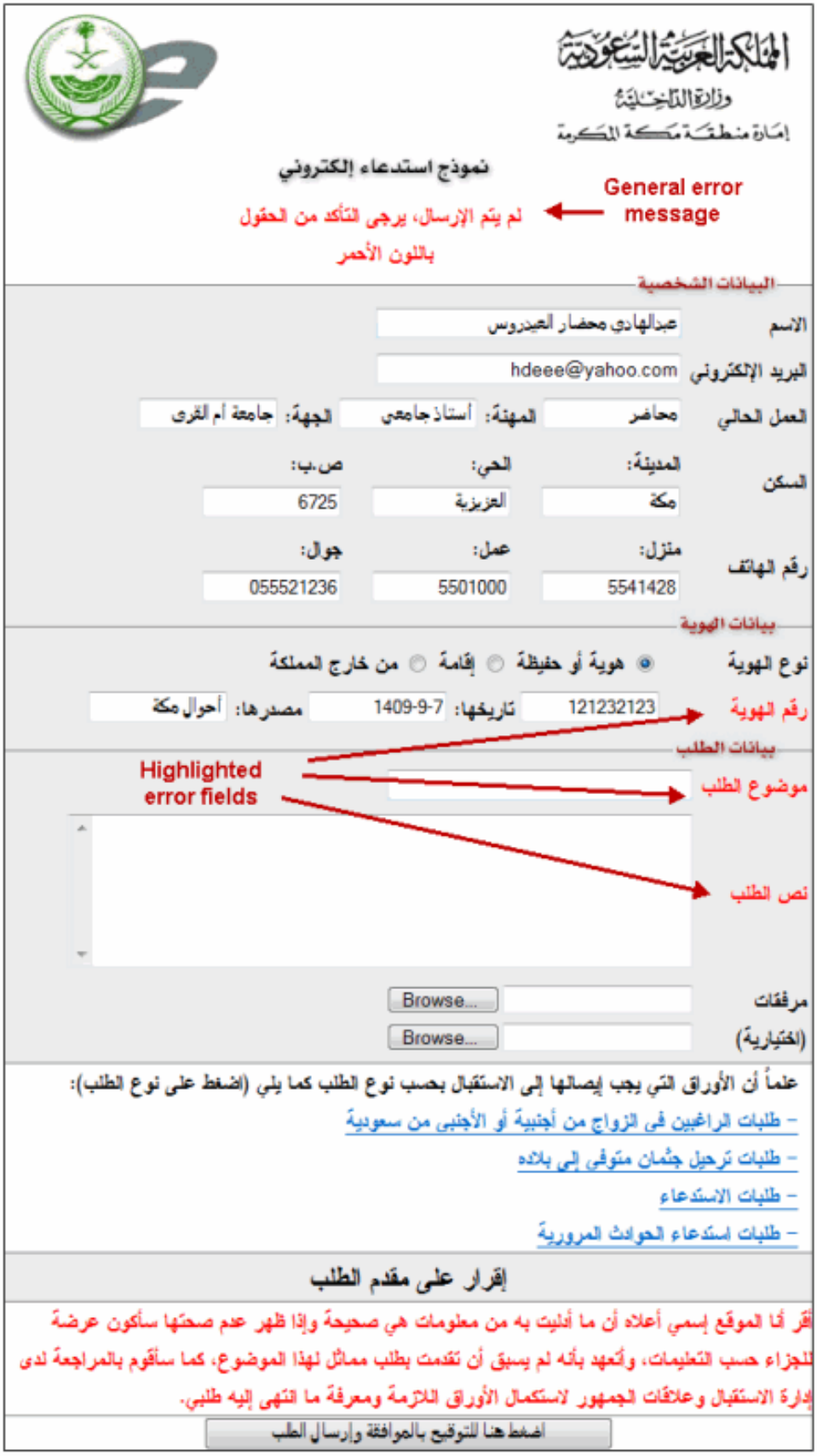


Figure 5.6: Error messages in EM

In addition, evaluators pointed out that both agencies lacked certain indicators that would help users, including:

- An A-Z directory was not available on either of the sites. This feature would help users to navigate directly to the required page.
- Labels were not used to indicate the field length.
- Fields did not contain a default value and only offered brief information about the way that those fields should be completed.
- The explanations of error messages were not sufficiently clear in order to solve a problem that might have occurred; only a differently coloured label was used by both agencies. Despite the existence of a contact e-mail found in JC, the explanations of errors would improve the time taken to overcome any problem.

5.3.4 Features and Functions

An e-Government website requires efficient web features and functions which will enable stakeholders to interact more with the site. It was found that common features regarding this heuristic principle were identified by evaluators in both sites, including the facilities to allow users to copy, paste and print the contents. These features enable users to keep the contents in soft or hard copies. However, when printing, every part of the page was printed. Evaluators commented that this was a problem and one of them defined it thus:

> *"It allows users to print, but using the browser tool, not their customized printing."*

Accordingly , it would be useful to allow users to print only appropriate content: i.e. not the navigation menu.

Features to allow information to be directed to users if they wished to register for this kind of service, such as RSS, were only found in JC. Despite the importance of this feature, an e-mail list was not available in any agency. This would also be a potential feature to keep users informed about anything new on the site.

However, there was no use of multimedia resources and both sites provided information only in the Arabic language. This means that the services provided are actually only for speakers of Arabic which was in contrast with the requirements of Yesser (Yesser, 2006b).

5.3.5 Data Entry Forms[2]

E-Government sites should allow stakeholders to input their data in an appropriate place. Commonly sought information should be clearly highlighted in an online form that users can become familiar with.

In all the examined websites, evaluators identified a noticeable lack of features which were needed in the data entry forms. Although these online forms were considered as the cornerstones of the e-Government online services, they were shown to be weak in the examined websites because of the following problems:

- The forms did not offer users any feedback concerning the submitted form. Feedback consisted simply of a short message that informed the user that he/she had submitted a form and a number was given (See Figure 5.7). This was a weakness since users could expect more information to be given: e.g. the subsequent action that would be initiated or when the request would be accepted.

[2] The name of 'Data Entry' principle has been changed into Transactional principle as illustrated in Section 9.3.10

Figure 5.7: A given number for a submitted online form

- Users were not informed about any delays that might occur. It was also found that, in EM, there was a long response time to any click; this is inappropriate. It would be useful to keep informing users of the progress during the processes to avoid any later problems with the system.
- Users were not allowed to confirm an action before they carried it out. This weakness was found in all the online forms in the examined websites. So, users were not able to review their request before sending or even cancelling it, this might cause their request to be rejected. It is important in such cases to allow users to review what will be sent and to allow them to cancel their request if necessary in order to avoid any mistakes.
- All forms in both the examined sites were on one page so users could enter data on one page only. However, users were not allowed to save partially completed contents. This lacks flexibility; allowing users to save partly completed forms may encourage them to use online services.

5.3.6 Visual Design (Minimising User's Memory Load)

A user should not have to memorise information throughout the website. Instructions should be accessible from any part of the website and should be able to be accessed throughout.

Evaluators found that some common positive heuristics applied to both sites:

- Images were only used in the logo, which gave a clue about the site. For example, in EM, the base colour of the logo was green and this was used in the text colours. The colour allows the context to be easily distinguished; furthermore, these colours match the users' expectations. Thus, the contrast in brightness between images and background colours was clear and white space was used efficiently.
- There were groups of links to specific pages and these groups had a title to tell users about the contents. However, the online service links were not the priority as information and news constituted the main part of the homepage of both the examined sites.
- Colour was used to indicate the most important figures in the text. This is a useful feature to emphasise to users the most important information (see the form in Figure 5.5).
- Error messages were placed at the top of online forms in both sites, which was the place most easily found by users. However, as shown before in Section 5.5.3, only in JC were more details found.

However, other heuristic features were not available in either EM or JC. Users were not offered the facility to personalise their page which would have enabled them to interact more with the website. In addition, the search box did not give users any hints or suggestions about entering data, such as those offered by commercial websites: e.g. using Ajax, Amazon can suggest the entry text, once the user has started to write any term. This is a useful technique that can allow users to enter data more efficiently.

5.3.7 Accessibility for Visually Impaired Users

Any e-Government website should be accessible to all citizens including those people with special needs. The questions below examine a subset of W3C priority guidelines

for visually impaired users which assess how well systems allow users with disabilities to have equal or equivalent use of information and services.

It was noted by evaluators that there were no accessibility features in any of the examined websites. Some simple features, such as adding captions to each link or label, were also not available. Furthermore, evaluators found that changing the text size did not affect all the components on any page. One evaluator pointed out this problem as follows:

"The technique of frames does not allow users to change text size."

It would be useful to add certain features to enable more users to interact with e-Government websites in Saudi Arabia. For example, some researchers, including Caldwell et al. (2004) and Brinck et al. (2008), have found that features such as increasing the font size and enabling users to change the colour potentially help users with this kind of disability.

5.3.8 Security and Privacy

Government sites are required to be protected against problems caused by hackers and citizens' information must always be protected when they are working online on a government website.

There was some use of security features in the examined websites. For example, users were logged out when the website was left inactive for a long time and the URL did not contain any information about users (e.g. user name or password). Only one site (JC) had a link to information concerning the privacy policy, but this was not in an appropriate location as users needed to scroll down to find it at the bottom of the homepage; it was also in a small font. Evaluators highlighted this problem with one of them commenting that it was:

"Not a clear link. It needs to be in an obvious place with a bigger font."

In fact, it is essential that this information is accessible to users and that it is in a prominent place in order to give them confidence concerning their rights on the site.

Both sites were lacking in several other heuristic characteristics in terms of security. There were no encryption techniques to show the kind of security that was being used. Furthermore, techniques that might give a user confidence when entering the site, such as a virtual keyboard feature to protect passwords that were entered, were not being used even though these were government websites where users provide personal data about which they need to feel confident and secure.

5.3.9 Precision of Information

Essential information should be precise and correct as inaccuracies may affect the citizen. Thus, the government has a responsibility to keep its websites up-to-date, accurate and properly maintained. It was found that all the examined websites adhered to some useful heuristic features. For example, both sites used the official domain name (*.gov.sa*) and the logo appeared at the head of each page (which is the recommended place according to Yesser (2007a, 2006b)). Furthermore, the services provided were highlighted efficiently in both the examined sites, though these were not the priority of the links.

However, the examined websites lacked several heuristic features regarding the precision of the information. Not all the data were date-stamped as only the current time and date appeared in most of the pages, as well as the date of certain items of news. Moreover, the time shown on the EM site was seen to be incorrect; evaluators suggested this problem was an issue of server time:

> *"The time is late. They perhaps use server time which may be correct only outside of Saudi Arabia."*

Apart from the dates found in the news, information regarding date stamps was often incorrect. In some places the date of an article was given as today's date whereas in fact the date needed to relate to the date the article was written or published.

One positive aspect was that the organisational charts were found to show the structure and responsibilities of the main divisions and units. Also, further details could be obtained in JC by downloading the entire structure and, in EM, by clicking

on the picture to explore the content. However, evaluators found that the details lacked some important information such as telephone numbers, addresses and contact e-mails which might be required by users. In the online form in EM only the services' requirements were introduced, as shown in Figure 5.5. This would be a helpful feature to allow users to become familiar with the requirements.

Lastly, EM had a general plan for its electronic services but there were no indications for other activities. In JC, on the other hand, some plans were available but they were limited to just two planning projects.

5.4 Heuristic Evaluation Results

This section presents the results of the heuristic evaluation in three ways. Firstly, it illustrates the overall result per principle that each agency achieved and compares the results of the websites that were examined. Secondly, the usability problems that emerged as a result of the heuristic evaluation can be used as predicted usability problems in order to design the tasks for usability testing. It is also possible that some of the problems identified by the heuristic evaluation approach could be investigated by web metrics.

5.4.1 Overall Results of Principles

This section presents the results for each usability principle. These are illustrated according to the percentage of questions that are met within each principle, comparing EM and JC. Figure 5.8 illustrates the percentage achieved for each principle for both JC and EM.

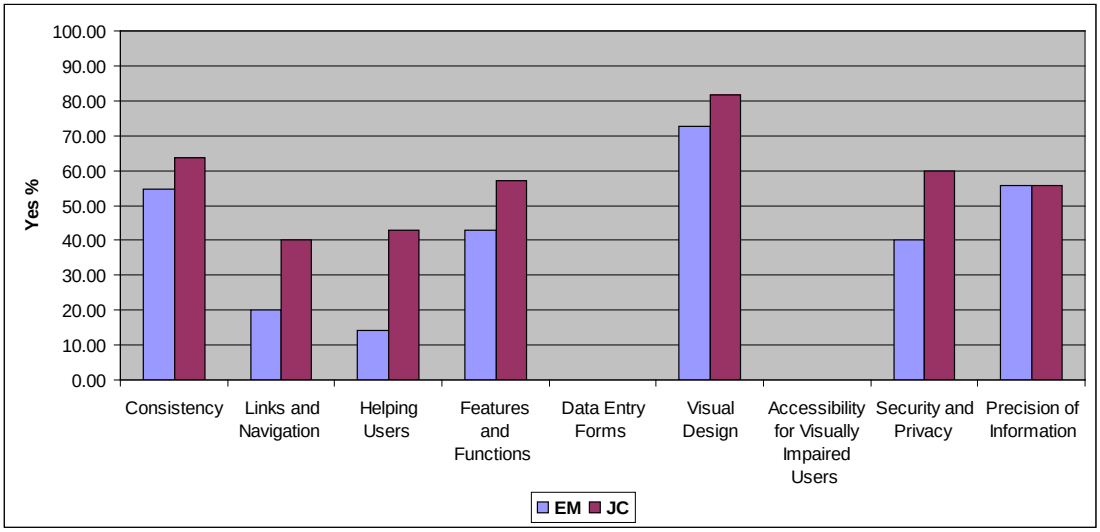


Figure 5.8: The results of the heuristic evaluation approach for two government agencies in Saudi Arabia

Although all the heuristic components should be met within each principle, Table 5.10 shows that this is not the case. It can be seen that more heuristic questions were met for each principle in JC than in EM. If it is assumed that, in order for each principle to be regarded as reasonably addressed, 75% of the heuristic components need to be met, then only JC properly addresses one principle (visual design), and EM did not meet any. However, if it is assumed that, for a principle to be properly addressed, more than 50% of heuristic components must be met, then EM only has three properly addressed principles (consistency, visual design, precision of information) compared to four in JC (consistency, features and functions, visual design, precision of information). When considering all 89 heuristics, the results show that JC achieved 43 heuristics whereas EM met only 30. These findings indicate that neither site is performing well in meeting the principles on the checklist. However, it can be seen that the JC website performed better than the EM site. This could be due to adherence to the rules designed by Yesser, which were applied in the JC site (remembering that the EM site was created prior to the Yesser programme). Despite these results, the designers of both sites need to pay more attention to usability issues.

Consequently, the developments in e-Government websites can be classified as in the early stages in Saudi Arabia. At the moment, websites are available and provide information but with inappropriate designs that do little to encourage users to utilise e-Government services. These problems are likely also to affect the successful implementation of e-Government in Saudi Arabia. In particular, those principles that were related to tasks in the transaction stages (such as data entry forms) show considerable weakness and are in need of further improvement. It is important that developers, as well as the Yesser programme, focus on usability aspects in order to improve the current position of e-Government implementation in Saudi Arabia.

The illustrated usability problems, as well as the results explained in this section, will be used to predict usability problems that can then themselves be used in designing usability testing tasks. This is explored in the next section.

5.4.2 Predicted Usability Problems

Many problems on the websites emerged from using the heuristic evaluation approach and several researchers have advised using the results of a heuristic approach to predict the problems that users might face and then to use these problems to drive usability testing to see if these problems really do cause problems in reality (see Section 2.6.2). The issues that emerged, as shown above, were used to design the tasks required in usability testing in order to examine these problems and to identify the voice of users. These issues include:

- A number of usability problems were found in the Consistency as well as Features and Functions principles. These may be clear from the first reaction of users to the website but they are likely to affect any further interactions of users with the site. Consequently, users first need to be examined regarding their interactions on the site in general terms before going on to in-depth tasks.
- It was shown that several problems are related to the navigation features and investigating these problems with users is important. This is because users may have difficulty exploring the site and so leave it without fulfilling their needs. This is evidence of the need to examine the navigation features.

- Providing information constitutes a basic role of e-Government. However, it was found that the information is often presented in an inappropriate way: i.e. the Precision of Information principle did not score well. So, users may not use this information or it might not be of sufficient depth to satisfy their needs; therefore, users need to perform a task that investigates the provided information.
- Seeking information is likely to be an essential function of e-Government websites, yet several usability problems were found in this area in particular. So, examining users in terms of this feature would help in identifying users' opinions about such features.
- Providing online services via a website is one of the most advanced features that users are seeking to use. However, it was shown that Data Entry Forms were the weakest of the applied principles. So, it is important to examine users in terms of these services to indicate their views concerning these features.

In the heuristic evaluation results, there were good levels of agreements between the three evaluators. Of the 89 issues examined across the nine principles, there were only 12 issues that the all three evaluators were not in agreement. As indicated in Section 5.2, in this case subsequently meetings with the evaluators were in need to investigate these issues. After the meetings, all the evaluators were in agreement about all of the issues in the heuristic checklist. The heuristic evaluators identified a considerable number of usability problems in the government agencies' websites that were examined. However, further consideration of some of these issues reveals that some of the heuristic features might also be inspected by web metrics, as a quantitative approach. The following section explains these potential web metrics.

5.4.3 Web Metrics that Emerged

During the analysis of the heuristic evaluation approach, it became clear that some heuristic components could be investigated using web metrics. This section states these metrics in general terms so they can be studied in a later chapter.

There are two kinds of web metrics that can be used to replace components on the heuristic checklist: those that can be known directly from analytic tools such as

Google Analytics and others that need to be adapted. In the former, the following web metrics are useful:

- Examining the site in terms of different web browsers.
- Investigating the different screen resolutions that are used by users.
- Testing that all links work: e.g. the link to the homepage, the most downloaded documents, the most visited pages.
- Helping users: e.g. the use of a search facility, FAQs, and an A-Z directory.

Other kinds of metric can be derived to inspect more detailed usability problems. In particular, some problems can be investigated by monitoring the use of the site. For example, it was shown from the heuristic results that navigation needs to be improved so it would be useful to examine the paths that users took to reach the online services, for example. These kinds of metric can be helpful in showing where users actually left the site, thus offering an automatic assessment of the site.

5.5 Summary

The analysis and results of the heuristic evaluation approach were explained in this chapter. Three independent evaluators used the designed questionnaire to evaluate two different government agencies in Saudi Arabia: Jeddah Council and Emirate of Makkah. Within each heuristic principle, a number of usability problems were inspected in both of the examined agencies However, it was found that Jeddah Council offered more usability features than EM. This actually shows the difference between these agencies prior to being supported by Yesser.

Despite the varying achievement of EM and JC, more serious usability problems still exist. These problems will potentially affect the usage of the information that is provided, as well as the use of the online services. Thus, these problems need to be focused upon by the examined agencies as well as by Yesser, as the organisation responsible for applying e-Government in Saudi Arabia. This is because these problems may reduce the usage of e-Government sites in Saudi Arabia and could potentially affect progress in terms of the use of government sites.

On the other hand, the usability problems that were generated from applying the heuristic evaluation approach have been used to derive several tasks that can be applied in usability testing. Furthermore, it is possible that some usability problems can be investigated via web metrics and that some web metrics could be derived to inspect usability problems automatically. These web metrics are illustrated in Chapter 7. The next chapter (Chapter 6) presents the findings and analysis of the usability testing involving actual users in Saudi Arabia in one of the examined websites.

Chapter Six: Usability Testing Analysis

6.1 Introduction

This chapter presents an analysis of the usability testing approach applied to the Emirate of Makkah (EM) website. It explains what usability testing found regarding the design of websites as part of the development of a multi-dimensional evaluation framework for e-Government websites.

This chapter is structured as follows: Section 6.2 introduces the participants and the environment for usability testing, Section 6.3 presents an analysis of the pre-test questionnaire while Section 6.4 presents an analysis of the conducted tasks, where five tasks were analysed. Section 6.5 offers the results of post-test interviews and Section 6.6 presents a discussion and the implications of users' responses to the observations that were conducted. Lastly, Section 6.7 offers a summary of the chapter.

6.2 Identifying and Initiating the Participants

The usability testing of the EM website was conducted by the researcher in Makkah City in September 2008. Testing was conducted in the computer laboratory at Umm Al-Qura University in Makkah. This laboratory has a new wireless network connection that covers a wide area. Due to the special recording software that was to be used, the researcher provided his personal laptop. Table 6.1 provides a summary of the participants' computing environment.

URL of tested website:	http://www.makkah.gov.sa/
Computer platforms:	Toshiba Satellite with 15.4 display
Memory:	1 GB
Screen resolution:	1024 × 768
Operating system:	Windows XP
Connection speed:	Wireless Shared T1
Browser tested:	Internet Explorer 6.0

Table 6.1: A summary of the computing environment

The researcher used TechSmith Camtasia Studio software version 4.0.1 to capture usability problems by recording users' interactions on the screen. Each video clip was about 60-70 minutes long, resulting in a 350-380 megabyte sized file.

The total time spent with each individual user was about two hours. At the beginning of each test, participants were given a short briefing on the work they were required to perform, told their rights during the testing, and introduced to the objectives of the target website. Furthermore, participants were served coffee in order to overcome any hesitation that they might have felt. Next, participants were asked to:

- Answer verbally a user background questionnaire.
- Answer verbally the questions about their initial impressions of the site.
- Navigate the examined site.
- Locate information and perform appropriate searches.
- Perform real-world tasks (applying for an online service) on the site.
- Perform an inquiry.
- Finally, answer the post-test interviews: i.e., verbally answer questions about their overall satisfaction.

Appendix 4 shows the user test forms (legal form, pre-test questionnaire, users' tasks, and post-test interview questions). The following sections illustrate the analysis of the above points and highlight the usability problems that were inspected.

6.3 Pre-test questionnaire

Participants were asked to answer some primary questions verbally. These were required to obtain background information in order to validate the participants that were selected. The results can be seen in Table 6.2.

Age	
18-25	1
25-30	3
31-40	1
41-50	
Over 50	
TOTAL (Participants)	**5**

Gender	
Women	1
Men	4
TOTAL (Participants)	**5**

Using a Personal Computer	
Less than 1 year	0
1 year	0
2-4 years	0
Over 5 years	5
TOTAL (Participants)	**5**

Work Experience	
Less than 1 year	0
1 year	0
2-4 years	2
More than 5 years	3
TOTAL (Participants)	**5**

Computer Usage	
Several times a day	4
Once a day	1
Once a week	0
More than once a week	0
Once a month	0
TOTAL (Participants)	**5**

Work Type	
Public Sector	4
Private Sector	1
TOTAL (Participants)	**5**

Using a Government Website	
Never	0
Less than 1 month	0
More than 1 month	1
More than 6 months	2
More than 12 months	2
TOTAL (Participants)	**5**

Table 6.2: A summary of participants' profiles

It was necessary to estimate the age of the respondents so users were asked to specify their age group. It was found that two-thirds of the selected users were between 25

and 30 years old; this category represents a considerable part of the population of Saudi Arabia. Furthermore, the majority of users that were selected were men. This was because opportunities for women to apply for government services in Saudi Arabia are rare so men usually do such work. However, the researcher secured the participation of one female to explain the problems that they might face as e-Government should be for all people in society. All users were familiar with using a personal computer and most used the computer several times daily. These are important factors that may influence the results of the usability testing.

Regarding their work experience, three participants had more than five years' experience, and two users had spent 2-4 years in their current employment. Lastly, all users had used e-Government websites but varied in their use of such websites. Only one user had used government sites more than once; the others were less frequent users but still used government sites more than once a year.

The following sections illustrate the analysis of the given tasks. This includes an analysis of the recorded clips, as well as the generated problems that the researcher identified.

6.4 Analysis of Tasks

This section introduces the analysis of the tasks performed by users. As mentioned before, users were asked to think aloud while conducting the given tasks. This was a critical demand from the researcher which allowed their interactions to be observed more efficiently.

6.4.1 Users' initial responses

At the beginning of this task, users were asked to spend five minutes exploring the contents of the homepage but not to click any link. After that, five questions were asked to find out the participants' perceptions.

Initially, each user had to scroll down the homepage, as not all the content could be seen without scrolling. It was reported that scrolling is not an appropriate design

feature, as shown in the preceding chapter. However, it was observed that users could explore the contents of the homepage easily. Users were able to read the content easily due to the font or colour used. Furthermore, participants felt comfortable because the site had achieved a significant rank in the Digital Excellence Award (*eAward*), as advertised on the site. This reassured participants that the content available to the public would be reliable.

In addition, the existence of a right menu was highlighted by users; this matched their expectations. This means that the EM website has positive features regarding the most appropriate position for the menu (on the right) which is useful for Arabic readers. However, users explored the content of the top menu as a last resort.

Even so, it was observed that users were confused by the content of the top and right menus. In particular, there was duplication of menu items in both, as can be seen in Figure 6.1. In addition, users felt that the order of the menu items did not efficiently highlight the services that could be accessed online. In particular, users found that the priority of items in the menu was not appropriate. For example, the first item was "Electronic Emirate", which introduces the e-Government project in the Emirate whereas the second was entitled "Citizens' services". Similarly, in the top menu, the first item on the right, which is the Arabic direction for reading (from right to left), was about "News" while the last item was about "Electronic Emirate". This was not to the liking of the majority of users as they wanted the services first.

> *"This is not a logical sequence. As a citizen, I would like the services to perform, not to read about what they did."*

> *"I am not interested in "News". I need to perform a service or even contact them by telephone, which is not considered here."*

> *"News may be interesting but it is my third or fourth priority. Looking for services is my first priority, which is not here."*

Figure 6.1: The redundant menu items in the Emirate of Makkah site

Participants found that the homepage of EM gave them an impression of formality. This was noticed in the logo, representing the Interior Ministry, to which the EM belongs. In addition, three users felt that the presence of the photo of the head of EM on the homepage gave users a feeling that the site was reliable.

"I can see the photo of Prince Khalid; that is a good thing."

Although the inclusion of a photograph might be thought somewhat unusual in some countries, in Saudi Arabia, photographs are considered important, especially in material for government agencies such as the Ministry of the Interior.

Users found that there were shortcuts to the online services, situated on the left side of the homepage. It was felt that providing such services was suitable for the site but that they were not easily found.

"These links should be in the right menu. It is what I am looking for usually, not those there on the left."

However, users flagged up several points regarding these shortcuts. First, the title of the inquiry services was found twice: i.e. the same titles were used for both manual and online requests. Second, it was felt that the placing of these links to services did not reflect the demands of participants, where putting links on the right is preferable. Instead, users found that news was given priority on the homepage which did not help

them locate the services. Users commented that there was much more news than services. They felt that news might be important but providing services was more important.

> *"It might be that news, especially for the Prince, is important. But providing services electronically to us should be the main thing on the site."*

This indicated that the way the services were presented was not up to the expectations of users and therefore users might spend more time to find the information that addressed their demands. Furthermore, it indicates that the services were not highlighted efficiently so users might miss them and not utilise the services provided online.

Additionally, three users noted that the existence of another version of the site in English was a useful feature. As one user said:

> *"It is good to have a version in a language other than Arabic because several million pilgrims come to Makkah every year. They may have some problems and therefore need the Emirate to find solutions."*

However, this link was not working, as was shown in the heuristic evaluation analysis in the preceding chapter.

6.4.2 Navigation of the site

Users were asked to navigate freely anywhere in the EM site and were given 10 minutes to do so. In this task, participants were allowed to navigate the site freely and, as before, were asked to think aloud while performing the task. At the beginning of the task, users used the right menu and went through each menu item. Users appreciated the convenience of placing the navigation menu on the right and used it all the time. This menu was found in a fixed place across a number of pages on the EM site, which is the most appropriate place. However, users struggled in several places:

1- Users had to wait after clicking the button to open the required page. This was noted in all the navigation conducted on the examined site. Three users clicked the link again, as they thought it was not working properly, and felt it was too slow.

"Do I need to wait? or click again?"

However, it should be noted that other factors might affect navigation: e.g. the effect of using recording software and perhaps the connection to the Internet in the laboratory. Interestingly, it was noticed that when the users opened some pages, the loading of downloaded pictures was shown in the status bar, as can be seen in Figure 6.2. This process often took about three seconds and, in the figure below, 17 items were still to download. This delay seems excessive and might be due to the quality of pictures used in those pages.

Figure 6.2: Downloading pictures

2- On the procedures page, four users read a short message at the top of the page which introduced a list of procedures that were required when applying for any service. It was felt that users could read the message and the list of procedures easily. This list contained four items which used the names of the procedures as a link, as can be seen in Figure 6.3. So, when the users explored each link, on clicking, it opened the same page with the details belonging to it. Also, when users clicked the link to another procedure, the remaining procedures disappeared. Moreover, participants found that, at the head of this list, there was also a link that allowed them to go back to the procedures' page. To allow users to go back again, without the need to look for the back button, was a positive feature. One user noticed that in the general request link, the user was asked to come early to the EM building to submit the request. It was thought that this was for a manual request and not for the online services, however this did cause some confusion to the user. This suggests that the differentiation between manual and online requests was not clearly presented. In addition, some participants thought that the procedures provided were limited; they expected more procedures to be available on the site.

Figure 6.3: The links in the procedures' page

3- Two out of the five users used the back button in Internet Explorer to return to the previous page. However, two users struggled to click on the header photo to return and then sought some indication to help them return: i.e. they used the right menu to navigate to other pages. Only one user found that the button to return to the homepage was located at the bottom of the page. This participant felt that this was not the usual place and that it should be at the top of any page.

4- In the government agencies' index page, three users found that the page lacked an appropriate title informing users about the contents. Moreover, little information was provided in this page: e.g. destination name, telephone and fax numbers. This page can be seen in Figure 6.4. The information in this page was displayed as a list of links for each agency's name. Clicking on any link of these list items reloaded the page, with the item selected being explored to show more details. With the page displayed in this way, users felt that information was often reloaded which took more time because of the slow response times, adding further to the time taken when navigating the EM site. More problems were found when a number of links in that list were found not to be working. Most participants also felt that there was noticeable repetition of the agency's name in the list: e.g. 15 items were listed for the Interior Ministry and 5 items for the Information Ministry. This indicated that the information did not meet users' needs.

Interestingly, it was noticed by one user that the free number provided in EM was an old one that had been used in the past.

"This free number is old. It looks as if no update has happened."

This indicated that limited information was provided and no date was associated with the information. It was clear that the information had not been updated for some time. This is not appropriate design.

Figure 6.4: Regional services' page

5- The duplication of menu items confused users as to which link they should use; this was discussed in the previous section.

6- In the self-service link, as can be seen in Figure 6.5, two users found that this page lacked an appropriate header to tell them about the content while there was a mass of information. The information was found as a block of text on the page with some pictures. Users could not identify the content easily until they started reading it although each paragraph had a title in red. One participant thought it was a news page.

"It looks like news: some pictures and a lot of text."

Figure 6.5: Self-service page

6- In the training programme page, four users felt that there was too much content: i.e. it was just a large block of text with few photos and without a heading for each paragraph. This page can be seen in Figure 6.6. Users who navigated to this page

started reading it but found it too time-consuming to continue so they moved on to explore other links.

Figure 6.6: Training Centre page

This indicates that excessive vertical scrolling existed widely in the EM site and that the method of presenting the contents was not motivating for users. This is a negative design aspect which will not be appreciated by users.

6.4.3 Using the Search Tool

Users were asked to carry out a search using the search tool provided on the EM site. They were given an exact term (specific text string) to perform the search. This was "تعين الامير خالد": i.e. the date of assigning a new head or prince for EM. This term was used because searching for services did not return any results. Therefore, another useful term was used to inspect the usability problems that might found regarding the design of the search facility. As the site focused on news, news items can be used to inspect the problems in the design of the search tool. It should be noted that this research concentrates on design issues and seeks to evaluate the efficiency of the design of the search tool; other search issues were beyond the scope of this research.

In the beginning, participants had to scroll to the right menu and try to locate the search tool. Only three out of the five users remembered where this tool was located. This might be because it is located near to the bottom in a number of pages, as three users mentioned.

> *"Why is it down? It should be up, shouldn't it?"*

This indicates that such a tool needs to be located in a consistent, reachable place on all the pages. Users wrote the given term and found a dropdown list that contained six choices for their search: in the whole site, in the news, in the index of regional services, in the regional services, in the index of departments, and in the tenders. Three users thought that the search should be conducted using "whole site search" (2 users), whereas others used "the news" option (3 users). Of those who selected the search in the news option, the results appeared as part of a news article with pictures, and highlighted some of the search string keywords. However, the results that were generated did not offer the required information and the highlighted keywords did not include all the terms entered: i.e. some keywords were highlighted. Therefore, these users had to go back and repeat the search using the "whole site search" option.

The results generated by using the search in the whole site option were shown as a group of links that referred to other pages, but without any description of the link or ranking of the search terms. Also, the exact term was not found in any link, as shown in Figure 6.7. Therefore, the users had to navigate using each link to find the

requested information. Hence, the requested information was found only after navigating the results that were produced, as can been seen in Figure 6.8.

Figure 6.7: Search results using search in all the site options

Figure 6.8: Search results

This task shows that the search tool did not provide results in a way that could help users find what they were looking for and several problems were found. These included that the results were presented without any description or ranking; even the

given links did not offer any clue about what users could find within these links. This shows that the search tool provided was very limited and needs to be improved

6.4.4 Applying using an online service

Participants were asked to use a selected online service in the EM site. They were given the details to be entered and 30 minutes to perform this task. This followed a procedure that required obtaining official permission from the EM: in this case, applying for a permit to transfer the body of a deceased person.

At the beginning of this task, users used a link on the left of the page from wherever they were from the previous task. This link, enabling users to reach the required online service, is found in most pages. Users also had the choice to follow the "apply online service" link and then navigate to another page. On this page, they were given the choice to apply for either a new online service or enquire about an existing request. Two users mentioned the problem of not going directly to the required page:

"I clicked the 'applying for services', not for query, oh, another repetition."

Users then had to click on the button, applying for a new request, to perform the task. When the form appeared, users first had to scroll down the page before they could start to fill out the fields. This shows that the page did not display appropriately and that scrolling had not been avoided. This actually matched the finding mentioned before regarding the excessive scrolling seen in the previous tasks.

In this form, users needed to enter their personal data: e.g. name, ID (number, date, issue place), address (street name, destination, P.O. Box), occupation, e-mail, telephone number (home, mobile, job, fax). Then users needed to enter their request as text within a specific box and attach the documents required to satisfy the official requirements of their application. The online form can be seen in Figure 6.9.

Each user began entering his/her personal data but various problems emerged. It was noticed that the format in the date of birth field was not stated. Three users asked which format they should use and then followed the given format. In addition, the occupation was requested twice (using different terms), once asking about users'

current work and the second about their occupation. Some participants mentioned this problem and stated that more details or help were required so that users could be more familiar with the meaning of these terms. However, there was no explanation of these terms on the form; this indicates that there is lack of help when completing this form.

The request is then written in an edit box, which uses an editor so that users can enter their request. It was observed that users felt that this was a basic editor; it did not include any features to help users write their request. For example, users felt that the font was too small and not clear enough to allow them easily to read what they had written. Furthermore, the user needed to scroll through this box to review the request. Therefore, the editor was found to be primitive and users could not write their request efficiently and easily.

Figure 6.9: The online form

Users then had to use the attachment boxes, which were below the edit box. It was noted that participants could easily see the checklist of required documents as it was directly below the attachment boxes (as can be seen in Figure 6.10). These procedures were introduced as a group of links so that the user could click the required one and read the details. However, this option reloaded the form again and expanded its contents, which was felt to cost more time.

In the online test, four documents were required to be attached. All of these documents were prepared and introduced to each user as a scanned picture. The user found several problems when attaching the required documents. Firstly, there were just two boxes to hold the documents while more needed to be attached: four attachments in the test task. Secondly, the accepted format of the documents was not mentioned to users: e.g. if users were allowed to send compressed files. Lastly, users could not see clearly the document they had entered.

> *"I cannot see the name of the file I have entered. How I can check I have entered the right file?"*

Figure 6.10: Procedures in the online form

Due to these limitations, three users attached the first two documents but could not enter the remaining ones; thus, they felt worried about the acceptance of their request. Two users tried to use a compressed version of these files. Before submitting the form, only two users had read the terms of use, which were located in the last part or bottom of the page. They noticed, from reading the terms of use, that any user of this online form had to visit the EM offices to provide the required documents and enquire about their request. They felt that this was a negative aspect of the online services.

> *"So, why do I need to visit the Emirate if I apply online? This is a wrong message which is not logical at all."*

This sends out a negative message, as some participants have found, and it would be interesting for research to study these kinds of message that affect the interactions of users with what they see. However, this is beyond the scope of this research which focuses on usability issues.

When users needed to confirm details on the form before submission, three participants faced problems. In all cases, the form appeared again and general error messages appeared at the top of page but without giving any details about what the problem was. It was noted that the participants were stuck for some time, trying to think of a way to solve this problem. Furthermore, it was found that in all the cases that had errors, the attached files were removed without any reason being given. The only message given was that the user was to read the 'red label' to find out what problem had occurred. Hence, users had to work through all the fields to find the problem. It was noticed that even then the details of the problem were not given. In practice, the red label was found by only one user where the problem was a missing digit in the ID number. Two users who tried to attach compressed files did not see the red label, as mentioned above, and so these users still had a problem. Yet when they attached only two documents instead of using compressed files, the problem went away. However, one user still attached the compressed file, and when the problem occurred again, that user attached the first two documents. This indicates that the error messages provided were not helpful in locating the exact problem; also, the options for attaching documents were very limited.

Another problem was that there was a long period of time between clicking for the form to be submitted and a response being given to users. Interestingly, three users clicked on the acceptance button again while they were waiting for a response. This indicates that users should be kept aware of what is happening while they are waiting.

After the request had been accepted, the request reference number appeared on the screen and a direct message instructed the user to write down this number for any future enquiry, as can be seen in Figure 6.11. However, participants felt there was a lack of information about what would happen next or a time by when the user could

expect feedback. All the participants felt that there was no clear message about what would happen to the application.

Figure 6.11: The reference number given after the user submitted the online form

At the same time, users received an e-mail that informed them that the request had been made but no further information, such as a reference number, was given; nor did the e-mail message contain anything about the service that had been applied for. This can be seen in Figure 6.12. The feedback did not confirm to users what they had written or whether the attachments had been received successfully. This was a noticeable weakness in the online form.

Figure 6.12: The reply e-mail for the online service request made on the EM site

6.4.5 Enquiry services

Users were asked to execute an enquiry to find out about their interactions using the reference numbers given for a number of online requests they had previously made. To do this, most participants (4) used the menu on the right side of the citizens' services page and selected the enquiry link. Only one user used the link in the 'shortcuts' on the left. A page appeared asking the user to enter a reference number for their request. Users entered the given number and clicked a search button. It was noticed that the page reloaded and a designed status bar appeared in the middle of screen with the message: "wait until the data downloads", as can be seen in Figure 6.13. Although the page needed to reload to show the status bar, which took some time, a status bar is useful to keep the user informed about what is happening. The result then appeared with the reference number of the request, the date the service application was made, the date when the order from the EM was issued, the agency where the order was to be executed, and the state of the request. However, while a button offering more details related to this request was displayed, it did not add any more details; it simply re-displayed the previous contents in another manner, as can be seen in Figure 6.14. It was felt that more information could be presented: e.g. the department that processed the request, and their telephone number or e-mail.

Figure 6.13: The status bar while waiting

Figure 6.14: The result of the enquiry service

6.5 Post-test interviews

After the participants had completed all five assigned tasks, they were interviewed to obtain their opinions of and suggestions for the EM website. This section illustrates the findings related to users' overall impressions of the site, the time taken to use the site, and the online services.

6.5.1 The overall impressions of the site

Users found that the design of the EM site did not encourage them to explore the content of the site. There were several reasons for this, as stated by participants:

1- The information provided was not easy to read, due to duplication and the considerable amount of information provided: e.g. in the government agencies' index page. One user suggested that:

> *"It is better for information to be presented in a brief way and users can then navigate to further information instead of duplication."*

2- Most participants felt that the existing format emphasised news and took up too much space. This seemed to be the focus of the site, when the focus should be on services:

> *"The information provided was limited and a bit unclear; about half the homepage was for news. Despite the fact that this prince is from the royal family, services are much more important than news."*

3- It was felt that the EM site was not clear enough in showing specific content for people living in all the different regions of Makkah. Furthermore, users felt that more information could be included:

"This site is provided for people that have a problem and would like the Emirate to help them. That is OK, but I think it is useful to add more information about the Makkah region and this can help more users."

4- The link to the homepage, which was thought essential, was not located in its expected place and four users found themselves lost in the site:

"I do not know where I am. Even the title of the page is no use."

5- Participants stated that the considerable amount of text in several pages did not motivate them to read the contents of the page.

6- It was felt that the order of menu items was not what users were expecting and that services' links were not the priority.

"Citizens' services have to be the first option in the menu, not news or what the Emirate did."

In terms of the search tool, it was felt that this was not helpful in locating information and needed to be improved.

1- Users had to spend more time to find what they needed from the results generated.

"It was difficult to use this service and even the results were not presented well; it was not clear at all."

"Found several links but it was not what I was looking for."

2- The place where the search tool was located was felt not to be the standard place.

"It should be near the menu."

The points above indicate that the focus on services was not up to the level that users were looking for. Thus, two issues can be drawn from these findings. Firstly, services were not highlighted appropriately and therefore users had to spend time to find them. Secondly, it was found that news took up a considerable part of the homepage which was felt not to match the participants' expectations.

6.5.2 Time used in navigation and search

The time taken to navigate and submit the online forms was found to be too long yet users were not informed that this would take a long time.

> *"It is acceptable if I have time but usually I do not have time to wait until it opens the clicked link; it is too slow."*

It was felt that there was a problem with the site as it was noticed that the response time was considerable. Two users suggested using a status bar, similar to that in the enquiry service for the online forms, to show what is happening. This indicates a need to look carefully at the time spent on the site in order to improve the site's overall performance.

6.5.3 The online form and enquiry services

Most users felt that the help provided with the online form was not useful. The form should contain clear instructions to help in completing the fields efficiently and appropriately. In particular, users stated that the error messages were not suitable and did not help solve the problems that occurred. For example, one user said:

> *"I cannot check the attached documents and I do not have enough boxes relating to the required documents."*

It is thought that such problems could be avoided if sufficient hints were provided. However, participants made errors because they were unable to find such hints.

Relating to feedback, the participants found that feedback was insufficient for several reasons:

1- Users were not informed about the details they entered on the form nor the documents attached.
2- The time and date of the submission of the form were not provided.
3- Four users thought that, on submitting their request, they would be informed about when the decision would be taken regarding the request that had been submitted.
4- Users found that there were no e-mail addresses or telephone numbers to record with the reference number. Thus, users felt worried about using this service due to the lack of details they had seen.

   "Only the reference number of my request was given on the screen but I did not receive it in my e-mail. It was not enough."

Thus, the above problems indicate the enhancements that are required for the site. Some participants stated that users should be allowed to review their request and attachments before the final submission. Moreover, some participants recommended that more important issues should be included in the site. This would allow accounts to be created for people to use the site so that, when they were applying for services, the data could be retrieved and the user would then not need to enter the data again; this would enable them to use their time more efficiently.

It was found that users had no concerns about security in EM. On the other hand, users felt that there were more serious problems with the site that could affect its use: in particular, the lack of detailed information offered on the site and the serious problems found in the online form. One participant stated:

> *"I am not worried about security but I am worried about using this site again because I did not find the information I was looking for and I could not perform the request and attach all the required documents. I don't think I will use this site for these critical reasons."*

Similarly, for the enquiry service, users thought that the service was limited from the point of view of informing users the stage their request had reached and the time needed to process the request. When users were asked to find the status of particular requests, some suggestions were made.

> *"It did not tell me how far my request had reached and how long it would take."*

For example, some participants mentioned the need to inform users if the request was still in process, where the request had gone inside the Emirate, how long it would take, and what actions had been taken until that point. Also, it would be helpful to protect their data when using the enquiry services as the current enquiry service is available to the public without any restrictions such as user name and password.

The suggestions of participants as stated above could lead to further improvements in the EM site. These improvements would encourage people to utilise the services provided more efficiently.

6.6 Discussion and implication of users' responses

This section presents the results of the analysis, as well as the issues raised by participants, which can be used to refine the designed heuristic checklist, and this allows the evaluation framework to be updatable. Furthermore, the web metrics that emerged from the results are shown.

6.6.1 Overall results

Two main findings can be determined from the results of the analysis of the usability testing.

1-Firstly, the results from the usability testing have emphasised the problems found by the heuristic evaluation defined in the preceding chapter. This proves that the expected problems investigated in the preceding chapter were found in the EM site. So, these problems will potentially affect the use of the services provided, as well as having an impact on the growth of e-Government in Saudi Arabia. This is because the EM in particular has achieved a significant ranking in the Digital Excellence Award, as advertised on the site. However, what was found disappointed the users.

2- Secondly, more problems were defined by observing users' interactions, as well as by listening to users' recommendations. These issues can be utilised to enhance the

design of e-Government websites in Saudi Arabia, as well as to enhance the heuristic checklist designed in this research, as explained in the next section.

6.6.2 Usability problem inspections to expand the heuristic checklist

A number of usability problems were inspected in this chapter. These problems, as well as the recommendations of participants, can be used to expand the heuristic checklist. These include:

- *Consistency* principle
  - Are the menu items given in a suitable order in terms of priority?
  - Does the website focus on providing services rather than anything else?

- *Navigation* of the site and finding information
  - Does the menu offer the services that the site provides?
  - Does the site use any technique to inform users about the process being conducted while they wait for a response?

- In *Transactions*
  - Does the current date and time appear in the online form?
  - Does the editor used for online forms contain features to allow users to enter their request efficiently?
  - Does the form include an email address or telephone number for help if the user is struggling when using the form?
  - Does the form clearly show the number of document attachments that are required so that the user can enter these in the appropriate boxes?
  - Are the attachments embedded in clear boxes so the user can check these easily?
  - Are the procedures described in the online form found easily by the user?
  - Are users told how long it will take to conduct the request?

- Does the feedback page inform the user about the reference number that is given, their request, and the attachments provided?
- Does the feedback e-mail contain the given reference number for the request?
- Does the feedback e-mail contain a confirmation of what was entered, as well as the names of the attachment documents?
- Does the feedback e-mail contain a telephone number and e-mail address so users can follow up their request?
- Does the enquiry service give an indication of which department is currently dealing with the request, and what it is doing?
- Does it indicate the time needed to process the request?
- Is the contact number provided of the department that holds the request?
- Does this service protect user data, such that the user needs authorisation to utilise this service?

6.6.3 Web metrics

The problems uncovered using the usability testing approach showed the essential need to inspect for such problems at an early stage by using web metrics as a quantitative measurement. For instance, it has been found that users have a problem with navigation and some of them felt lost in the site. This problem could be investigated by using a set of web metrics that will allow users to be monitored during their interactions on the site (from entering the site to leaving it), and to produce reports that can help identify these navigation problems.

In addition, it has been found that it is important to monitor time, because of the delays that were documented, as this may affect the utilisation of the EM site. This raises the need to monitor users' interactions regarding the time dimension during a day’s work. For example, at peak times, such delays may increase the number of users leaving the site without completing their requests; monitoring might draw attention early to the need to improve this situation.

6.7 Summary

This chapter has illustrated the results of usability testing on the Emirate of Makkah website. It has proved that the expected usability problems found using the heuristic evaluation approach were also found during the usability testing. However, participants in the usability testing found more problems related to the design of the Emirate of Makkah website in different parts. These problems have been stated in this chapter and will be used to refine the evaluation framework of e-Government websites. It has been demonstrated that the problems seen during usability testing produced several heuristics that need to be included in the heuristic checklist. Additionally, it has been highlighted that using a quantitative approach (web metrics) may provide a way of examining the usage of the website.

The next chapter (Chapter 7) presents the analysis and findings of the web analytics tool as a quantitative approach currently used in the Emirate of Makkah website.

Chapter Seven: Web Analytics Analysis

7.1 Introduction

This chapter presents an analysis of the web analytics method applied to the Emirate of Makkah (EM) website, which is one of the best e-Government websites in the Kingdom of Saudi Arabia.. It explains what web measurement tools can provide in order to demonstrate the contribution they can bring to the multidimensional evaluation framework for e-Government websites.

This chapter is structured as follows: Section 7.2 introduces the specifications of the web analytics used in the analysis of the EM website and presents some of the web metrics that are available in the web analytic tools used. Section 7.3 presents the overall results using web analytic tools. Section 7.4 illustrates an analysis of the selected pages which were concerned with servicing users while Section 7.5 presents the summary of derived web metrics. Section 7.6 presents a discussion of the results obtained by using web analytic tools and their implications. Lastly, Section 7.7 offers a summary of the chapter.

7.2 Web Analytic Tools in EM

The researcher first needed to obtain a copy of a log file and access to the Google Analytics reports for the EM website. This was a complex process and the researcher had to present the objectives of his research to the EM website managers before access was granted. Consequently, the copy of the log file was finally obtained from EM after waiting for some time for the server to be shut down and a log file produced. This file covers the time range from 07/09/2007 14:36:39 to 02/09/2008 09:40:10; it is 1.5 Gigabytes in size and takes about 74 minutes to generate the reports using WebLog Expert (WLE) version 5.7 professional. In addition, access to the Google Analytics (GA) account was obtained. The EM website account has a unique id number, which is UA-424562-1. GA was used from 18 June 2006, and it is still used. Figure 7.1 shows the monthly visits to EM as reported by GA.

Figure 7.1: Number of visits to the EM site by weekly view in GA

As the obtained data did not cover the same periods, the researcher decided to only consider data obtained by GA over a similar time frame to the log file (i.e. 07/09/2007 to 02/09/2008). Many of the metrics and KPIs that can be calculated depend on the specific web analytics tool being used and the fundamentals of the products may clearly influence the results obtained. It is also necessary to highlight the definitions of the metrics used in order to avoid any mismatches in the results between the two different methods of collecting traffic data. These definitions can be seen in Table 7.1.

	Metric Name	**Meaning**	**Availability**	
			WLE	**GA**
1	Hit (Click)	Hit is counted for the all elements on any page: i.e., downloadable file types, such as gif, flash, CSS.	√	×
2	Page View	The actual requested pages.	√	√
3	Visit	Counted when a visitor generates activity on the site within 30 minutes (session).	×	√
4	Visitor	Counted when users use a web browser to visit the website.	√	√
5	Bounce Rate	The ratio of single page visits resulting from this page (i.e. it measures the effectiveness of a page).	×	√
6	Average Time on the Site	The average time that the visitor spends on the site.	×	√
7	Bandwidth	The volume of bandwidth used on the site, i.e. the amount of data transferred in a given time	√	×

	Metric Name	Meaning	Availability	
			WLE	GA
		period.		
8	Failed Requests	The number that shows all requests to the server that were not delivered.	√	×
9	Cache requests	The number of requests from a cache.	√	×
10	Unique IP Address	The unique visitors by IP address.	√	×

Table 7.1: Basic common web metrics available in WLE and GA

It can be seen from Table 7.1, each tool has its own web metrics, enabling each tool to provide useful analysis; some web metrics are also common to both tools. However, the way that these web metrics are generated differs. For instance, page views are counted in GA when the page is downloaded into the browser, whereas in WLE they are counted when a page begins to be served by the web server whether it completes it or not. Similarly WLE calculates unique visitors based on IP address, whereas GA uses cookies to determine unique visitors. This will influence the analysis, as discussed in the following sections.

Consequently, the overall results of both GA and WLE for the EM site will be presented. This includes an illustration of the available web metrics for both tools and an illustration of the features only available in each of the web analytic tools used. Then these tools will be used to illustrate an analysis of important pages related to the online services being considered in the e-Government website.

7.3 Overall Analytics on the EM Website

A considerable number of metrics have been used to illustrate the interactions on the EM site. Both WLE and GA offer similar web metrics but generate different results and so it was found that there was a large difference in the measurements from each tool due to the different methods of collecting traffic data outlined above. Thus, the results from each tool vary, which can be seen in Table 7.2 where the general usage results are summarised.

Metric	WLE	Google Analytics
Number of Hits	5,780,426	
Average Hits per Day	15,968	
Average Hits per Visitor	17.66	
Visits		159,360
Cached Requests	1,495,517	
Failed Requests	54,780	
Total Page Views	2,039,330	628,713
Average Page Views per Day	5,633	
Average Page Views per Visitor	6.23	3.95
Total Visitors	327,356	76,209
Average Visitors per Day	904	387.07
Total Unique IPs	99,431	
Absolute Unique Visitors		65,307
New Visits		62277.9,(39.08%)
Average Time on the Site		04:39
Bounce rate		28.58%
Total Bandwidth	68.20 GB	
Average Bandwidth per Day	192.92 MB	
Average Bandwidth per Hit	12.37 KB	
Average Bandwidth per Visitor	218.46 KB	

Table 7.2: WLE and GA summary of usage

Table 7.2 shows that each analytic method collects different data, as well as using different web metrics. For example, WLE uses the hit metric to represent each click on the website and therefore the number of clicks per page depends on the contents of each page; GA, on the other hand, counts each page downloaded from the site. In addition, WLE, because its data is sourced from the server logs, is able to measure several important metrics: e.g. cache requests, failed requests and bandwidth statistics; GA does not do this. However, GA offers more metrics, such as time on the site and bounce rate, as well as the ability to customise the analytic reports which may allow the derivation of KPI data. WLE, on the other hand, presents the analysis in

static reports. These differences support the need for a hybrid approach in data collection and subsequent data analysis.

Thus, the analysis of the hybrid method needs to focus on the usability issues and must identify consistent web metrics in order to inspect usability problems. The following sections present the overall results for both web analytic tools used in this research.

7.3.1 Visitor Trending

Google Analytics provides a number of features to analyse visitor trending on a site in contrast with the limited features in WLE. This section illustrates these features including length of visit, depth of visit, landing and exit pages.

7.3.1.1 Length and Depth of Visit

It can be seen in Figure 7.2 that about 34% of visitors spent more than three minutes, whereas about 50% of visitors spent less than one minute on the site. Also, for visitors who spent 1-10 seconds on the site more of them reached the EM site directly (i.e. by typing in a URL) compared to those who came via search engines or by following links (referral traffic), whereas for other duration periods more visitors reached the EM site via search engines, as can be seen in Table 7.3. Similarly, the same information can be seen in the depth of visit data in GA where the majority of visitors navigated only a few pages: 28.54% of visitors visited one page and 25.25% two pages (Figure 7.3). More of the one-page visits were from visitors who came directly to the site however for visitors who viewed more than one page the most common method of reaching the site was via a search engine, as can be seen in Table 7.4. This indicates that direct users spent only a few seconds in the EM site, and this may be related to the design of the homepage which may not have encouraged visitors to explore it. However, it should be noted that this is an assumption; it is not possible to state definitely that this is the reason why direct users spent only a few seconds on the site.

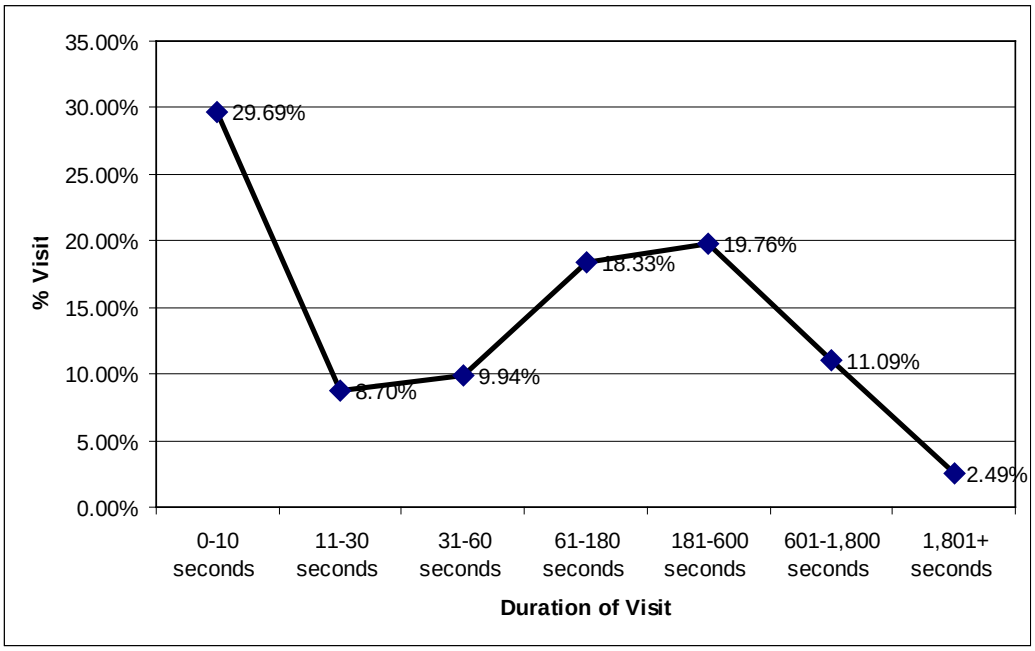


Figure 7.2: Length of visit by GA

Duration of visit	Visits with this duration	Percentage of all visits
0-10 seconds		
All Visits	47,310.00	29.69%
Search Traffic	15,997.00	10.04%
Direct Traffic	17,596.00	11.04%
Referral Traffic	13,715.00	8.61%
11-30 seconds		
All Visits	13,872.00	8.70%
Search Traffic	7,480.00	4.69%
Direct Traffic	4,943.00	3.10%
Referral Traffic	1,449.00	0.91%
31-60 seconds		
All Visits	15,844.00	9.94%
Search Traffic	8,426.00	5.29%
Direct Traffic	5,137.00	3.22%
Referral Traffic	2,281.00	1.43%
61-180 seconds		
All Visits	29,213.00	18.33%
Search Traffic	15,461.00	9.70%

Duration of visit	Visits with this duration	Percentage of all visits
Direct Traffic	8,095.00	5.08%
Referral Traffic	5,656.00	3.55%
181-600 seconds		
All Visits	31,482.00	19.76%
Search Traffic	17,078.00	10.72%
Direct Traffic	8,004.00	5.02%
Referral Traffic	6,399.00	4.02%
601-1,800 seconds		
All Visits	17,668.00	11.09%
Search Traffic	9,613.00	6.03%
Direct Traffic	4,505.00	2.83%
Referral Traffic	3,550.00	2.23%
1,801+ seconds		
All Visits	3,971.00	2.49%
Search Traffic	2,065.00	1.30%
Direct Traffic	1,090.00	0.68%
Referral Traffic	816.00	0.51%

Table 7.3: Length of visits by traffic sources in GA.

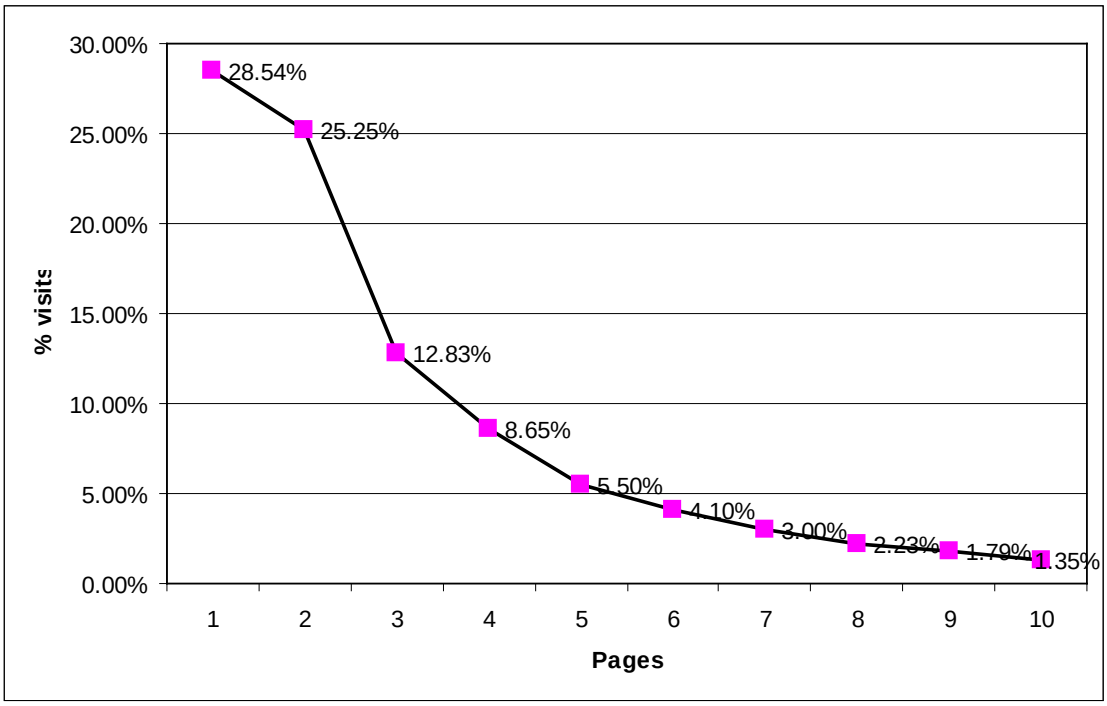


Figure 7.3: Depth of visit by GA.

Pages tallied	Visits with this many page views	Percentage of all visits
1 page view		
All Visits	45,476.00	28.54%
Search Traffic	15,073.00	9.46%
Direct Traffic	16,899.00	10.60%
Referral Traffic	13,502.00	8.47%
2 page views		
All Visits	40,238.00	25.25%
Search Traffic	20,257.00	12.71%
Direct Traffic	13,779.00	8.65%
Referral Traffic	6,202.00	3.89%
3 page views		
All Visits	20,443.00	12.83%
Search Traffic	10,792.00	6.77%
Direct Traffic	5,545.00	3.48%
Referral Traffic	4,105.00	2.58%
4 page views		
All Visits	13,781.00	8.65%
Search Traffic	7,417.00	4.65%
Direct Traffic	3,909.00	2.45%
Referral Traffic	2,455.00	1.54%
5 page views		
All Visits	8,764.00	5.50%
Search Traffic	4,891.00	3.07%
Direct Traffic	2,224.00	1.40%
Referral Traffic	1,648.00	1.03%

Table 7.4: Depth of visits by traffic sources in GA.

7.3.1.2 Landing and Exit Pages

GA enables the identification of the landing and exit pages; this provides useful information concerning the pages used, as can be seen in Tables 7.5 and 7.6. It can be

seen in Table 7.5 that the homepage of the EM site recorded a noticeable bounce rate particularly for new visitors. WLE, however, showed that the homepage was the top landing page but without supplying any other details: e.g. new/return visitors or bounce rate. Similarly, by using exit pages, it was found that the homepage recorded the highest exit page rate in the EM site (this may in part be due to the large bounce rate for this page). Despite these limitations, this might be accounted for by supposing that visitors could have struggled when exploring the contents of the homepage of the EM site and so left the site. However, as before, although the web metrics indicate a problem, they do not provide accurate reasons why users experienced such problems, an alternative reason may be that visitors did not appreciate what the site was about and on accessing the home page they decided that this site was not what they desired; therefore the reasons provided above are simply assumptions.

	Page	Entrances	Bounce Rate
1.	/ ??(homepage)		
	All Visits	113,347	22.71%
	New Visitors	47,774	28.23%
	Returning Visitors	65,573	18.69%
2.	/dbshow.php?scope=7bfcbf5&tb=comm_master		
	All Visits	3,925	13.07%
	New Visitors	763	19.00%
	Returning Visitors	3,162	11.64%
3.	/home.php [3]		
	All Visits	2,884	45.70%
	New Visitors	1,553	61.62%
	Returning Visitors	1,331	27.12%
4.	/dbshow.php?scope=8a4adb5&asSC=130&tb=comm_master&search=reset		
	All Visits	2,118	13.55%
	New Visitors	193	15.03%
	Returning Visitors	1,925	13.40%
5.	/view.php?scope=1814b475&dr=&ir=&id=6851		
	All Visits	1,841	68.50%
	New Visitors	1,577	68.86%
	Returning Visitors	264	66.29%

Table 7.5: Landing pages for new and returning visitors in GA

[3] During the data collection period EM used several filenames to refer to the homepage (for example, home.php), the first and third entries could therefore be combined in the above table.

	Page	Exits	% Exit
1	/		
	All Visits	36,112	23.52%
	New Visitors	18,642	28.41%
	Returning Visitors	17,470	19.88%
2	/form.php		
	All Visits	3,618	21.61%
	New Visitors	1,059	19.72%
	Returning Visitors	2,559	22.49%
3	/dbshow.php?scope=7bfcbf5&tb=comm_master		
	All Visits	2,969	8.69%
	New Visitors	1,320	10.58%
	Returning Visitors	1,649	7.60%
4	/browse.php?asSC=287&id=6121		
	All Visits	2,407	26.28%
	New Visitors	1,478	24.93%
	Returning Visitors	929	28.76%
5	/dbshow.php?scope=8a4adb5&asSC=130&tb=comm_master&search=reset		
	All Visits	2,289	7.26%
	New Visitors	580	6.78%
	Returning Visitors	1,709	7.44%

Table 7.6: Exit pages for new and returning visitors in GA

7.3.2 Activity by Time

This section shows the interactions on the EM site in terms of the time dimension. These activities are shown using specific metrics: e.g. page views, average time on the site, bounce rate, and bandwidth web metrics. These metrics are presented in hourly and monthly units since this conforms with the literature of Gonccalves and Ramasco (2008) who used such time periods to represent the load on Emory University's website. However, it shows that each tool has different metrics and, in order to show

this, different interpretations are used. This has been combined into a KPI to explain the traffic more efficiently.

Inconsistent data were found in the page views by the hour of the day dimension; peaks found were in different periods for each of the tools. This might be due to the fact that Saudi time is seven hours ahead of the USA where the server is; therefore GA uses US time whereas WLE uses Saudi time. In order to overcome this problem, GA time has been shifted seven hours forward to show time synchronised data which can be measured. This can be seen in Figure 7.3 which explores page views over the EM site. However, it should be noticed that the local traffic to the EM site (e.g. internal visits by government employees) has not been extracted due to the limitations of WLE and GA. Despite this limitation, the figure illustrates that the highest usage occurs between the beginning of the working day up to midday. However, each of the analytic tools is able provide more details. For example, WLE provides an important web metric, which is bandwidth per hour making WLE worth using for hourly dimensions, as can be seen in Figure 7.4.

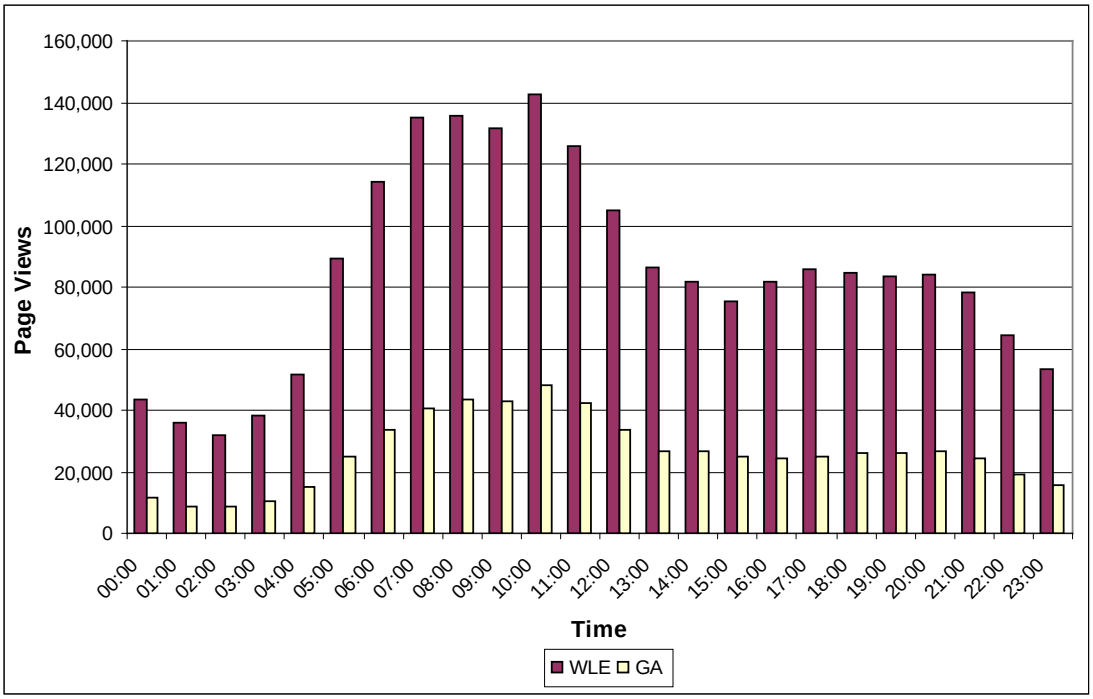


Figure 7.3: Page views on the EM site for each hour in a day in both WLE and GA

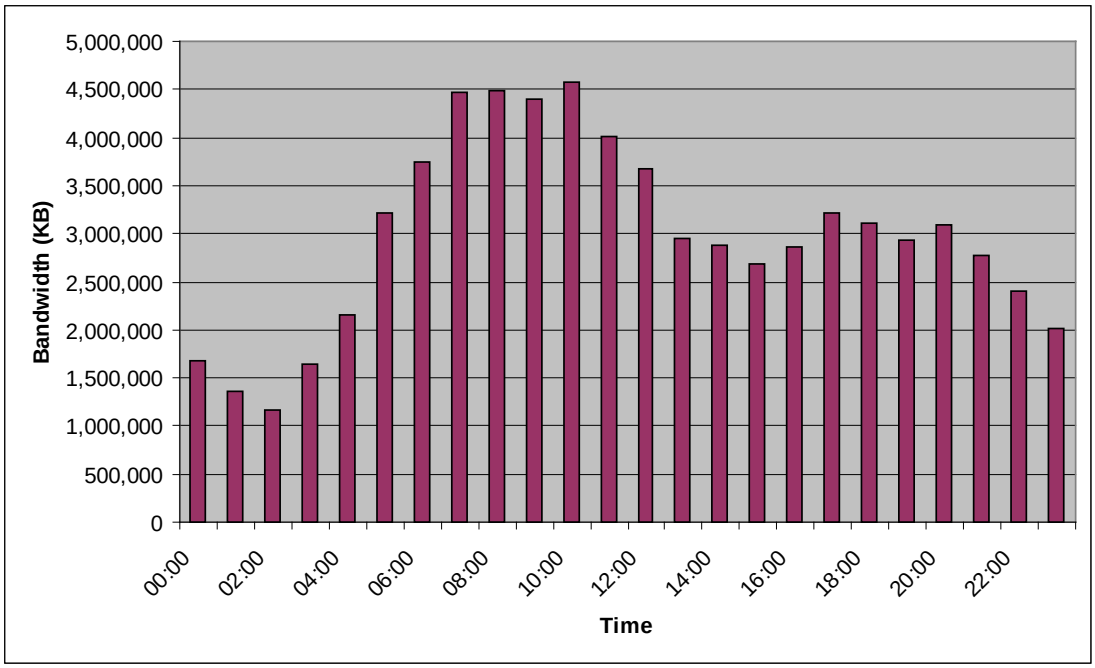


Figure 7.4: Bandwidth per hour using WLE

However, GA provides an hourly breakdown for a number of metrics, such as page views, bounce rate, average time on the site, and new and returning visitors, as can be seen in Figure 7.5 and Table 7.7. It is very useful to know about users who leave the site, as this includes some measure of visit quality. This actually shows that during the peak time (08.00-12.00AM), when most users visited the EM site, new visitors spent more time on the site and viewed more pages. Also, those visitors who spent the longest average time visited at 7.00am but that this was not the time of the highest number of page views which was at 10.00am. This indicates that, during the peak time, more visitors reached the EM site and spent relatively more average time on the site but recorded a considerable bounce rate (25.26%-26.75%). One possible reason for this could be that visitors during peak time may have had problems in navigating the site easily. Moreover, this might be related to the amount of images in the EM site that produced difficulties in navigating the site, as will be explained further in Section 7.4.7.1. However, as with other metrics, one of the lessons that can be learned from this is that to be certain of the reasons why particular behaviour is observed, further user or heuristic studies need to be conducted.

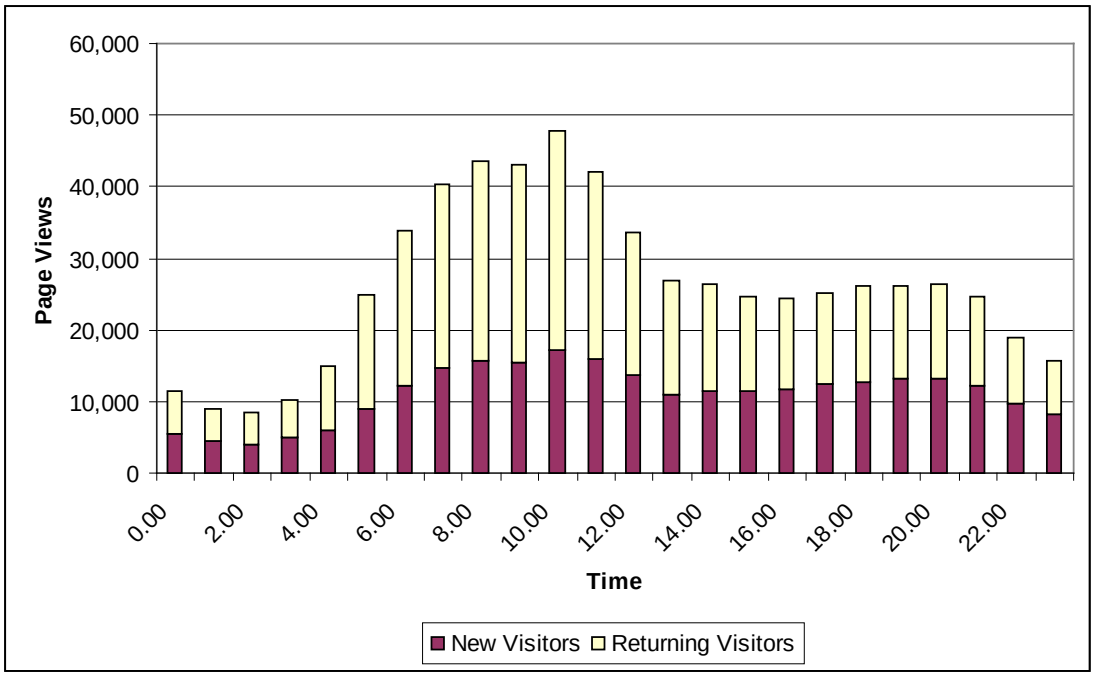


Figure 7.5: Page views on the EM site for each hour by new and returning visitors by GA

Table 7.7: Page views by bounce rate on the EM site for each hour of a day using GA

Hour of the day	Page Views	Visits	Pages/ Visit	Bounce Rate	Avg. Time on Site
00:00					
All Visits	11,345	2,572	4.41	35.54%	00:04:08
New Visitors	5,583	1,237	4.51	35.17%	00:04:40
Returning Visitors	5,762	1,335	4.32	35.88%	00:03:39
01:00					
All Visits	8,858	2,091	4.24	36.59%	00:04:22
New Visitors	4,398	971	4.53	37.90%	00:04:55
Returning Visitors	4,460	1,120	3.98	35.45%	00:03:54
02:00					
All Visits	8,507	2,026	4.2	33.91%	00:04:39
New Visitors	4,089	893	4.58	33.26%	00:05:35
Returning Visitors	4,418	1,133	3.9	34.42%	00:03:56
03:00					
All Visits	10,155	2,567	3.96	34.75%	00:05:13
New Visitors	4,900	1,121	4.37	36.75%	00:05:13
Returning Visitors	5,255	1,446	3.63	33.20%	00:05:14
04:00					
All Visits	15,044	4,102	3.67	28.72%	00:04:55
New Visitors	6,072	1,512	4.02	32.74%	00:04:54
Returning Visitors	8,972	2,590	3.46	26.37%	00:04:56
05:00					
All Visits	24,774	6,632	3.74	26.60%	00:04:46
New Visitors	8,929	2,224	4.01	32.91%	00:05:02
Returning Visitors	15,845	4,408	3.59	23.41%	00:04:38
06:00					
All Visits	33,784	8,825	3.83	26.76%	00:03:34
New Visitors	12,114	2,905	4.17	31.36%	00:04:01
Returning Visitors	21,670	5,920	3.66	24.51%	00:03:21
07:00					
All Visits	40,411	11,332	3.57	25.12%	00:05:28
New Visitors	14,688	3,755	3.91	29.16%	00:06:18
Returning Visitors	25,723	7,577	3.39	23.12%	00:05:03
08:00					
All Visits	43,609	11,236	3.88	25.26%	00:04:42
New Visitors	15,751	3,650	4.32	31.48%	00:05:02
Returning Visitors	27,858	7,586	3.67	22.26%	00:04:32
09:00					
All Visits	43,130	11,174	3.86	25.75%	00:04:49
New Visitors	15,514	3,675	4.22	30.94%	00:05:19

Table 7.7: continued

Returning Visitors	27,616	7,499	3.68	23.20%	00:04:35
10:00					
All Visits	47,875	12,285	3.9	25.48%	00:04:54
New Visitors	17,134	4,109	4.17	31.78%	00:05:10
Returning Visitors	30,741	8,176	3.76	22.31%	00:04:46
11:00					
All Visits	42,089	10,303	4.09	26.13%	00:04:46
New Visitors	15,882	3,588	4.43	31.94%	00:05:50
Returning Visitors	26,207	6,715	3.9	23.02%	00:04:11
12:00					
All Visits	33,611	8,425	3.99	26.75%	00:04:24
New Visitors	13,682	3,184	4.3	32.69%	00:05:17
Returning Visitors	19,929	5,241	3.8	23.14%	00:03:53
13:00					
All Visits	26,915	7,076	3.8	28.26%	00:04:29
New Visitors	10,927	2,740	3.99	33.25%	00:05:14
Returning Visitors	15,988	4,336	3.69	25.12%	00:04:01
14:00					
All Visits	26,427	6,919	3.82	30.29%	00:04:18
New Visitors	11,502	2,857	4.03	35.91%	00:04:59
Returning Visitors	14,925	4,062	3.67	26.34%	00:03:49
15:00					
All Visits	24,694	6,465	3.82	30.92%	00:04:20
New Visitors	11,353	2,800	4.05	35.61%	00:04:48
Returning Visitors	13,341	3,665	3.64	27.34%	00:03:59
16:00					
All Visits	24,409	6,447	3.79	31.01%	00:04:21
New Visitors	11,621	2,871	4.05	35.67%	00:04:56
Returning Visitors	12,788	3,576	3.58	27.27%	00:03:53
17:00					
All Visits	25,043	6,394	3.92	30.72%	00:04:22
New Visitors	12,371	2,994	4.13	33.63%	00:04:52
Returning Visitors	12,672	3,400	3.73	28.15%	00:03:56
18:00					
All Visits	26,121	6,481	4.03	31.58%	00:04:49
New Visitors	12,726	3,061	4.16	35.74%	00:05:04
Returning Visitors	13,395	3,420	3.92	27.87%	00:04:35

Table 7.7: continued

19:00					
All Visits	26,236	6,323	4.15	30.92%	00:05:04
New Visitors	13,108	3,040	4.31	32.76%	00:05:38
Returning Visitors	13,128	3,283	4	29.21%	00:04:32
20:00					
All Visits	26,456	6,227	4.25	29.28%	00:04:52
New Visitors	13,284	2,927	4.54	31.47%	00:05:26
Returning Visitors	13,172	3,300	3.99	27.33%	00:04:21
21:00					
All Visits	24,568	5,595	4.39	31.35%	00:04:37
New Visitors	12,213	2,667	4.58	34.72%	00:05:03
Returning Visitors	12,355	2,928	4.22	28.28%	00:04:13
22:00					
All Visits	18,851	4,376	4.31	33.32%	00:04:18
New Visitors	9,771	2,113	4.62	35.87%	00:04:37
Returning Visitors	9,080	2,263	4.01	30.93%	00:04:00
23:00					
All Visits	15,801	3,487	4.53	33.87%	00:04:33
New Visitors	8,104	1,653	4.9	36.54%	00:05:07
Returning Visitors	7,697	1,834	4.2	31.46%	00:04:02

Table 7.7: Page views by bounce rate on the EM site for each hour of a day using GA

Additionally, Table 7.8 shows the most frequently viewed pages on the EM site, according to the time spent on each of these pages: i.e. *Time on Page (TP).* It can be seen that a high average time on page was recorded for particular pages (e.g. the procedures page and the Prince's News page). Moreover, a high bounce rate was found for the (Information about Makkah) page. This KPI indicated important pages that recorded noticeably high levels of reading.

	Page	Pageviews	Avg. Time on Page	Bounce Rate	% Exit
1.	/	153,511	00:04:44	22.71%	23.52%
2.	/dbshow.php?scope=7bfcbf5&tb=comm_master	34,171	00:05:40	13.07%	8.69%
3.	/dbshow.php?scope=8a4adb5&asSC=130&tb=comm_master&search=reset (prince news)	31,533	00:06:09	13.55%	7.26%
4.	/form.php	16,746	00:05:21	30.43%	21.61%
5.	/browse.php?asSC=287&id=6120 (information about Makkah)	10,198	00:01:27	75.72%	16.75%
6.	/browse.php?asSC=287&id=6121	9,158	00:04:48	39.96%	26.28%
7.	/browse.php?asSC=275 (procedures page)	8,182	00:07:35	9.72%	8.31%
8.	/dbshow.php?scope=8a4adb5&asSC=130&tb=comm_master&stlp[unknown]=yes&lp=1	7,261	00:06:23	11.15%	7.27%
9.	/browse.php?asSC=275&form=1	6,870	00:05:05	46.31%	32.33%
10.	/browse.php?scope=5f60875&asSC=99&00=	5,624	00:07:09	17.60%	10.26%

Table 7.8: The most numerous page views on the EM site according to the time on each of these pages

In terms of monthly page views, as shown in Figure 7.6, it can be seen that both tools generate somewhat different indications. For example, WLE showed May 2008 as the peak of page views, whereas GA showed June 2008 as the highest. The differences may be due to the mechanism behind the log file analysis (WLE). WLE results include all activities on the server (including the spiders and proxies) and therefore this result needs to be combined with other metrics as it may indicate an existing error on the site; this is discussed later in this section.

In Figure 7.6, steady growth in usage can be seen during September 2007 which reaches a peak in November 2007, which is the Hajj season. Also, steady growth can be seen during December 2007, reaching a peak in May 2008; a noticeable decline follows in June and July with a slight increase in August 2008, which was a holiday period in Saudi Arabia. This is useful information which identifies periods of greatest load in the EM site. This can be further emphasised by WLE, which provides bandwidth metrics for each month (Figure 7.7). This shows that May, then August,

were the highest bandwidth months, whereas May and April were the highest in terms of page views (see Figure 7.6). Similarly, GA shows that during May the highest bounce rate was recorded, while the highest average visitor time was in August. These metrics clearly allow the bandwidth needs of the EM site to be identified. One reason for these metrics (high page views and high bounce rates during specific periods of times) could be that users could not interact well with the site because of problems they might face; this could relate to the results of the download quality metrics (i.e. error metric), as indicated in Section 7.3.7.1.As before, this assumption needs to be linked to previous findings with regard to peak times, however this additional information adds weight to the feeling that users encountered problems.

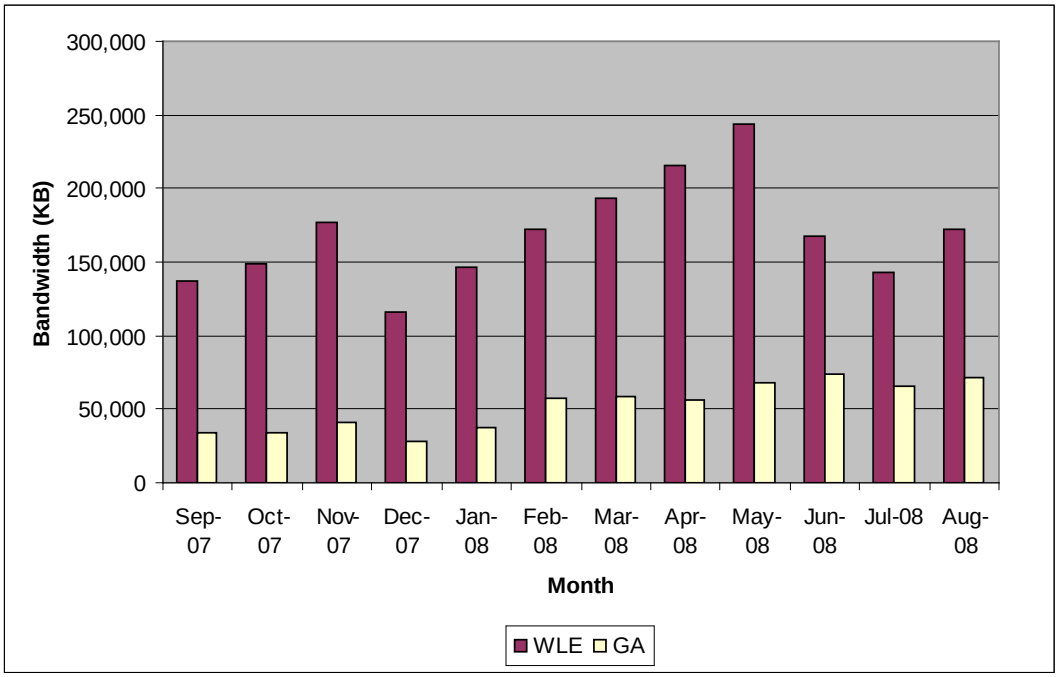


Figure 7.6: Monthly page views using both tools (WLE and GA)

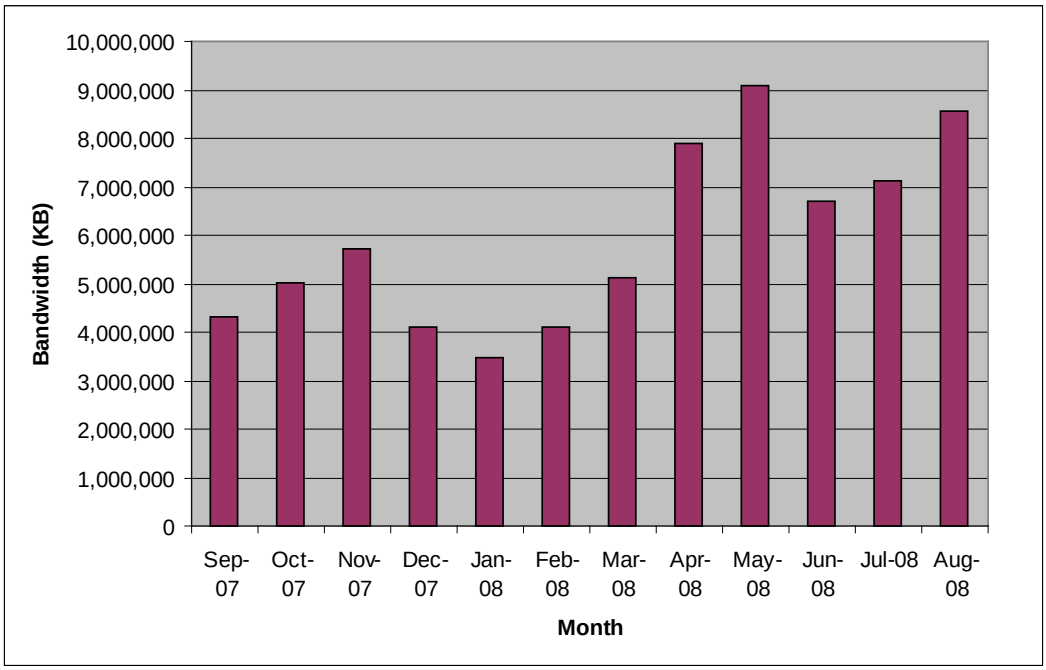


Figure 7.7: Monthly page views showing the bandwidth for the EM site using WLE

7.3.3 Countries and Cities

Both web analytic tools show that most users came from Saudi Arabia. However, each tool presents this information in its own way. For example, WLE shows that 74.59% of visitors were from Saudi Arabia, whereas GA recorded 85% of visits from Saudi Arabia. It can also be noticed that different results were obtained concerning visitors and visits from the USA. One reason for this might be that high levels of traffic from the US in WLE (the log file approach to analytics) were due to spiders and proxies that can increase the activity recorded in the log file.

Moreover, GA offers more metrics that offer much more detail, as was explained before. As can be seen in Table 7.9, the majority of visitors came from Saudi Arabia and within those visitors “new” visitors spent more time (5.36 minutes on average) and visited more pages (4.63) but with a higher bounce rate (26.69%). These trends can be seen more clearly with the visitors from outside Saudi Arabia. For example, there was a large percentage of visitors from Egypt but it can seen that new visitors from this area recorded considerably high bounce rates. Similarly, new visitors from the US and the UK also viewed a large number of pages but recorded a high bounce rate. As before, the high bounce rate metric indicates that there may be a problem but they do not indicate what the problem is. If the site values visitors from these

countries, then these results indicate that further forms of testing, e.g. heuristic evaluation, should look into the reasons behind these results.

	Country/Territory	Visits	Page Views	Pages/Visit	Bounce Rate	Avg. Time on Site
1.	Saudi Arabia					
	All Visits	135,590	552,317	4.07	25.68%	00:04:46
	New Visitors	48,176	223,020	4.63	26.96%	00:05:36
	Returning Visitors	87,414	329,297	3.77	24.98%	00:04:19
2.	Egypt					
	All Visits	3,846	14,504	3.77	31.12%	00:05:18
	New Visitors	1,924	6,777	3.52	43.30%	00:04:22
	Returning Visitors	1,922	7,727	4.02	18.94%	00:06:13
3.	United States					
	All Visits	3,475	10,071	2.90	51.94%	00:02:47
	New Visitors	1,852	5,208	2.81	62.20%	00:02:37
	Returning Visitors	1,623	4,863	3.00	40.23%	00:03:00
4.	(Not set)					
	All Visits	2,702	11,756	4.35	22.98%	00:04:26
	New Visitors	1,065	5,150	4.84	25.82%	00:05:05
	Returning Visitors	1,637	6,606	4.04	21.14%	00:04:00
5.	United Kingdom					
	All Visits	1,705	5,597	3.28	40.47%	00:03:38
	New Visitors	883	2,871	3.25	49.38%	00:03:17
	Returning Visitors	822	2,726	3.32	30.90%	00:04:00
6.	Algeria					
	All Visits	1,248	2,720	2.18	65.95%	00:02:30
	New Visitors	1,113	2,349	2.11	67.30%	00:02:24
	Returning Visitors	135	371	2.75	54.81%	00:03:21
7.	United Arab Emirates					
	All Visits	1,059	2,692	2.54	60.91%	00:02:50
	New Visitors	787	1,957	2.49	61.12%	00:02:52
	Returning Visitors	272	735	2.70	60.29%	00:02:44
8.	Germany					
	All Visits	861	3,115	3.62	38.56%	00:03:27
	New Visitors	481	1,696	3.53	46.57%	00:03:34
	Returning Visitors	380	1,419	3.73	28.42%	00:03:19
9.	Morocco					
	All Visits	823	2,247	2.73	53.46%	00:02:52
	New Visitors	625	1,456	2.33	62.40%	00:02:24
	Returning Visitors	198	791	3.99	25.25%	00:04:20
10.	Jordan					
	All Visits	679	2,465	3.63	33.14%	00:04:28
	New Visitors	483	1,620	3.35	39.54%	00:03:43
	Returning Visitors	196	845	4.31	17.35%	00:06:17

Table 7.9: GA results by countries

In addition, GA provides the most detailed results such as including the city where users came from, as can be seen in Table 7.10. However, GA's categorisation is limited because not all the cities in the Kingdom of Saudi Arabia appear in these results; instead, only the four main cities are shown. Makkah City, where it would seem sensible that most activity would be likely to come from, does not appear. It should be noted that GA uses a "not set" message in several reports to report unknown data. These limitations do affect the usefulness of the results that are produced.

It can be seen from the pages/visit metric that the majority of visitors from the cities in Saudi Arabia were mainly new visitors; however, these visitors recorded noticeably higher bounce rates despite spending more time on average on the site. On the other hand, users visiting from outside Saudi Arabia showed less interest in the contents. For example, new visitors from Cairo, Asyut and Algiers spent the shortest times and recorded even higher bounce rates. The reasons for these problems are unclear but might point to visitors arriving at the site without appreciating the site's content and only subsequently finding that the site does not meet their needs, alternatively it may indicate either problems in navigation or the design of the navigational panel. Actually, this would support the findings in several heuristic principles analysed in Sections 6.3.1, 6.3.2 and 6.3.3. For example, the Consistency, Help Users and Navigation principles obtained low rankings.

	City	Visits	Page Views	Pages/ Visit	Bounce Rate	Avg. Time on Site
1	Riyadh					
	All Visits	75,340	300,352	3.99	28.00%	00:04:48
	New Visitors	25,762	118,860	4.61	27.27%	00:05:42
	Returning Visitors	49,578	181,492	3.66	28.38%	00:04:19
2	Jeddah					
	All Visits	34,255	146,873	4.29	21.79%	00:04:46
	New Visitors	12,396	60,432	4.88	24.38%	00:05:35
	Returning Visitors	21,859	86,441	3.95	20.33%	00:04:18
3	(Not set)					
	All Visits	27,319	109,533	4.01	26.52%	00:04:45
	New Visitors	11,149	46,714	4.19	34.00%	00:05:24
	Returning Visitors	16,170	62,819	3.88	21.35%	00:04:18
4	Dhahran					
	All Visits	2,834	10,194	3.60	25.16%	00:04:53
	New Visitors	1,277	4,851	3.80	29.99%	00:05:26
	Returning Visitors	1,557	5,343	3.43	21.19%	00:04:26
5	Cairo					
	All Visits	1,963	7,866	4.01	25.32%	00:05:54
	New Visitors	778	2,958	3.80	40.87%	00:04:31
	Returning Visitors	1,185	4,908	4.14	15.11%	00:06:48
6	Ad Dammam					
	All Visits	1,634	6,485	3.97	25.70%	00:04:31
	New Visitors	611	2,550	4.17	32.73%	00:04:44
	Returning Visitors	1,023	3,935	3.85	21.51%	00:04:24
7	Asyut					
	All Visits	1,207	4,266	3.53	38.61%	00:04:34
	New Visitors	774	2,764	3.57	42.76%	00:04:29
	Returning Visitors	433	1,502	3.47	31.18%	00:04:43
8	Algiers					
	All Visits	954	2,065	2.16	66.46%	00:02:22
	New Visitors	842	1,741	2.07	67.93%	00:02:14
	Returning Visitors	112	324	2.89	55.36%	00:03:25
9	London					
	All Visits	778	2,765	3.55	36.63%	00:03:33
	New Visitors	394	1,425	3.62	47.21%	00:03:26
	Returning Visitors	384	1,340	3.49	25.78%	00:03:41
10	Amman					
	All Visits	643	2,313	3.60	33.28%	00:04:25
	New Visitors	458	1,535	3.35	39.30%	00:03:40
	Returning Visitors	185	778	4.21	18.38%	00:06:18

Table 7.10: GA results by cities

The above reports can be utilised to discover, in general terms, where users come from. This is useful information because Makkah is a holy city which is visited by

hundreds of thousands of pilgrims who may use the Emirate services. Consequently, identifying users' locations is helpful in indicating the likely popularity of certain services; it can also be used to identify the interactions of users that come from specific cities.

7.3.4 Network Information

Some of the data produced by the web analytic tools that were used were totally inconsistent in terms of network information. This can be seen for several of the results including the top hosts' data, the top-level domains and the network location. This is due to the method that each tool uses to collect the traffic data. In particular, the WLE log file analysis tool includes requests from servers, proxies and spiders, whereas GA uses the tagged method for measuring the interactions from browsers; therefore each tool provides different metrics. It might be assumed that log file analysis would provide the most useful information in this area, but GA can potentially provide useful information. For instance, the network locations of users provided by GA (Table 7.11) represent mostly ISPs in Saudi Arabia, which is useful for identifying certain problems. For example, Section 2.5.3 showed that the IPA site had a problem as some users from particular ISPs were not able to access this site so results such as those in Table 7.11 could help determine the extent of this problem.

	Network Location	Visits	Pages /Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	national engineering services	15,992	4.11	00:04:45	40.73%	22.06%
2.	provider [4]	15,070	3.43	00:04:18	25.68%	43.30%
3.	adsl and leased line customers	12,789	4.05	00:04:45	31.79%	21.96%
4.	saudinet saudi telecom company	11,128	4.12	00:04:16	37.76%	24.51%
5.	unknown	7,051	4.50	00:04:34	37.14%	23.59%
6.	al faisaliah internet services & technology	6,197	4.41	00:04:52	38.52%	24.53%
7.	international computer company	5,604	4.02	00:04:48	32.26%	22.45%
8.	adsl customer	4,568	4.43	00:05:03	41.90%	24.04%
9.	shabakah net	2,730	4.27	00:04:55	34.43%	22.27%
10.	(not set)	2,691	4.35	00:04:26	39.20%	23.00%

Table 7.11: Network location by GA

Moreover, in this regard, GA also allows the connection type that users have used to reach the EM site to be identified (Table 7.12). Despite the "Unknown" description used for the highest number of visits in Table 7.12, dialup connection types show a noticeably higher bounce rate and highest average time on the site. Although the reasons for this cannot be definitely determined, it may indicate that visitors using a dialup connection may have had problems in exploring the site, e.g. downloading the images or viewing more pages. This is helpful information which can be used to improve performance, e.g. to reduce the size or number of images on the site to allow those who have a dialup connection to navigate the site easily.

[4] This is the name of a network in Saudi Arabia

	Connection Speed	Visits	Page Views	Pages/ Visit	Bounce Rate	Avg. Time on Site
1	Unknown					
	All Visits	88,425	359,945	4.07	25.94%	00:04:44
	New Visitors	35,807	154,909	4.33	32.18%	00:05:13
	Returning Visitors	52,618	205,036	3.90	21.70%	00:04:24
2	Dialup					
	All Visits	27,998	103,623	3.70	35.18%	00:04:55
	New Visitors	8,794	38,175	4.34	29.91%	00:05:44
	Returning Visitors	19,204	65,448	3.41	37.60%	00:04:32
3	DSL					
	All Visits	25,083	99,157	3.95	28.41%	00:04:18
	New Visitors	10,523	43,806	4.16	36.62%	00:04:36
	Returning Visitors	14,560	55,351	3.80	22.48%	00:04:05
4	T1					
	All Visits	16,736	62,725	3.75	29.70%	00:04:20
	New Visitors	6,593	26,623	4.04	34.72%	00:05:21
	Returning Visitors	10,143	36,102	3.56	26.44%	00:03:41
5	Cable [5]					
	All Visits	853	2,256	2.64	58.26%	00:02:07
	New Visitors	673	1,650	2.45	63.30%	00:01:56
	Returning Visitors	180	606	3.37	39.44%	00:02:50

Table 7.12: Connection type by GA

7.3.5 Traffic Sources

This section illustrates the different traffic sources that users have used to reach the EM site. There are three types of sources: direct, referrers and search engines. It was found that, GA offers good classification whereby it was found that most visitors used search engines to reach the EM site. In particular, 47.8% used search engines, 30.98% was direct traffic, and about 24.14% reached the EM site via links from other websites. Table 7.13 shows these indications. The remainder in this section explains the traffic sources (direct, referrers and search engines) that visitors used to reach the EM site.

[5] Although visitors using cable connections experienced large bounce rates, there was only a small number of this type of connection.

	Medium	Visits	Pages/ Visit	% New Visits	Avg. Time on Site	Bounce Rate
1.	Search Engines					
	All Visits	76,120	4.48	36.47%	00:05:11	19.80%
	New Visitors	27,760	5.06	100.00%	00:06:03	24.85%
	Returning Visitors	48,360	4.14	0.00%	00:04:41	16.90%
2.	Direct					
	All Visits	49,370	3.30	32.01%	00:04:02	34.23%
	New Visitors	15,803	3.68	100.00%	00:05:01	30.43%
	Returning Visitors	33,567	3.13	0.00%	00:03:34	36.02%
3.	Referral					
	All Visits	33,866	3.69	56.05%	00:04:20	39.87%
	New Visitors	18,981	3.53	100.00%	00:04:00	47.83%
	Returning Visitors	14,885	3.89	0.00%	00:04:46	29.71%

Table 7.13: Traffic sources by GA

7.3.5.1 Direct Traffic

For direct access, which represents visitors who reached the EM site directly (e.g. by typing in a URL or having the site in their favourite links), it can be seen that considerable bounce rates were recorded for all visits, and particularly for return visitors. As this is a government site, it could be expected that direct users may appreciate the site's content, so what can be seen may indicate that such visitors experienced problems in exploring the contents of the EM site.

7.3.5.2 Referrers

Referrers' information is used to indicate users who have reached the EM site through a link on other websites. It was found that 24.14% of visitors reached the EM site via referrer links. However, some data can be inconsistent with regard to referring sites if these data are taken directly from the output of each analytic tool. This is because each tool has its own categorisation of results (due to the different data traffic sources). For example, data concerning the top referring sites in WLE by visitors metrics, as in shown in Table 7.14, show that "no referrer" site is included in the results, and the URL of the EM site as well as the Google search engine appeared. These are not really referring sites. By contrast, the results from GA provided in Table 7.15 do not include these URLs.

However, even when the differences above are taken into consideration, there are noticeably inconsistent results between the data generated by both tools. For example, the highest referring site in WLE (ignoring Google, the EM site itself and no referrer) was alquma.net whereas in GA the first rank was eyoon.com . Despite the different web metrics produced by the different tools, considering both results could improve the performance of the site. This is because each tool provides information about referrers regarding its way of collecting data, i.e. server data in WLE and browser data in GA. Therefore it is possible to obtain a variety of results which enable any maintenance that is required on the site to be explored. Despite the inconsistent rankings regarding the referrer sites, the results do indicate those sites that are responsible for delivering people to the EM website and, by considering results from both tools, a wide range of sites can be identified. This may help managers of the EM site identify sites with whom they could develop deeper relationships.

	Site	Visitors
1	No Referrer	124,579
2	http://www.makkah.gov.sa	62,829
3	http://www.google.com.sa	39,148
4	http://www.alquma.net	24,960
5	http://www.google.com	8,275
6	http://alquma.net	7,377
7	http://www.eyoon.com	3,329
8	http://www.makgate.com	2,735
9	http://ar.wikipedia.org	2,491
10	http://www.raddadi.com	2,252

Table 7.14: Top referring sites by WLE

	Source	Visits	Pages/ Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	eyoon.com					
	All Visits	7,205	4.22	00:04:58	44.01%	28.48%
	New Visitors	3,171	4.60	00:05:50	100.00%	31.03%
	Returning Visitors	4,034	3.92	00:04:18	0.00%	26.47%
2.	raddadi.com					
	All Visits	3,095	3.78	00:04:34	57.06%	35.86%
	New Visitors	1,766	3.72	00:04:28	100.00%	41.85%
	Returning Visitors	1,329	3.87	00:04:42	0.00%	27.92%
3.	ar.wikipedia.org					
	All Visits	2,629	2.41	00:02:20	83.07%	65.42%
	New Visitors	2,184	2.25	00:01:59	100.00%	67.95%
	Returning Visitors	445	3.20	00:04:01	0.00%	53.03%
4.	jcci.org.sa					
	All Visits	1,871	2.29	00:02:18	68.68%	60.56%
	New Visitors	1,285	2.48	00:02:33	100.00%	57.74%
	Returning Visitors	586	1.88	00:01:46	0.00%	66.72%
5.	jeddah.gov.sa					
	All Visits	1,766	4.33	00:04:41	53.40%	27.69%
	New Visitors	943	4.39	00:05:05	100.00%	30.43%
	Returning Visitors	823	4.25	00:04:15	0.00%	24.54%

Table 7.15: Top referring sites by GA

The features in GA that offer more metrics and greater detail are also available for referrer sites information: GA provides details for every page in the EM site that is used by a referrer whereas WLE does not offer this. It can be seen in Table 7.16 that most visitors arrived at the homepage of the EM site. Despite this fact, other pages showed fewer requests but their new visitors recorded the highest bounce rates. Interestingly, some referrer sites referred to the page containing online forms (number 10 in Table 7.16) but new visitors to this page recorded the highest bounce rate. Regarding the limited visits made to the online forms by referrer sites, this may indicate that the form page does not contain sufficient information to enable new users to use the form correctly and that it may be inappropriate for new users to come directly to the form. If possible, it might be better if new users could be funnelled via the home page and that further improvements should be made to the EM site: e.g. providing a clear link on the homepage to take users directly to the online form. However, this is still an assumption as WA does not provide sufficient details about the precise usability problems that exist on the site; whereas the problems in online

forms were identified more clearly by other usability studies, as indicated in Sections 5.3.5 and 6.4.4.

	Landing Page	Visits	Pages/ Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	/					
	All Visits	21,986	3.97	00:04:38	57.75%	33.69%
	New Visitors	12,697	3.96	00:04:40	100.00%	40.68%
	Returning Visitors	9,289	3.99	00:04:37	0.00%	24.13%
2.	/view.php?scope=1814b475&dr=&ir=&id=6851					
	All Visits	1,744	2.12	00:01:48	88.88%	68.46%
	New Visitors	1,550	2.10	00:01:49	100.00%	69.03%
	Returning Visitors	194	2.24	00:01:42	0.00%	63.92%
3.	/home.php					
	All Visits	1,555	2.42	00:02:53	74.21%	65.08%
	New Visitors	1,154	2.05	00:01:49	100.00%	72.36%
	Returning Visitors	401	3.48	00:05:55	0.00%	44.14%
4.	/view.php?scope=1814b475&dr=&ir=&id=6850					
	All Visits	875	2.15	00:01:49	89.83%	68.69%
	New Visitors	786	2.15	00:01:46	100.00%	68.19%
	Returning Visitors	89	2.15	00:02:17	0.00%	73.03%
5.	/dbshow.php?scope=7bfcbf5&tb=comm_master					
	All Visits	731	3.56	00:05:07	18.06%	12.86%
	New Visitors	132	4.15	00:05:04	100.00%	40.91%
	Returning Visitors	599	3.43	00:05:08	0.00%	6.68%
6.	/browse.php?scope=8956b75&asSC=404					
	All Visits	581	2.97	00:03:25	88.47%	42.17%
	New Visitors	514	2.99	00:03:30	100.00%	41.83%
	Returning Visitors	67	2.82	00:02:49	0.00%	44.78%
7.	/browse.php?asSC=275					
	All Visits	335	4.93	00:08:25	38.21%	7.16%
	New Visitors	128	4.91	00:07:36	100.00%	3.91%
	Returning Visitors	207	4.94	00:08:55	0.00%	9.18%
8.	/browse.php?asSC=287&id=6121					
	All Visits	323	2.30	00:02:53	74.92%	59.75%
	New Visitors	242	2.20	00:02:54	100.00%	64.05%
	Returning Visitors	81	2.62	00:02:48	0.00%	46.91%
9.	/form.php					
	All Visits	277	3.98	00:06:13	3.25%	22.38%
	New Visitors	9	1.78	00:01:31	100.00%	44.44%
	Returning Visitors	268	4.05	00:06:22	0.00%	21.64%
10	/browse.php?asSC=275&form=1					
	All Visits	268	2.50	00:03:18	66.42%	66.04%
	New Visitors	178	1.85	00:02:10	100.00%	76.97%
	Returning Visitors	90	3.78	00:05:33	0.00%	44.44%

Table 7.16: Top landing pages that referrers used by GA

7.3.5 3 Search Engines

This section presents an analysis of the search engines that were used to reach the EM site. This is illustrated in two ways: firstly, by indicating the search engines that were most frequently used to seek or locate the EM site; and, secondly, the most commonly used phrases in search engines that conducted users to the EM site. However, it should be noticed that paid search marketing was not used, i.e. only organic searches were considered.

7.3.5.3.1 Top Search Engines

More consistency between GA and WLE was found in terms of the top search engines. Both tools recorded that the Google and Yahoo search engines were the most frequently used. However, there were a number of differences regarding the remaining search engines due to, as before, the different ways of collecting traffic data between WLE and GA which gave rise to inconsistent results. Despite these limitations, GA offers several results, as can be seen in Table 7.17.

	Source	Visits	Page Views	Pages/ Visit	Avg. Time on Site	% New Visits	Bounce Rate
1	Google						
	All Visits	72,148	325,250	4.51	00:05:12	36.40%	19.44%
	New Visitors	26,260	134,244	5.11	00:06:06	100.00%	24.21%
	Returning Visitors	45,888	191,006	4.16	00:04:41	0.00%	16.70%
2	yahoo						
	All Visits	2,014	8,107	4.03	00:05:12	38.03%	26.81%
	New Visitors	766	3,418	4.46	00:06:17	100.00%	33.94%
	Returning Visitors	1,248	4,689	3.76	00:04:33	0.00%	22.44%
3	'live' [6]						
	All Visits	953	3,520	3.69	00:04:44	35.36%	29.70%
	New Visitors	337	1,335	3.96	00:04:21	100.00%	40.06%
	Returning Visitors	616	2,185	3.55	00:04:57	0.00%	24.03%
4	'search'						
	All Visits	506	2,379	4.70	00:05:04	36.76%	16.21%
	New Visitors	186	947	5.09	00:05:44	100.00%	22.58%
	Returning Visitors	320	1,432	4.48	00:04:41	0.00%	12.50%
5	msn						
	All Visits	416	1,317	3.17	00:04:03	42.55%	27.88%
	New Visitors	177	549	3.10	00:03:22	100.00%	47.46%
	Returning Visitors	239	768	3.21	00:04:33	0.00%	13.39%

Table 7.17: Top search engines by GA

[6] 'live', 'search' and 'msn' all refer to Microsoft's search engine now referred to as Bing.

The largest percentage of visits was made using search engines (Table 7.13); these visitors spent more time and viewed more pages on their first visit. However, new visitors from search engines recorded significant bounce rates. The reasons for this problem were unclear but might indicate either problems in that the services that can be obtained from the EM site were not clear, or that the design was not helpful in allowing them to navigate the site easily. This suggests that it is necessary to understand the information needs of the people who intend to use the EM site in order to understand what might be useful for them; user studies may be the best way to acquire this information. This should give the site managers a greater appreciation of the reasons behind the demand for using electronic government. Despite the previous indications, the key phrases used in search engines still need to be studied because this was the most frequently used method of reaching the site, as will be seen in the next section.

7.3.5.3.2 Search Engines and Phrases

Both tools allow the phrases employed by users using the different search engines to reach the site to be identified. These phrases can be explored, although some inconsistent data were found in both sets of results, as is shown in Tables 7.18 and 7.19. However, as before, GA allowed more metrics related to each phrase to be measured. For example, the new visitors spent more time and viewed more pages and recorded greater average time on site irrespective of which phrase they had used in the search engine. This indicates that these visitors may explore the contents of the site and navigate more pages. This may indicate that the result of the search might not be sufficiently well organised to allow users to find what they were looking for easily. Also, the "أمارة منطقة مكة المكرمة"[7] phrase showed the highest average time on the site as well as the highest percentage of new users, which shows that such a phrase reflects more interested users. This result can be used to redefine keyword terms in all the pages in the EM site to allow search engines to identify the site.

[7] This is an Arabic phrase which means "Emirate of Makkah Almukaramah region". These are Arabic words where each word can be written in different forms and several formats so it appears several times in Tables 7.17 and 7.18.

	Phrase	Searches
Google		
1	امارة منطقة مكة المكرمة	5,46□
2	امارة مكة	5,424
3	امارة منطقة مكة	3□556
4	امارة مكة المكرمة	2,139
□	الامارة	1,7□3

Table 7.18: Top search phrases for users using the Google search engine by WLE

	Keyword	Visits	Page Views	Pages/ Visit	Bounce Rate	Avg. Time on Site
1.	امارة منطقة مكة المكرمة					
	All Visits	9,340	45,022	4.82	15.07%	00:05:44
	New Visitors	2,957	17,548	5.93	11.23%	00:07:08
	Returning Visitors	6,383	27,474	4.30	16.86%	00:05:05
2.	أمارة مكة					
	All Visits	8,505	37,674	4.43	15.30%	00:05:22
	New Visitors	2,635	14,103	5.35	13.43%	00:07:38
	Returning Visitors	5,870	23,571	4.02	16.13%	00:04:21
3.						امارة منطقة مكة
	All Visits	5,820	27,792	4.78	13.35%	00:05:12
	New Visitors	1,850	11,207	6.06	11.89%	00:06:50
	Returning Visitors	3,970	16,585	4.18	14.03%	00:04:26
4.	أمارة مكة المكرمة					
	All Visits	3,208	15,806	4.93	12.38%	00:05:30
	New Visitors	1,108	6,513	5.88	10.92%	00:07:10
	Returning Visitors	2,100	9,293	4.43	13.14%	00:04:37
5.	الامارة					
	All Visits	2,588	10,805	4.18	18.97%	00:04:52
	New Visitors	858	3,545	4.13	28.79%	00:04:32
	Returning Visitors	1,730	7,260	4.20	14.10%	00:05:01

Table 7.19: Top search phrases for users using the Google search engine by GA

It is perhaps more important for the analysis tools to show the top landing pages from these visits from search engines. These results can be seen in Tables 7.20 and 7.21. However, as before, different web metrics were used and different results were generated but, despite the different results, by using both sets of results, the most frequently requested pages and the possible usability problems can be identified. For instance, as can be seen in Table 7.20, the same title was repeated for several different pages; this indicates a failure to allocate separate titles to each page which may

confuse visitors. However, it can be seen in Table 7.21 that about 78% of visitors that reached the EM site via Google reached the homepage, and that new visitors recorded more average time on the site (/ and /home.php refer to the homepage of the EM site) but with a high bounce rate. This may indicate that the design of the homepage was not easy to use and/or its contents were not well defined, alternatively it could mean that visitors who arrived at the home page via search engines and who did not leave immediately did become engaged in the site and visited more pages out of interest. However, to determine which reason applied, further user studies need to be undertaken. One other outcome of this could be that if particular content is in high demand by visitors, then it may be possible to move such content up a level in the structure of the EM site: for example, to move these to the homepage to make it much more accessible for users.

	Page	Visitors
1	أمـــــــارة منطقـــــــة مكـــــــة المكرمـــــــة - أخبـــــــار الأميـــــــر *Emirate of Makkah Al-Mukaramah – The prince's news* http://www.makkah.gov.sa/	41,260
2	http://www.makkah.gov.sa/ view.php	2,183
3	أمـــــــارة منطقـــــــة مكـــــــة المكرمـــــــة - أخبـــــــار الأميـــــــر *Emirate of Makkah Al-Mukaramah – The prince's news* http://www.makkah.gov.sa/ browse.php	□,966
4	أمـــــــارة منطقـــــــة مكـــــــة المكرمـــــــة - أخبـــــــار الأميـــــــر *Emirate of Makkah Al-Mukaramah – The prince's news* http://www.makkah.gov.sa/ home.php	1,320
5	http://www.makkah.gov.sa/ kfahd/index.php	1,113
6	أمـــــــارة منطقـــــــة مكـــــــة المكرمـــــــة - أخبـــــــار الأميـــــــر *Emirate of Makkah Al-Mukaramah – The prince's news* http://www.makkah.gov.sa/ index.php	509
7	ســـــــــــجل التعـــــــــــازي | قائمـــــــــــة التعـــــــــــازي *List of condolences* http://www.makkah.gov.sa/ pmajeed/index.php	280
8	ســـــــــــجل التهنئـــــــــــة | قائمـــــــــــة التهـــــــــــاني *Register congratulations* http://www.makkah.gov.sa/ amir/index.php	274
9	دليـــــــــــل الخصـــــــــــومات والتســـــــــــهيلات الخاصـــــــــــة *Offers* and *Discounts for the EM employees* http://www.makkah.gov.sa/ daleel/index.php	205
10	*Emirate of Makkah - Imarat Makkah Al-Mokarramah* http://www.makkah.gov.sa/ english/index.php	135

Table 7.20: Top entry pages for users arriving from the Google search engine by WLE

	Landing Page	Visits	Pages/ Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	/					
	All Visits	56,260	4.65	00:05:11	40.30%	15.44%
	New Visitors	22,675	5.21	00:06:08	100.00%	21.82%
	Returning Visitors	33,585	4.28	00:04:32	0.00%	11.13%
2.	/dbshow.php?scope=7bfcbf5&tb=comm_master					
	All Visits	1,232	4.02	00:07:12	2.52%	9.66%
	New Visitors	31	8.81	01:43:59	100.00%	16.13%
	Returning Visitors	1,201	3.89	00:04:42	0.00%	9.49%
3.	/view.php?scope=8956b75&dr=&ir=&id=4601					
	All Visits	1,048	1.60	00:01:13	82.06%	77.96%
	New Visitors	860	1.60	00:01:16	100.00%	78.14%
	Returning Visitors	188	1.56	00:01:01	0.00%	77.13%
4.	/dbshow.php?scope=8a4adb5&asSC=130&tb=comm_master&search=reset					
	All Visits	864	3.65	00:06:23	0.58%	16.67%
	New Visitors	5	18.80	00:26:02	100.00%	0.00%
	Returning Visitors	859	3.56	00:06:16	0.00%	16.76%
5.	/home.php					
	All Visits	521	4.28	00:05:44	44.53%	18.62%
	New Visitors	232	4.66	00:06:24	100.00%	20.69%
	Returning Visitors	289	3.98	00:05:11	0.00%	16.96%

Table 7.21: Top entry pages for users arriving from the Google search engine by GA

7.3.5.4 Search Tool

The log file analysis provides information about queries on the pages. One interesting piece of information concerned the use of a local query tool on the EM site which was designed to serve local searching on the site by identifying the interactions on a particular page (*search.php*). Because of the limited number of hits that were recorded on that file (0.7% from all visitors), several indications can be drawn. For example, the information shows that people searching for “Blood Cancer” spent the longest amount of time in terms of the total view time, i.e. 27.10 minutes in total, while people searching for “Employment” took the second longest time (25.50 minutes), as shown in Table 7.22. Actually, neither of these key terms is related to the services that the Emirate provides. This indicates that the goal of the EM site was not clear to visitors, since they were searching for services that were not offered.

	Page	Hits	Page views	Total View Time	Average View Time	Visitors	Bandwidth
1	srcSUBCAT=0&KEYWORDS=وظائف&start=1&special=&scope=8956b75&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=0&srcLANG=1&srcTYPE=1&matchesPage=0	44	44	17:50	00:24	35	812
2	srcSUBCAT=0&KEYWORDS=وظائف&start=1&special=&scope=14cd78b5&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=0&srcLANG=1&srcTYPE=1&matchesPage=0	15	15	05:42	00:23	11	373
3	srcSUBCAT=0&KEYWORDS=التوظيف&start=1&special=&scope=8956b75&srcCAT=0&optMATCH=1&srcDOMAIN =1&srcEDITION=0&srcLANG=1&srcTYPE=1&matchesPage=0	19	19	25:50	01:22	11	338
4	srcSUBCAT=0&KEYWORDS=الزواج&start=1&special=&scope=8956b75&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=0&srcLANG=1&srcTYPE=1&matchesPage=0	17	17	21:38	01:16	11	278
5	srcSUBCAT=0&KEYWORDS=سرطان+الدم&start=1&special=&scope=8956b75&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=0&srcLANG=1&srcTYPE=1&matchesPage=0	15	15	27:10	01:49	10	322
6	srcSUBCAT=0&KEYWORDS=منح&start=1&special=&scope=8956b75&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=0&srcLANG=1&srcTYPE=1&matchesPage=0	15	15	21:50	01:27	10	328
7	srcSUBCAT=A&KEYWORDS=&start=1&special=&scope=10550ff5&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=7&srcLANG=1&srcTYPE=1&matchesPage=0&image.x=40&image.y=9	14	14	05:42	00:24	8	173
8	srcSUBCAT=0&KEYWORDS=زواج&start=1&special=&scope=8956b75&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=0&srcLANG=1&srcTYPE=1&matchesPage=0	8	8	05:12	00:39	7	129
9	srcSUBCAT=0&KEYWORDS=منح+الاراضي&start=1&special=&scope=8956b75&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=0&srcLANG=1&srcTYPE=1&matchesPage=0	10	10	04:47	00:29	7	97
10	srcSUBCAT=A&KEYWORDS=رابغ&start=1&special=&scope=8956b75&srcCAT=0&optMATCH=1&srcDOMAIN=1&srcEDITION=7&srcLANG=1&srcTYPE=1&matchesPage=0&image.x=50&image.y=15	8	8	09:38	01:12	7	201

Table 7.22: Search terms recorded by GA in the search tool

Users searching using other terms such as “Marriage”, spent an average of 21.38 minutes in total view time despite the existence of a link on the homepage for this service; this could indicate several important issues. Firstly, perhaps users spent too much time on the site searching for a particular issue because the design of the search

results may not have helped them to find easily what they were looking for, so they spent more time than was necessary. It is also possible that the results of the local search tool were not accurate enough to enable users to find the information easily so users spent more time navigating through the results. However, it might also indicate that users found the pages on marriage and then spent a good deal of time reading the pages because they were useful. On investigating the site, this link (the marriage service link) is the second item on the left panel in the fourth group and therefore it might not be in a noticeable place, resulting in users having to employ the search tool. Thus, it might be useful to change the location of this service and put it in a more prominent place where users could reach it without the need to spend time carrying out a search. These findings actually support the results of the heuristics evaluation recorded in Section 5.3.3. These showed that the EM website does not facilitate local searching with the result that users can face difficulties in using the site for this purpose. However, this discussion does reinforce the finding that using only web analytic tools does not accurately identify the usability problems; other usability methods need to be used in association with analytics tools.

Similarly, such information can be found if the view is customised to show the key terms used. In particular, the analysis of *search.php* file shows different key terms: e.g. people looking for jobs and services in Makkah (getting a visa, finding hotels around the Holy Mosque, etc.). However, use of the search facility was limited in that *search.php* only accounted for 0.8% of the all page views. Moreover, the high average times on the site were for visitors looking for news (30.46 minutes) and looking for one department in the EM (29.46 minutes). This might indicate that the news, as well as the structure of the EM agency, was not well organised, so users spent more time finding such information. However, as before, heuristic and user studies are needed to confirm this.

A final interesting metric is the page views of the *search.php* page which indicates an increased use of this search tool, as can be seen in Figure 7.8. This indicates that it is necessary to monitor this tool efficiently as this could aid further enhancement.

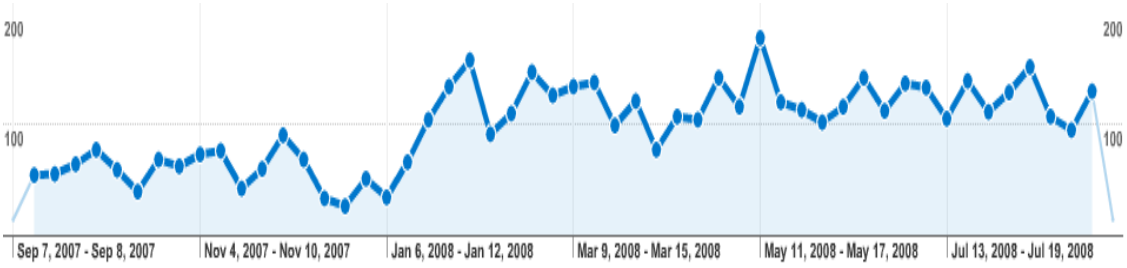


Figure 7.8: The increased use of search tools (weekly view)

7.3.6 Browser Statistics

This section introduces the results regarding the different browsers that users of the EM site had used. This also illustrates the operating systems for those users as well as the combination of browsers and operating systems. It should be noted that only the web metrics related to client side information that are available in GA are explained.

7.3.6.1 Kinds of Browser

It was found that the Internet Explorer browser was most commonly used (93.83% in GA and 76.32% in WLE) while other browsers were less popular. Moreover, by using GA, the users who used the Opera browser were shown to spend the highest average time on the site; these visitors also exhibited a high bounce rate, as shown in Table 7.23. In addition, other browsers showed considerable levels of bounce rate. Of the possible reasons for this, it may be that certain browsers do not enable users to utilise the functionality of the EM site. However, this is an assumption and needs to be linked to the findings of other usability methods. In fact these findings actually support the findings of the heuristics evaluation recorded in Section 5.3.1 which showed that the EM website does not facilitate the browsing of its site using different browsers with the result that users can face difficulties in using the site. This indicates that using web analytic tools can allow problems regarding browsers to be identified at an early stage.

	Browser	Visits	Pages/ Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	Internet Explorer					
	All Visits	149,522	4.02	00:04:39	38.35%	27.25%
	New Visitors	57,340	4.35	00:05:06	100.00%	32.02%
	Returning Visitors	92,182	3.81	00:04:21	0.00%	24.28%
2.	Firefox					
	All Visits	7,051	2.90	00:03:38	43.68%	47.95%
	New Visitors	3,080	3.28	00:03:54	100.00%	46.56%
	Returning Visitors	3,971	2.59	00:03:26	0.00%	49.03%
3.	Safari					
	All Visits	1,831	2.63	00:05:16	93.61%	46.81%
	New Visitors	1,714	2.60	00:05:22	100.00%	47.37%
	Returning Visitors	117	2.97	00:03:44	0.00%	38.46%
4.	Opera					
	All Visits	866	2.75	00:12:05	40.18%	52.89%
	New Visitors	348	3.48	00:26:06	100.00%	43.10%
	Returning Visitors	518	2.26	00:02:40	0.00%	59.46%
5.	Mozilla					
	All Visits	44	4.05	00:04:07	65.91%	40.91%
	New Visitors	29	4.17	00:05:04	100.00%	48.28%
	Returning Visitors	15	3.80	00:02:19	0.00%	26.67%

Table 7.23: Browsers by GA

However, the data is not consistent between WLE and GA. In particular, the Mozilla browser was the second most common in terms of visits in WLE whereas, in GA, it was Firefox. No obvious explanation can be given for the findings, though it would seem that the results from GA may be more accurate as these results are based on the client's data where the kind of browser used is regarded as basic information (i.e. collected data). So, these metrics are likely to be helpful in identifying any potential limitations in the design of the EM site in its ongoing development.

More features, which enable the version of each browser to be viewed, are provided by GA, as can be seen in Table 7.24, whereas WLE offers limited reports. So, GA provides useful information for reviewing the functionality of each element in the contents of the EM site.

	Browser Version	Visits	Page Views	Pages/ Visit	Bounce Rate	Avg. Time on Site
1.	6.0					
	All Visits	98,917	405,219	4.10	26.31%	00:04:49
	New Visitors	38,598	168,361	4.36	31.67%	00:05:09
	Returning Visitors	60,319	236,858	3.93	22.88%	00:04:36
2.	7.0					
	All Visits	49,869	192,891	3.87	29.21%	00:04:19
	New Visitors	18,526	80,538	4.35	32.70%	00:05:01
	Returning Visitors	31,343	112,353	3.58	27.15%	00:03:53
3.	5.5					
	All Visits	511	1,725	3.38	16.63%	00:04:19
	New Visitors	113	390	3.45	34.51%	00:04:38
	Returning Visitors	398	1,335	3.35	11.56%	00:04:13
4.	5.01					
	All Visits	117	429	3.67	25.64%	00:04:18
	New Visitors	56	203	3.62	30.36%	00:04:49
	Returning Visitors	61	226	3.70	21.31%	00:03:50
5.	5.0					
	All Visits	60	327	5.45	21.67%	00:09:07
	New Visitors	19	88	4.63	52.63%	00:05:28
	Returning Visitors	41	239	5.83	7.32%	00:10:48

Table 7.24: Browser versions in Internet Explorer by GA

7.3.6.2 Operating Systems

As can be seen in Tables 7.25 and 7.26, GA is much more precise in identifying the most frequently used operating systems. This is because the results in GA are collected from browsers so are able to collect more detailed data and present the analysis by the 'family' of each operating system. Conversely, with WLE, results are categorised depending on each specific operating system. For example, the various Windows operating systems are found several times, as can be seen in Table 7.25. Moreover, GA provides more thorough details as can be seen in several pieces of useful information. For example, it was found that a small number of users employed an *iPhone* operating system, as can be seen in Table 7.26, while users with a Macintosh system showed the highest percentage in terms of bounce rate. This also supports the problem of incompatibilities which exist in the EM website. Furthermore, using mobile phones to access the EM site is a challenging issue facing the e-Government website and so it is interesting to find out the extent of the use of *iPhone*, as will be shown later in this chapter.

	Operating System	Hits	Visitors	% of Total Visitors
1	Windows XP	4,825,332	242,585	76.22%
2	Others	174,645	43,867	13.78%
3	Windows Vista	503,877	21,531	6.77%
4	Windows 2000	157,214	4,909	1.54%
5	Windows ME	37,914	1,528	0.48%
6	Mac OS	28,914	1,144	0.36%
7	Windows 98	10,957	865	0.27%
8	Linux	14,312	795	0.25%
9	Windows Server 2003	8,374	556	0.17%
10	Windows NT	1,719	187	0.06

Table 7.25: Operating system by WLE

	Operating System	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	Windows	156,741	3.97	00:04:36	38.62%	28.18%
2.	SymbianOS	1,141	3.02	00:07:26	99.82%	30.76%
3.	Macintosh	719	1.86	00:01:40	80.25%	71.77%
4.	Linux	471	2.07	00:02:46	16.77%	69.43%
5.	(not set)	268	4.05	00:33:03	72.76%	37.69%
6.	iPhone	19	1.74	00:01:02	84.21%	47.37%
7.	FreeBSD	1	1.00	00:00:00	100.00%	100.00%

Table 7.26: Operating system by GA

In addition, GA provides useful metrics that help in identifying the emergence of new operating systems. For example, *SymbianOS*, which is an operating system licensed by the world's leading mobile phone manufacturers, showed users spending about double the average time on the site; most of these were new visitors (Table 7.26). This potentially indicates that such visitors may have problems in exploring the EM site, and that if more users were to use the *SymbianOS* over time, then it might be worth considering re-designing the site to better support these users. In particular, the time dimension in the weekly view in Figure 7.9 shows a steady increase in users who use

such an operating system. This may be a useful fact to know so that developers can ensure that the website works efficiently with new devices.

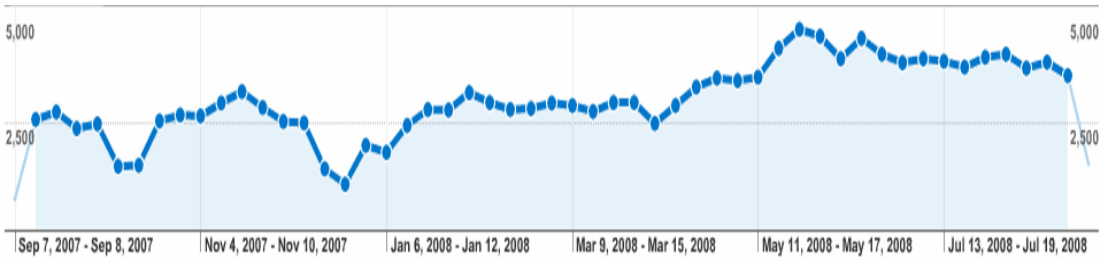


Figure 7.9: Weekly page view of the SymbianOS Operating System by GA

7.3.6.3 Browsers and OS

Both WLE and GA offer details of browsers for each operating system, as can be seen in Tables 7.26 and 7.27. However, the extra detail provided by GA provides useful information. These extra data are shown in Table 7.28. For instance, nearly twenty times more visits were made using the Safari browser on *SymbianOS* compared to the same browser on the Windows Operating System. This OS also recorded the longest average time on the site. This may indicate that the visitors using mobile phones found problems in the EM site.

	Operating System Version	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	XP	138,850	4.01	00:04:40	38.86%	27.41%
2.	Vista	14,604	3.63	00:03:50	38.15%	36.38%
3.	2000	1,678	3.75	00:04:22	35.22%	27.65%
4.	98	1,363	4.12	00:06:58	20.32%	14.60%
5.	Server 2003	234	2.74	00:02:49	56.41%	57.26%
6.	95	5	8.40	00:15:29	20.00%	0.00%
7.	ME	5	1.80	00:07:45	100.00%	60.00%
8.	NT	2	1.00	00:00:00	100.00%	100.00%

Table 7.27: Windows Operating System and its versions by GA

	Browser and OS	Visits	Pages/ Visit	Avg. Time on Site	% Of Visits	Bounce Rate
1.	Internet Explorer / Windows					
	All Visits	149,498	4.02	00:04:39	38.35%	27.25%
	New Visitors	57,326	4.36	00:05:06		32.02%
	Returning Visitors	92,172	3.81	00:04:21		24.28%
2.	Firefox / Windows					
	All Visits	6,447	2.97	00:03:43	45.42%	46.49%
	New Visitors	2,928	3.32	00:03:58		46.31%
	Returning Visitors	3,519	2.68	00:03:31		46.63%
3.	Safari / SymbianOS					
	All Visits	1,135	3.02	00:07:28	100.00%	30.66%
	New Visitors	1,135	3.02	00:07:28		30.66%
	Returning Visitors	0	0.00	00:00:00		0.00%
4.	Opera / Windows					
	All Visits	683	2.26	00:02:46	33.38%	57.69%
	New Visitors	228	2.88	00:04:00		48.25%
	Returning Visitors	455	1.95	00:02:09		62.42%
5.	Safari / Macintosh					
	All Visits	568	1.70	00:01:23	86.80%	79.93%
	New Visitors	493	1.55	00:00:55		86.41%
	Returning Visitors	75	2.65	00:04:27		37.33%
6.	Firefox / Linux					
	All Visits	449	2.00	00:02:48	13.59%	70.38%
	New Visitors	61	2.90	00:02:42		47.54%
	Returning Visitors	388	1.86	00:02:49		73.97%
7.	Opera / (not set)					
	All Visits	173	4.72	00:02:25	64.74%	32.95%
	New Visitors	112	4.79	01:02:47		30.36%
	Returning Visitors	61	4.59	00:02:31		37.70%
8.	Firefox / Macintosh					
	All Visits	138	2.56	00:02:58	53.62%	36.96%
	New Visitors	74	2.65	00:02:46		43.24%
	Returning Visitors	64	2.45	00:03:12		29.69%
9.	Safari / Windows					
	All Visits	67	4.09	00:02:49	41.79%	43.28%
	New Visitors	28	4.71	00:03:15		46.43%
	Returning Visitors	39	3.64	00:02:31		41.03%
10.	Safari / (not set)					
	All Visits	42	2.67	00:04:02	100.00%	40.48%
	New Visitors	42	2.67	00:04:02		40.48%
	Returning Visitors	0	0.00	00:00:00	0.00%	0.00%

Table 7.28: Browsers for Windows XP operating system by GA

7.3.6.4 Web Metrics Available Solely in GA

Several web metrics are available only in GA because it gathers client data. These include: screen colour, screen resolution, flash version, and Java support. All of these metrics are presented in this section.

It was found that most users have 32-bit screen colour and 1024x768 screen resolution, as can be seen in Tables 7.29 and 7.30. However, it can also be seen that several screen resolutions were used by users and this information can be helpful, for example, in identifying the dimensions of any navigational panel (links) and keeping these independent. In addition, information regarding the version of flash player installed on the browser shows that a number of users have version 9.0, as can be seen in Table 7.31. It is useful to know this due to the current usage of some flash files in the templates that are applied in most pages in the EM site – a reasonable number of users still have version 6.0 installed on their browsers, therefore it would be inappropriate to include flash content that requires versions greater than 6.0. Lastly, most users have Java support, as can be seen in Table 7.32. These data are important as they enable developers to make informal decisions about which versions of Java to support on the site. Despite the fact that very few visitors (1%) did not have Java support, these visitors recorded considerable average times on the site and recorded a noticeable bounce rate. This may indicate that such visitors had problems in exploring the EM site, but again it indicates that these problems should be explored using alternative usability methods.

	Screen Colours	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	32-bit	146,979	3.97	00:04:38	38.72%	28.23%
2.	16-bit	10,035	3.87	00:05:10	43.93%	27.11%
3.	24-bit	2,188	2.71	00:03:05	54.11%	56.17%
4.	8-bit	135	5.10	00:05:59	17.04%	22.22%
5.	1-bit	13	2.77	00:02:11	69.23%	38.46%
6.	0-bit	8	1.75	00:01:04	75.00%	37.50%
7.	undefined-bit	2	5.50	00:10:32	100.00%	0.00%

Table 7.29: Screen colours by GA

	Screen Resolution	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	1024x768	78,004	3.96	00:04:35	39.15%	27.81%
2.	1280x800	29,879	4.29	00:04:50	41.36%	26.10%
3.	800x600	23,839	4.05	00:04:54	38.89%	24.80%
4.	1280x1024	9,621	3.48	00:03:57	35.78%	33.78%
5.	1152x864	6,125	3.69	00:04:33	33.01%	31.84%
6.	1280x768	3,038	3.95	00:04:41	37.10%	26.89%
7.	1680x1050	2,163	1.44	00:00:45	12.30%	87.06%
8.	1440x900	1,776	3.74	00:04:11	46.85%	35.42%
9.	1280x960	1,056	3.58	00:04:29	39.96%	24.05%
10.	240x320	970	3.02	00:06:40	99.79%	34.23%

Table 7.30: Screen resolutions by GA

	Flash Version	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	9.0	75,858	4.00	00:04:53	40.73%	26.10%
2.	9.0 r124	24,937	4.11	00:04:07	37.52%	27.10%
3.	9.0 r115	15,100	3.74	00:03:51	31.32%	33.64%
4.	6.0	7,400	4.03	00:05:10	47.35%	24.74%
5.	9.0 r28	5,950	3.33	00:03:19	29.08%	47.83%
6.	9.0 r47	5,519	3.57	00:04:13	35.39%	40.82%
7.	8.0	5,443	4.08	00:05:47	34.14%	26.25%
8.	(not set)	5,200	3.52	00:06:19	49.27%	29.27%
9.	9.0 r45	3,243	3.80	00:04:06	35.49%	30.47%
10.	7.0	2,852	4.22	00:05:32	42.50%	24.33%

Table 7.31: Flash version by GA

	Java Support	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	Yes	156,473	3.97	00:04:36	38.84%	28.22%
2.	No	2,887	2.86	00:07:25	61.24%	45.45%

Table 7.32: Java support information by GA

7.3.7 Web metrics in WLF only

The log file analysis is able to find particular measurements that can be useful to indicate usability problems in the EM site. This section presents these metrics (for download quality) which include: error web metrics, most requested images, and most downloaded files on the EM site.

7.3.7.1 Error Web Metrics

Several useful web metrics are found only in the log file system. These include: error types, the details of each error, and states code. Table 7.33 shows the error types on the EM site and the daily error types during one year. Figure 7.10 shows that the "Not Found" error exists all the time during the examined period and the highest number was recorded in May 2008. This is unsurprising given the finding in Section 7.4.2 regarding the high volume of traffic in May 2008. Interestingly, many errors were the “page not found” error, as can be seen in Table 7.33. Table 7.34 shows that these errors occur mainly on the English version of the EM site. This may indicate that many errors exist in such pages and also that the English version is in demand by some users. It therefore helps developers to know that this section of the site needs to be examined, the errors corrected, and that the section should be better maintained in future.

	Code	**Description**	**Count**
1	404	Not Found	35,169
2	500	Internal Server Error	18,102
3	403	Forbidden	1,407
4	412	Precondition Failed	58
5	401	Unauthorised	44
		Total	**54,780**

Table 7.33: Error types generated by WLE

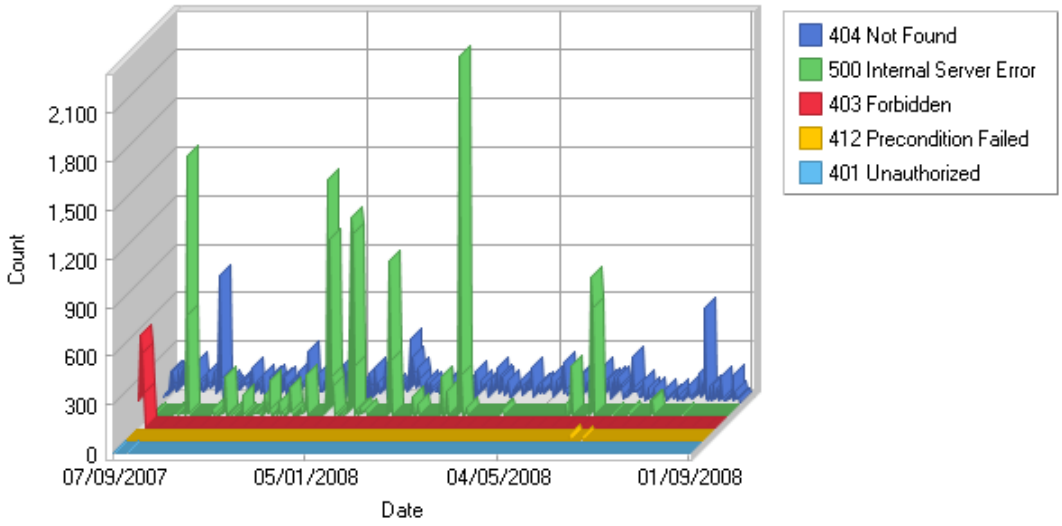


Figure 7.10: Daily error types by WLE

	Request / Referrer	Count
1	/english/image/bg-l.gif http://www.makkah.gov.sa/ english/index.php	3,492
2	/english/image-e/foter.gif http://www.makkah.gov.sa/ english/index.php	3,339
3	/english/image-e/bg-r.gif http://www.makkah.gov.sa/ english/index.php	3,312
4	/english/image/bg-l.gif http://www.makkah.gov.sa/ english/index.php?checktr=1	2,868
5	/english/image-e/bg-r.gif http://www.makkah.gov.sa/ english/index.php?checktr=1	2,832
6	/english/image-e/foter.gif http://www.makkah.gov.sa/ english/index.php?checktr=1	2,832
7	/im/eimarahb-h.gif, No Referrer	1,618
8	/im/haikalb-h.gif, No Referrer	833
9	/im/newsb-h.gif, No Referrer	819
10	/im/amirb-h.gif, No Referrer	818

Table 7.34: Page not found error (404) generated by WLE

Additionally, WLE provides web metrics for downloaded files, as can be seen in Table 7.35. This is useful information that can help to overcome the limitations found in not using the available features in GA in terms of monitoring the files used by the developers in the EM site. Table 7.35 shows the file most frequently downloaded by visitors was *robots.txt* file which is used to control spiders that visit the EM website. This table also provides useful information about "incomplete requests" and bandwidth metrics to monitor the files that are most frequently used. This is a useful combination to monitor the downloaded operations as can be seen with the *ipa-plan28-29.zip* file which recorded the highest bandwidth and 38.87% of incomplete requests. This was a noticeable value that indicates problems in downloading such files. Information such as this could result in simple amendments to the website, such as indicating to users that this is a large file that will take a substantial amount of time to download.

However, closer inspection of these results show that most of these downloaded files were related to internal work within the Emirate of Makkah that should not be publicly accessible, such as local reports. It was found to be easy to access to these files as there were no restrictions limiting access to them. This is actually a security problem. Furthermore, some links led to documents which referred to actual decisions and orders made by the Emirate which were considered to be confidential. So, such files must be protected to keep the work strictly confidential. This shows the usefulness of using the "most downloaded files" metric to monitor any lack of security on the site.

	File	**Hits**	**Incomplete Requests**	**Visitors**	**Bandwidth (KB)**
1	http://www.makkah.gov.sa/ robots.txt	11,309	0	9,262	502
2	http://www.makkah.gov.sa/ documents/ipa-plan28-29.zip	1,451	564	780	333,260
3	http://www.makkah.gov.sa/ documents/ipa-plan29.zip	528	126	291	137,651
4	http://www.makkah.gov.sa/ files/finalreport/press.zip	2	0	2	3,723
5	http://www.makkah.gov.sa/ files/finalreport/letters.zip	2	0	2	12,162

6	http://www.makkah.gov.sa/ clj4650pcl6winvista2kxp2003.exe	4	0	2	16,102
7	http://www.makkah.gov.sa/ makkah_db.tar.gz	1	0	1	60,966
8	http://www.makkah.gov.sa/ squid-2.6.STABLE13.tar.gz	1	0	1	1,589
9	http://www.makkah.gov.sa/ images.tar.gz	6	5	1	28,374
10	http://www.makkah.gov.sa/ documents/e-IMARAH-for-e-Gov3.zip	1	0	1	7,992
11	http://www.makkah.gov.sa/ documents/e-IMARAH-for-e-Doc2005.zip	1	0	1	5,402
12	http://www.makkah.gov.sa/ clj4650fw_win_07_006_0.exe	1	0	1	13,544
13	http://www.makkah.gov.sa/ download/sp38088.exe	1	0	1	21,025
14	http://www.makkah.gov.sa/ download/makkah_.sql.gz	1	0	1	4,519
15	http://www.makkah.gov.sa/ download/data.tar.gz	26	26	1	25,720
	Total	13,335	721	N/A	672,538

Table 7.35: Most downloaded files generated by WLE

7.3.7.2 Most Requested Images

WLE also provided useful information regarding the most frequently downloaded images, as can be seen in Table 7.36. This is helpful in identifying those images that were frequently used that might cause problems. In particular, it was found that header files, which appear in all pages, take a considerable amount of bandwidth, as well as appearing in the most incomplete request metrics (Table 7.36). This indicates an existing usability problem with the images used in the EM site. This information can help developers to make judgments about the use of images on the site. For example, heavily used images should be optimised for size as well as quality. This is actually an important issue which may accelerate the navigation time of the EM site, as found in several tasks in the usability testing chapter.

	Image	Hits	Incomplete Requests	Visitors	Bandwidth (KB)
1	http://www.makkah.gov.sa/Themes/design/arabic/im/header.jpg	109,295	638	77,793	1,950,561
2	http://www.makkah.gov.sa/Themes/design/arabic/ im/header-2.jpg	107,712	259	77,158	772,824
3	http://www.makkah.gov.sa/Themes/design/arabic/im/eimarahb.gif	113,035	21	76,474	68,700
4	http://www.makkah.gov.sa/Themes/design/arabic/im/haikalb.gif	110,341	7	75,652	56,976
5	http://www.makkah.gov.sa/Themes/design/arabic/im/amirb.gif	108,894	7	75,282	48,725
6	http://www.makkah.gov.sa/Themes/design/arabic/im/newsb.gif	108,986	7	75,223	45,883
7	http://www.makkah.gov.sa/Themes/design/arabic/im/icon1.gif	107,690	9	75,092	46,996
8	http://www.makkah.gov.sa/Themes/design/arabic/im/bgsubright.gif	180,532	4	74,314	10,338
9	http://www.makkah.gov.sa/Themes/design/arabic/img/header.jpg	101,946	299	73,644	604,481
10	http://www.makkah.gov.sa/Themes/design/arabic/ img/a.jpg	100,655	3	73,090	26,636

Table 7.36: Most requested images on the EM site by WLE

7.3.7.3 Other Top Files

WLE provides useful information regarding the most popular file types that were downloaded on the site. It can be seen in Table 7.37 that flash files (*swf*) were one of the most often downloaded files, but it shows that such files recorded the highest incomplete requests; they also used a considerable amount of bandwidth. This is an indication that such kinds of file may be causing problems and their use needs to be reviewed to avoid causing problems for users.

	File Type	Hits	Incomplete Requests	Bandwidth (KB)
1	gif	2,803,477	427	1,754,807
2	php	1,757,148	0	39,806,023
3	jpg	568,448	1,445	5,312,277

4	swf	287,470	2,620	14,540,142
5	htm	259,658	0	8,660,751
6	ico	31,548	24	264,295
7	txt	11,309	0	502
8	css	2,494	1	5,726
9	zip	1,985	690	500,192
10	ppt	909	633	208,919

Table 7.37: Most requested file types on the EM site

7.4 Applying Particular Metrics in Online Services

As explained in Section 4.5.3.3, limitations exist in terms of using the full range of features available in Google Analytics on the EM website. This is due to concerns felt by the website owners over implementing these features. One shortcoming is the inability of developers to assign goals and funnels. This feature in GA allows users to be monitored as they progress through a set of pages and defines the place where users leave the site without reaching their intended target. For example, it is worth monitoring users of online services in the EM site and attempting to define why users do not complete online forms. To overcome this problem, the researcher used the exit pages feature available in GA to define, to some extent, where users leave the site while applying for the online services.

Several important points emerged, found in the results in Table 7.38, which can be highlighted in the set of links used to reach the online form. These are as follows:

1- The link to “apply for an online form” on the homepage takes users to a page (number 1 in Table 7.38) that contains two options: an enquiry link and the “apply for an online form” link. The average time users spent on the page (number 1 in Table 7.38) was 0.52 minutes when there was clearly two options: inquiry or apply for an online request. This seems a long time and might be an indication that the link was not obvious, suggesting maintenance is required for this page.

2- Users spent an average time of 5.48 minutes on the online form (number 2 in Table 7.38). This might be an acceptable time if users do not make any mistakes. This actually needs to be related to the findings concerning usability where examined users spent an average of about 7 minutes (without errors) to

complete all the fields in the online form. However, this page recorded a considerable bounce rate of 46.31% which might be an indication of difficulties that visitors found in filling in the online form and interacting with the contents on that page; this needs to be carefully studied. It suggests that more investigations are required for this particular form. This actually confirms the findings of the usability testing where the users indicated there were many problems with the online form. So, using analytic tools helps to give an early indication of problems that may exist but these need to be proven by using other usability methods.

	Page	Page Views	Avg. Time on Page	Bounce Rate	% Exit
1	/browse.php?asSC=275	8,182	00:00:52	9.72%	8.31%
	New Users	4,609	00:00:52	10.76%	8.33%
	Return Users	3,573	00:00:52	9.19%	8.28%
2	/browse.php?asSC=275&form=1	6,870	00:05:48	46.31%	32.33%
	New Users	3,733	00:05:37	64.14%	32.71%
	Return Users	3,137	00:06:00	32.99%	31.88%
3	/form.php	16,746	00:01:26	30.43%	21.61%
	New Users	5,370	00:01:21	30.09%	19.72%
	Return Users	11,376	00:01:29	30.47%	22.49%

Table 7.38: The way to reach an online form in the EM site

Interestingly, as can be seen in Table 7.39, most visitors who reached the online form were using Internet Explorer to browse the Internet (94.71%). It also shows that very little access to the online form, as well as a considerably high bounce rate, was recorded for certain other browsers. This supports the previous finding: that the EM site is not compatible with all the available browsers. So, obtaining such information from the web analytic tools can help a good deal in improving the site.

	Browser	Page Views	Unique Page Views	Avg. Time on Page	Bounce Rate	% Exit
1.	Internet Explorer					
	All Visits	6,507	5,448	00:05:48	42.76%	31.81%
	New Visitors	3,497	2,955	00:05:33	59.83%	31.77%
	Returning Visitors	3,010	2,493	00:06:05	32.09%	31.86%
2.	Firefox					
	All Visits	275	241	00:05:36	79.69%	46.55%
	New Visitors	188	168	00:06:09	83.02%	48.94%
	Returning Visitors	87	73	00:04:34	63.64%	41.38%
3.	Opera					
	All Visits	56	33	00:04:28	50.00%	23.21%
	New Visitors	17	14	00:07:34	100.00%	47.06%
	Returning Visitors	39	19	00:03:39	33.33%	12.82%
4.	Safari					
	All Visits	28	24	00:12:46	50.00%	35.71%
	New Visitors	27	23	00:13:27	50.00%	37.04%
	Returning Visitors	1	1	00:01:01	0.00%	0.00%
5.	Mozilla					
	All Visits	4	3	00:01:38	0.00%	0.00%
	New Visitors	4	3	00:01:38	0.00%	0.00%
	Returning Visitors	0	0	00:00:00	0.00%	0.00%

Table 7.39: The most frequently used browsers in the online form in the EM site

7.5 Summary of Web Metrics

The above results show that several metrics facilitated a wide inspection of the traffic and provided an inspection of the usability problems that might possibly exist in the EM site. The web metrics that were generated in this chapter are summarised in Table 7.40. However, it should be noticed that more web metrics can be included as stated in Section 8.3.

	KPI	**Contents**	**Tool**
1	*Page Views (PV)*	The number of page views for particular pages	GA
2	*Screen Resolution (SR)*	The list of top screen resolutions	GA
3	*Time on the Page (TP)*	Average time on a page + Bounce rate	GA
4	*Browser Bounce (BB)*	Bounce rate + Browser visits	GA
5	*Download Quality (DQ)*	Bandwidth + Incomplete requests	WLE
6	*Peak time(PT)*	Page views + Bandwidth	WLE
7	*Landing Pages (LP)*	Pages/visit +Average time on the site + Bounce rate + Visitor type	GA
8	*Countries and Cities (CC)*	-Average time + Pages/visit + Bounce rate -Country + Bounce rate -Page Not Found + Count of Error	GA

Table 7.40: Web metrics for e-Government websites

7.6 Web Analytic Tools: Limitations and a Discussion of their Use

The analysis of the EM site has shown a number of limitations in the results provided by the analytics packages. These can be categorised into three main limitations. Firstly, the existing of anonymous results, which have been found in the generated reports. For example, several GA reports contain '/', "not set", "No Referrer", "Unknown" which limit the ability to obtain more accurate information. Secondly, there is a lack of customisation in the reports in WLE which does not allow evaluators to focus on several important areas. Finally, and most importantly, in many cases the results do not provide enough information about the reasons behind the results and whether metrics such as 'long time periods spent on pages' are due to users struggling to use the page or simply finding the contents very informative.

However, using a hybrid approach to collect the data (i.e. using both the log file and tagged page approaches), leads to the emergence of several useful measurements. These measurements have the potential to provide an indication of the usability problems that may exist in the e-Government websites. It should also be noticed that the features in GA facilitate greater analysis and allow more inspection of the data to

be made. Moreover, it was found that, using KPIs in the analysis, gave a useful indication regarding performance. In particular, KPIs explain the traffic on the site, as well as over a period of time; this allows the traffic to be monitored and the performance to be summarised.

Although the generated results indicate the existence of the usability problems, the reasons behind these problems could be more accurately determined by other usability methods, e.g. heuristic and usability testing. This suggests that web metrics may be helpful in identifying usability problems automatically at an early stage; this might help in increasing the utilisation of the EM site. In particular, the order of the approaches used in the usability evaluation framework for e-Government websites can be amended in order to potentially generate the most cost effective approach. This is because web analytic tools appear to have the potential to inform evaluators about possible usability problems that might exist in the site and therefore such tools may possibly be used, to a certain extent, to derive the design of a heuristic evaluation as well as usability testing.

Related problems were found in that the Emirate of Makkah IT staff had not reached a sufficient level of efficiency in using web analytic tools as they were not using certain features that were offered in GA: for example, monitoring the downloading of files, searching, and defining goals. Similarly, a *lite* version of WLE is being used in EM; this provides only about 10% of the features found in the *professional* version, which this research has used. These findings actually support points made in Section 2.5.3 concerning the lack of a budget sufficient to provide and maintain the website. So, these factors have a major influence on the future development of the EM site.

The results introduced in this chapter could potentially provide an early interpretation of the data traffic on the e-Government websites and thus, in the case of the EM site, these results may identify existing usability problems at an early stage, which can be used in the further development of the site.

7.7 Summary

To sum up, this chapter has presented an analysis of the Emirate of Makkah website in which a hybrid approach was used to illustrate the results obtained from log files and tagged pages. It was found that common web metrics can be generated from each of these tools. However, each tool has its own web metrics which allow them to produce particularly useful results. The web metrics that are generated by using KPIs explain the traffic on the EM site more precisely and partly reinforce the findings from the heuristic evaluation and usability testing methods. This indicates that the use of analytic tools is important in evaluating the e-Government websites and this makes it possible to refine the contents of the evaluation framework, as is discussed in the next chapter.

Chapter Eight: Refinement of the Evaluation Framework

8.1 Introduction

This chapter reflects on the results of implementing the evaluation framework for e-Government websites. This framework contained heuristic evaluation, usability testing and the deployment of web analytic tools, as discussed in Chapters 5, 6 and 7. This chapter discusses the significance and efficiency of these approaches.

The chapter is structured as follows: Section 8.2 reintroduces the background to the initial evaluation framework for e-Government websites. Section 8.3 analyses the results from the first implementation of the evaluation framework in order to refine it to obtain a more effective evaluation. This section includes the results generated from the case study, as well as the limitations of the methods that were used. Section 8.4 considers the refinement of the evaluation framework and discusses the ability of each usability method to provide useful information about usability problems. Then, the summary is presented in Section 8.5.

8.2 The Initial Evaluation Framework

Based on the research investigated in the literature review in Chapter 2, it was found that there is a definite need to evaluate e-Government websites. Particularly, there exists a need to study the interactions and behaviours of users of such websites in order to derive ways of enhancing and improving their design. This was found in several research studies and several approaches have already been applied. However, few studies have designed a framework which uses several approaches to examine the usage of e-Government websites. Within this area in particular, the evaluation framework designed by Thompson et al. (2003) was shown to offer a comprehensive evaluation framework. Thus, this research initially adopted this evaluation framework and applied it to a case study on e-Government websites in Saudi Arabia, as explained in Chapter 3.

Figure 8.1 shows the particular methods that were used in the first implementation of this evaluation framework. Briefly, the framework used document analysis and interviews to investigate the state of e-Government in Saudi Arabia, as explained in Chapter 4. This was followed by employing three usability methods to examine one of the best websites in Saudi

Arabia; this was the Emirate of Makkah (EM) website, as discussed in Chapters 5, 6 and 7. Significant results emerged from the first implementation that was conducted. These identified usability problems that existed in the examined e-Government website.

However, it is important that any revision of the evaluation framework enables it to extend its capabilities in terms of inspecting the usability problems at an early stage. In particular, it was found that, by utilising web analytic tools, some important usability problems emerged (see Chapter 7). This indicates that such an approach might potentially be used at a fundamental level and then might be followed by the other approaches within the evaluation framework in order to clarify and emphasise the usability problems that had been discovered. This is because it has been found that web metrics can produce two kinds of result: firstly, web metrics can identify those usability problems that obviously exist in the site and, secondly, those usability problems that may exist but that need to be explained by further usability inspection methods. However, not all the methods used in the initial evaluation framework are considered in the refined framework. This is because the focus of the first implementation was the state of e-Government in Saudi Arabia, which is unlikely to be different in the second implementation. This relates to the national strategy for e-Government in Saudi Arabia which is reviewed and enhanced every five years, as explained in Section 4.4.2. Therefore, the documents' analysis and interviews were ignored from the refined evaluation framework but can be used if required, as indicated in Figure 8.1.

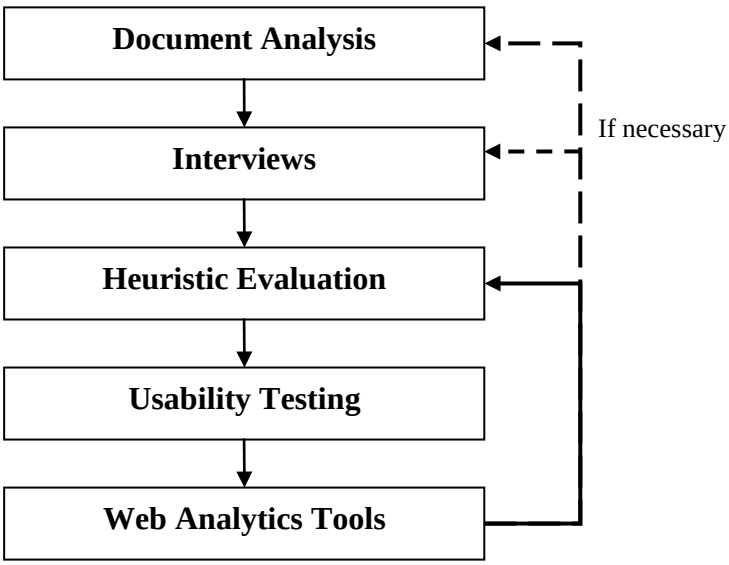


Figure 8.1: Particular methods used within the evaluation framework for e-Government websites

More importantly, in order to create a framework that is cost effective, the evaluation framework could be refined by changing the order of the evaluation methods used. In particular, web analytic tools can be deployed first, followed by other usability methods, including heuristic evaluation and usability testing, in order to examine the site from qualitative and quantitative points of view. However, it should be noted that some usability problems were discovered by one or more of the usability methods, and in order to limit expenditure and organisational time, it is necessary to define the ability of each method to discover particular usability problems. This is discussed in the next section.

8.3 Usability Problems Identified by Methods in the Evaluation Framework

As illustrated previously in Section 3.4.2.3, heuristic evaluation was first used to identify existing usability problems; its results were then used to design the usability testing tasks. This is because heuristic evaluation is able to identify detailed problems in the design of a website interface. It also has the ability to cover a wide range of problems which, in turn, allows it to be used to derive the usability testing tasks. Then usability testing was employed further to examine the existing problems defined by the heuristic evaluation; however, from this, some new problems emerged. After this, web analytic tools were shown to identify similar usability problems that had been revealed by other usability studies. Thus, it is important to examine the validity of each usability method in refining an evaluation framework. This is provided by focusing on the problems identified on the examined site.

The following subsections are structured around the heuristic checklist used in the heuristic evaluation (HE) which formed the basis of the first implementation; its results are then compared with those usability problems identified by the usability testing (UT) and the web analytic tools (WA). Lastly, the web metrics KPIs that were derived in the first implementation are stated. In the following discussion, issues identified by HE, UT and WA were placed into the same categories that were used for heuristics. Thus, a judgement can be made as to which of the three techniques is able to identify a particular problem should it exist on the site; this includes examining the ability of a technique to identify a problem, as shown in Table 8.1.

	Sign	Description
1	**Yes**	The technique is able to accurately identify a problem.
2	**Partial**	The technique may be able to provide indicators that a problem may exist but it cannot accurately pinpoint the issue.
3	**No**	The technique is not able to identify a problem.
4	**?**	Unable to determine if this technique is suitable or not.

Table 8.1: The indications for use in the heuristic principles listed in this chapter

In order to add more detail to the following tables, the metrics, together with the indications they provide, are listed within each heuristic principle. The range of KPI indications that are included in these tables are illustrated in Table 8.2. Although these KPIs are based on those KPIs summarised in Table 7.39, these KPIs also include some web metrics that had not used in the first implementation (metrics 9-12) as well as those metrics published recently (metrics 13).

	KPI	Contents	Tool
1	*Page Views (PV)*	The number of page views for particular pages	GA
2	*Screen Resolution (SR)*	The list of top screen resolutions	GA
3	*Time on the Page (TP)*	Average time on a page + Bounce rate	GA
4	*Browser Bounce (BB)*	Bounce rate + Browser visits	GA
5	*Download Quality (DQ)*	Bandwidth + Incomplete requests	WLE
6	*Peak time(PT)*	Page views + Bandwidth	WLE
7	*Landing Pages (LP)*	Pages/visit +Average time on the site + Bounce rate + Visitor type	GA
8	*Countries and Cities (CC)*	-Average time + Pages/visit + Bounce rate -Country + Bounce rate -Page Not Found + Count of Error	GA
9	*Site Overlay (SO)*	Clickstream analysis over a particular page	GA
10	*Events Tracking (ET)*	For downloading documents	GA
11	*Really Simple Syndication (RSS)*	Including the number of visits which counts for all sessions during a period of time, unique visitors, subscribers, unique blog readers (Kaushik, 2007, p.320)	GA

	KPI	Contents	Tool
12	*Goals Definition (GD)*	Including where users exit a particular set of steps, and to where, and conversion rate.	GA
13	*Site Search (SS)*	Average searches per visit, percent of visits using search, search results to site exits ratio (Hasan et al., 2009).	GA

Table 8.2: Web metric for e-Government websites

However, there is an explicit absence of standard key terms in web analytic tools, as can be seen in several key terms used for KPIs in WA. For example, some WA tools use response metrics to monitor the interactions on several activities: e.g. e-mails opened, e-mails bounced, not arrived, clicks, unsubscribed rates (Peterson, 2004, p.221). However, other WA tools, such as those in GA (2007), use event tracking (ET) metrics to provide similar measurements. In fact, this shows clearly the lack of standards of WA; this may affect the utilisation of such tools and may reduce the benefits of the analytics. Thus, in this research, the key terms used in both web analytic tools (GA and WLE) are used to overcome this lack of standards. Moreover, some KPIs, e.g. Hasan et al (2009), have recently appeared in the literature, and will be used for further enhancement of the considered KPIs. The following tables (8.3-8.11) illustrate the results produced from the used usability methods and show whether the technique actually identified a problem on the EM website. The ‘further comments’ column in these tables indicates the opinion of the researcher as to which of the techniques would be able to identify a problem, should such a problem exist.

	Review Checklist	HE	UT	WA	Further comments
1.1	Is the site compatible with all web browsers?	**Yes**	**?**	**Yes (BB)**	HE and WA (by using BB metrics), should be able to identify this problem, whereas this issue was not considered using UT. On the EM site, HE and WA identified this problem.
1.2	Do the pages display clearly, given the screen resolutions commonly used by users?	**Yes**	**Yes**	**Yes (SR)**	All the techniques used should be able to pinpoint this issue (in WA, the SR metric is appropriate). During the evaluation on the EM website, this problem was not found.
1.3	Is a consistent design used across all pages within the website?	**Yes**	**Yes**	**Partial (TP, PT)**	HE and UT should be able to pinpoint this problem accurately, and WA can provide an indication that this problem may exist using the TP and PT metrics. During the evaluations, HE and UT did identify this problem and WA did provide some indicators but without clear details.
1.4	Is all content on the site consistently presented?	**Yes**	**Yes**	**No**	HE and UT should be able to identify this problem, whereas WA is unable to be used to examine these issues. During the evaluations these problems were not found.
1.5	Are texts and links consistently described by meaningful labels?	**Yes**	**Yes**	**No**	
1.6	Does each page have a title to describe the contents?	**Yes**	**?**	**Yes (LP)**	HE should be able to pinpoint this problem, and WA provides an indication by using the LP metric. Whereas this issue was not considered using UT. In the evaluation of EM, HE and WA did identify this problem.
1.7	Is the most important information	**Yes**	**Yes**	**No**	HE and UT are able to identify this problem, whereas WA cannot be used to

	Review Checklist	HE	UT	WA	Further comments
	consistently placed in a noticeable position?				examine this issue. During the evaluations no problems were found for this issue.
1.8	Are the graphic features used (e.g. images) consistently displayed?	**Yes**	**?**	**Yes (DQ)**	WA provides accurate details about this problem by using the DQ metric, and HE should be able to pinpoint this problem, but in UT, this issue was not considered. In the evaluation of EM, HE and WA did identify this problem.
1.9	Are headers easily distinguishable so they are readily noticed by the user?	**Yes**	**Yes**	**No**	HE and UT should be able to pinpoint this problem, whereas it is not possible to use WA to examine this issue. During the evaluation of EM, HE and UT did identify this problem.
1.10	Are there consistent explanations of what is required in a data entry field?	**Yes**	**Yes**	**Partial (TP)**	HE and UT should be able to pinpoint this problem. WA provides an indication by using the TP metric. In the evaluation of EM, HE did identify this problem whereas WA provides indicators without clear details.
1.11	Do data entry forms follow a consistent presentation and format?	**Yes**	**Yes**	**No**	HE and UT should be able to pinpoint this problem accurately, whereas WA cannot be used for this issue. In the evaluation of EM, HE and UT did not identify a problem with this issue.
1.12	Are the menu items prioritised?	**Yes**	**Yes**	**Partial (TP)**	HE and UT should be able to pinpoint this problem accurately, and WA can provide an indication that this problem may exist using the TP metric. During the evaluations UT did identify this problem and WA did provide some indicators without clear details. However, in HE, this issue was not included and therefore such a question can be added to the heuristic checklist.

	Review Checklist	HE	UT	WA	Further comments
1.13	Are the services well highlighted?	**Yes**	**Yes**	**Partial (TP,PT)**	HE and UT should be able to pinpoint this problem accurately, and WA can provide an indication that this problem may exist using the TP and PT metrics. During the evaluations UT did identify this problem and WA did provide some indicators without clear details. However, in HE, this issue was not included, and therefore such questions can be added to the heuristic checklist.

Table 8.3: Consistency problems

	Review Checklist	HE	UT	WA	Further comments
2.1	Are groups of links displayed in the most logical way, using good practice?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine these issues. In the evaluation of EM, HE and UT did not identify problems in these issues.
2.2	Is the navigation area placed in a noticeable position so the user can easily use it?	**Yes**	**Yes**	**No**	
2.3	Do pages contain appropriate menu entries to link to related information?	**Yes**	**?**	**Partial (SO)**	HE should be able to pinpoint this problem accurately, and WA can provide an indication that problems may exist in this issue by using the SO metric, but in UT this issue was not considered. During the evaluations HE did identify these problems and WA did provide some indicators but without offering particular evidence behind this problem, which shows the need to use other usability methods for greater clarification of the existing problems.
2.4	Are there appropriate links within the body text on pages?	**Yes**	**?**	**Partial (SO)**	
2.5	Are links within the body text labelled appropriately (e.g. the “click here” label is avoided)?	**Yes**	**?**	**No**	HE should be able to pinpoint this problem accurately, whereas WA cannot be used to examine these issues, and in UT these issues were not considered. In the evaluation, HE did identify problems in these issues.
2.6	Are links shown in standard colours?	**Yes**	**?**	**No**	

	Review Checklist	HE	UT	WA	Further comments
2.7	Do all links work?	**Yes**	**?**	**Partial (SO)**	HE should be able to pinpoint this problem accurately, and WA can provide an indication that this problem may exist using the SO metric, but in UT this issue was not considered. During the evaluations HE did identify this problem, and in WA, SO did provide some indicators without clear details.
2.8	Do link colours indicate visited and unvisited links?	**Yes**	**?**	**No**	HE should be able to pinpoint this problem accurately, whereas it is not possible to use WA to examine this issue, and this issue was not considered using UT. In the evaluation, HE did identify problems in these issues.
2.9	Do outbound links usually open in a new window?	**Yes**	**?**	**No**	
2.10	Do all sub-pages contain a link to the homepage in a noticeable place?	**Yes**	**Yes**	**No**	HE and UT should be able to pinpoint this problem, whereas WA is unable to be used to examine this issue. In the evaluation of EM, HE and UT did identify this problem.
2.11	Do links clearly indicate what will happen (e.g. a new page or file will download)?	**Yes**	**?**	**No**	HE should be able to pinpoint this problem accurately, whereas WA is unable to be used for this issue, and this issue was not considered using UT. In the evaluation of EM, HE did identify this problem.
2.12	Is excessive vertical scrolling minimised on each page?	**Yes**	**Yes**	**Partial (TP)**	HE and UT should be able to pinpoint this problem, and WA can provide an indication that this problem may exist using the TP metric. During the evaluations HE and UT did identify this problem and WA did provide some indicators without clear details.
2.13	Is there a group of links to the	**Yes**	**?**	**No**	HE should be able to pinpoint these problems accurately, but these issues were

	Review Checklist	HE	UT	WA	Further comments
	most visited pages?				not considered using UT, and WA is unable to be used to examine these issues. During the evaluations HE did identify problems in these issues.
2.14	Is there a group of links to the most downloaded documents?	**Yes**	**?**	**No**	
2.15	Does the site provide inquiry services in a noticeable place?	**Yes**	**Yes**	**No**	HE and UT should be able to pinpoint this problem, whereas WA is unable to be used to examine this issue. In the evaluation of EM, HE and UT did not identify any problem in this issue.
2.16	Is the menu offering the services clear?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these issues, whereas WA is unable to be used to examine them. In the EM site, UT was able to identify these problems, whereas these issues were not included in the HE checklist, so the designed checklist can be improved.
2.17	Does the site inform users about the processes while they wait for a response?	**Yes**	**Yes**	**No**	

Table 8.4: Links and navigation problems

	Review Checklist	HE	UT	WA	Further comments
3.1	Are there search capabilities on the site?	**Yes**	**Yes**	**SS**	HE and UT should be able to identify this problem. In WA, using the SS metric should allow this issue to be examined. In the examined site, HE, UT and WA were able to identify the existence of this feature.
3.2	If applicable, are advanced search facilities provided?	**Yes**	**?**	**No**	HE should only be able to identify this problem accurately, but this issue was not considered using UT, and WA is unable to be used to examine this issue. In the EM website, HE identified this problem.
3.3	Are the search results described clearly?	**Yes**	**Yes**	**Partial (SS)**	HE and UT should be able to identify this problem. WA provides an indication about a problem by using the SS metric. In the examined site, HE and UT identified this problem, but the SS metric provided indicators without clear details.
3.4	Is the ranking of search results appropriate?	**Yes**	**?**	**Partial (SS)**	HE should be able to identify these problems, whereas WA provides an indication about these problems by using the SS metric, and in UT these issues were not considered. In the examined site, HE identified these problems, but the SS metric provided indicators without clear details.
3.5	Can the search facility be used in other languages?				
3.6	Is information on commonly used search terms provided to users?	**Yes**	**?**	**No**	HE should be able to identify these problems accurately, whereas WA is unable to be used to examine these issues, and in UT these issues were not considered. In the EM website HE identified these problems.
3.7	Can a FAQ page be easily located?	**Yes**	**?**	**No**	
3.8	Does the FAQ page provide	**Yes**	**?**	**Partial**	HE should be able to identify this problem accurately, whereas WA provides

	Review Checklist	HE	UT	WA	Further comments
	useful information?			(**TP**)	indicators about these issues, and these issues were not considered using UT. In the EM website HE identified these problems: TP in 3.8, ET in 3.9 and 3.10. However, these web metric provided indications about these issues without clear details.
3.9	Does the website provide documents that can be downloaded?	**Yes**	**?**	**Partial** (**ET**)	
3.10	Is there a contact e-mail on every page?	**Yes**	**?**	**Partial** (**ET**)	
3.11	Is it easy to find a site map?	**Yes**	**?**	**No**	HE should be able to identify these problems accurately, whereas WA is unable to be used to examine these issues, and in UT these issues were not considered. In the EM website HE identified these problems.
3.12	Is it easy to find an A-Z directory?	**Yes**	**?**	**No**	
3.13	Does the website contain Contact Us information?	**Yes**	**?**	**Partial** (**PV**)	HE should be able to identify these problems accurately, whereas WA provides indicators about this issue, and this issue was not considered using UT. In the EM website HE did not identify any problem in this issue and the PV metric showed demand for this page (by assuming the use of typical page names).
3.14	Does the website allow users to enter their query in feedback form?	**Yes**	**Yes**	**No**	HE and UT should be able to identify this problem, whereas WA is unable to be used to examine this issue. In the EM website HE and UT did not identify any problem in this issue.
3.15	Are optional data entry fields clearly marked?	**Yes**	**Yes**	**Partial** (**TP**)	HE and UT should be able to identify this problem, whereas WA provides an indication about this issue by using the TP metric. During the evaluation of the EM website HE and UT did identify this problem, and the TP metric provided

	Review Checklist	HE	UT	WA	Further comments
					indications about this problem but without clear detail about it.
3.16	Do fields in data entry forms contain default values where appropriate?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these issues, whereas WA is unable to be used to examine these issues. In the EM website HE and UT did identify problems in all of these issues.
3.17	For user input fields, is there clear information about how these fields should be filled out?	**Yes**	**Yes**	**No**	
3.18	Have labels been used to indicate field length?	**Yes**	**Yes**	**No**	
3.19	Does the website warn users if they are about to make a possible error?	**Yes**	**Yes**	**No**	
3.20	Are data-entry error messages displayed in an observable location?	**Yes**	**Yes**	**No**	
3.21	Do data entry error messages explain how to solve the error?	**Yes**	**Yes**	**No**	

Table 8.5: Problems regarding help for users

	Review Checklist	HE	UT	WA	Further comments
4.1	Are multimedia resources (e.g. video clips) provided in an effective way (i.e. downloading in reasonable time)?	**Yes**	**?**	**Yes (DQ)**	HE and WA (DQ metric) should be able to identify this problem, whereas this issue was not considered using UT. In the EM website, WA and HE did identify this problem.
4.2	Is the site available in other languages?	**Yes**	**?**	**Yes (CC)**	HE should be able to identify accurately this problem, and WA provides an indication about this issue by using the CC metric; but this issue was not considered using UT. In the EM website, HE and WA did identify this problem.
4.3	Is there an RSS feed to keep the user informed of anything new in the site?	**Yes**	**?**	**Partial (RSS)**	HE should be able to identify accurately this problem, and WA provides an indication about this issue, but in UT this issue was not considered. In the EM website, HE did identify this problem, whereas in WA, RSS could not be implemented because it requires a code to allow this feature to be monitored.
4.4	Is there an e-mail list feature that can keep users informed about anything new on the site?	**Yes**	**?**	**Partial (ET)**	HE should be able to identify accurately this problem, whereas WA provides an indication about this issue, and in UT this issue was not considered. In the EM website HE did identify this problem, whereas in WA, ET metric could not be implemented because it needs a code to allow this feature to be monitored.
4.5	Are users allowed to copy the contents?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine these issues. In the EM website, HE and UT did not

	Review Checklist	HE	UT	WA	Further comments
4.6	Are users allowed to paste text to specific text boxes?	**Yes**	**Yes**	**No**	identify problems in these issues.
4.7	Are users able to print the contents of pages?	**Yes**	**?**	**No**	HE is able to identify this problem, whereas WA is unable to be used to examine this issue, and in UT this issue was not considered. In the EM website no problems were recorded for this issue.
4.8	Were flash files well introduced and caused no problems?	**Yes**	**?**	**Yes (DQ)**	WA should be able to identify accurately this problem by using the DQ metric, but this issue was not introduced in the HE heuristic checklist, and was considered using UT. In the EM website, the DQ metric did identify this problem. This suggests that such issues can be included in the HE checklist.

Table 8.6: Problems with features and functions

	Review Checklist	HE	UT	WA	Further comments
5.1	After the user completes an action, does the feedback indicate that the next action can be started?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine these issues. In the examined site, HE and UT did identify these problems.
5.2	If there are noticeable delays in the website's response time, is the user kept informed of the system's progress?	**Yes**	**Yes**	**No**	
5.3	Are users asked to 'confirm' actions before they are executed?	**Yes**	**Yes**	**Partial (GD**	HE and UT should be able to identify this problem, whereas in WA, the GD metric provides an indication for this issue. In the examined site, HE and UT did identify this problem, whereas GD could not been used because it requires a particular set-up which was not used.
5.4	Can users cancel an operation in progress?	**Yes**	**Yes**	**Partial (GD)**	
5.5	If users can go back to a previous page, can they change their choice on the earlier page?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine these issues. In the examined site, HE and UT did identify these problems.
5.6	For data entry pages with many fields, are users able to save partially completed forms?	**Yes**	**Yes**	**No**	

	Review Checklist	HE	UT	WA	Further comments
5.7	Does the current date and time appear in the online form?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine this issue. In the EM website UT did identify these problems but the HE checklist did not include these issues. So, these issues should be included in the HE to improve its functionality.
5.8	Does the editor used for online forms contain features that allow users to enter their request efficiently?	**Yes**	**Yes**	**Partial (TP)**	HE and UT should be able to identify this problem, and in WA, the TP metric provides indications for this issue. In the examined site, UT did identify this problem, whereas the HE checklist did not include this question. This shows that an improvement can be made in the used methods. In WA, the TP metric provides some indication but without clear details about this problem.
5.9	Does the form include an email address or telephone number for help if the user is struggling when using the form?	**Yes**	**Yes**	**No**	
5.10	Does the form clearly show the number of document attachments that are required so that the user can enter these in the appropriate boxes?	**Yes**	**Yes**	**No**	

	Review Checklist	HE	UT	WA	Further comments
5.11	Are the attachments embedded in clear boxes so the user can check these easily?	**Yes**	**Yes**	**No**	
5.12	Are the procedures described in the online form found easily by the user?	**Yes**	**Yes**	**Partial (TP)**	HE and UT should be able to identify this problem, and in WA, the TP metric provides indications for this issue. In the examined site, UT did identify this problem, whereas the HE checklist did not include this question. This shows that an improvement can be made in the used methods. In WA, the TP metric provides some indication but without clear details about this problem.
5.13	Are users told how long it will take to conduct the request?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine these issues. In the EM website UT did identify problems in these issues (5.13-5.21) but the HE checklist did not include these issues. So, these issues should be included in the HE to improve its functionality.
5.14	Does the feedback page inform users about the reference number that is given, their request, and the attachments provided?	**Yes**	**Yes**	**No**	
5.15	Does the feedback email contain the given reference number for the request?	**Yes**	**Yes**	**No**	
5.16	Does the feedback email contain a	**Yes**	**Yes**	**No**	

	Review Checklist	HE	UT	WA	Further comments
	confirmation of what was entered, as well as the names of the attachment documents?				
5.17	Does the feedback email contain a telephone number and e-mail address so users can follow up their request?	**Yes**	**Yes**	**No**	
5.18	Does the enquiry service give an indication of which department is currently dealing with the request, and what it is doing?	**Yes**	**Yes**	**No**	
5.19	Does the enquiry service indicate the time needed to process the request?	**Yes**	**Yes**	**No**	
5.20	Is the contact number provided of the department that holds the request in the enquiry service?	**Yes**	**Yes**	**No**	
5.21	Does the enquiry service protect user data, such that the user needs	**Yes**	**Yes**	**No**	

	Review Checklist	HE	UT	WA	Further comments
	authorisation to utilise this service?				

Table 8.7: Problems with the transactions principle (data entry forms)

	Review Checklist	HE	UT	WA	Further comments
6.1	Are messages placed where the eye is likely to be looking on the screen?	**Yes**	**Yes**	**No**	HE and UT should be able to identify this problem, whereas WA is unable to be used to examine this issue. In the examined site, HE and UT did identify this problem.
6.2	Have items (links, images, text) been grouped under logical headings?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine these issues. In the examined site, no problems were identified in these issues.
6.3	Have headings been separated to allow users easily to identify each group?	**Yes**	**Yes**	**No**	
6.4	Is there good colour and brightness contrast between image and background colours?	**Yes**	**Yes**	**No**	
6.5	Is colour used appropriately to emphasise important information?	**Yes**	**Yes**	**No**	
6.6	Does the website offer the feature of personalised pages to suit different citizens' profiles?	**Yes**	**?**	**No**	HE should be able to identify these problems, whereas WA is unable to be used to examine these issues, and in UT this issue was not considered. In the examined site, HE and UT did identify problems in these issues.

	Review Checklist	HE	UT	WA	Further comments
6.7	Is the search text box able to suggest relevant keywords to match the letters entered initially?	**Yes**	**?**	**No**	
6.8	Does the colour of text differ from the background colour so text can be easily read?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine these issues. In the examined site, no problems were identified for these issues.
6.9	Do the colours used on the site conform to common expectations about colour codes?	**Yes**	**Yes**	**No**	
6.10	Is white space used efficiently within pages?	**Yes**	**Yes**	**No**	
6.11	If images are used as visual cues, do they match cultural conventions?	**Yes**	**Yes**	**No**	

Table 8.8: Visual design problems

	Review Checklist	HE	UT	WA	Further comments
7.1	Can disabled users easily access and navigate the site?	**Yes**	**?**	**No**	HE should be able to identify these issues, but these issues were not considered using UT, and WA is unable to be used to examine this issue. In the EM website HE identified these problems.
7.2	Is there a special version of the website for visually impaired users?	**Yes**	**?**	**No**	
7.3	Does the website allow users to control fonts and colour to aid reading so visually impaired users can easily access and navigate the site?	**Yes**	**?**	**No**	

Table 8.9: Problems regarding accessibility for visually impaired users

	Review Checklist	HE	UT	WA	Further comments
8.1	Does the site have a clear link to privacy policy information?	**Yes**	**?**	**No**	HE should be able to identify these problems, whereas these issues were not considered using UT, and WA is unable to be used to examine these issues. In the EM website HE did identify these problems.
8.2	Does the website use encryption techniques appropriately when acquiring user data?	**Yes**	**?**	**No**	
8.3	Where applicable, does the website employ virtual keyboards for password input?	**Yes**	**?**	**No**	
8.4	If the user has signed into the system, does the text in the URL contain any information about the user?	**Yes**	**?**	**No**	HE should be able to identify these problems, whereas WA is unable to be used to examine these issues, and these issues were not considered using UT. In the examined site, these issues were not implemented.
8.5	Does the website log out users when the website is left inactive for a considerable time?	**Yes**	**?**	**No**	

	Review Checklist	HE	UT	WA	Further comments
8.6	Are any private documents openly accessible?	**No**	**?**	**Yes (DQ)**	WA should be able to identify this problem accurately, whereas this issue was not considered using UT, and was not introduced in the HE checklist. In the EM website WA identified this problem by using the DQ metric; it found that private files were openly accessible.

Table 8.10: Security and privacy problems

	Review Checklist	HE	UT	WA	Further comments
9.1	Does the domain name refer to the official government website (.gov.sa) (Should there be a dot before gov?)	**Yes**	**?**	**No**	HE should be able to identify accurately this problem, whereas WA is unable to be used to examine this issue, and in UT this issue was not examined. In the EM website, this issue was applied.
9.2	Is information clearly date stamped?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine this issue. In the examined site, E and UT identified this problem.
9.3	Does the agency logo appear in a prominent place on the page?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine this issue. In the EM website, this issue was applied.
9.4	Is there a clear description in a prominent location in the site explaining what the agency does?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine this issue. In the EM, HE and UT identified problems in this issue.
9.5	Does the agency structure and responsibilities of main divisions and units appear in a prominent location on the site?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine this issue. In the EM website this issues was applied.
9.6	Does the organisational chart explain the senior management's organisation in the	**Yes**	**?**	**No**	HE and UT should be able to identify this problem, whereas WA is unable to be used to examine this issue. In the EM, HE and UT

	Review Checklist	HE	UT	WA	Further comments
	agency?				identified a problem in this issue.
9.7	Does the agency offer a list of services that are provided so users have a clear view about the website?	**Yes**	**Yes**	**No**	HE and UT should be able to identify these problems, whereas WA is unable to be used to examine this issue. In the EM website these issues were applied.
9.8	Are services' requirements well explained so users can recognise the benefits and effects of applying for services?	**Yes**	**Yes**	**No**	
9.9	Does the site contain information about the planned projects of the agency?	**Yes**	**?**	**No**	HE should be able to identify this problem, whereas WA is unable to be used to examine this issue, and in UT this issue was not considered. In the EM website HE did identify this problem.

Table 8.11: Problems regarding the precision of information

8.4 Refinement of the Evaluation Framework

It can be seen that each usability method has its own strengths and weaknesses; these allow each method to provide valuable results. This section explains the ability of each method to identify usability problems and also discusses the results of the qualitative and quantitative usability methods (HE, UT, and WA) in order to refine the evaluation framework of e-Government websites.

It was found that many of the problems identified by the UT or WA approaches could be classified as belonging to one of the nine heuristic principles used in the first heuristic evaluation. Employing the UT method did not provide evidence of any new problems in all of these principles; however, it did provide evidence of new problems that might apply to some of the main heuristic principles, including consistency, helping users, and transactions. For instance, the analysis of users' interactions during the UT allowed two more issues concerning consistency to be identified; these needed to be included in the HE. Moreover, the UT method helped to maintain other methods and thus more issues to be inspected. For example, with regard to the transactions principle, the UT method highlighted a number of problems that other methods had not investigated; this allowed the HE checklist to be adapted in order to cover these issues. Therefore it would seem sensible if the heuristic checklist was updated to cover these issues and that the UT method should be used only in those cases where the heuristic approach was deemed insufficient and where there was a clear need for UT methods.

Similarly, several web metrics allowed a particular issue to be examined. Thus, because it was possible to examine certain heuristics using web metrics in WA, this meant that the issue could be excluded from being examined by HE. For instance, four metrics were able to identify problems in consistency principle so there was no need to examine these issues using other methods. Moreover, in features and functions, and in security principles, web metrics can be used efficiently to examine particular issues. This shows a potential feature of WA which allows the number of issues examined by other methods to be reduced in the evaluation framework.

However, it is clear that many of the web metrics that were used only provided partial indications of problems; e.g. they could not pinpoint specific details in the majority of the defined usability principles. In particular, WA was shown to be able to provide some direct indications for some issues in only four main principles 'consistency', 'helping users', 'features and functions', and 'security and privacy'. Therefore, when evaluating a website, more detail is required by using HE and UT. This is because the outputs of the WA were only partial indicators of what was happening on the site; they did not show the reasons for such problems and therefore other usability methods need to be used to clarify the outputs of the WA. In addition, it was found that the majority of usability problems were identified by HE methods. In fact, the results of HE provided detailed and exhaustive information regarding problems in the examined sites. In the first evaluation these results were used to design the UT method that examined the existing problems in more detail. The UT method, however, while it pinpointed those usability problems indicated by evaluators, was also able uniquely to identify a small number of problems. Some of these could be used to refine the heuristic checklist; this supports using the UT method. However, some of the issues examined by HE can be excluded from UT method, as can be seen in Table 8.12. This shows how the developed evaluation framework can be iteratively enhanced and improved to both improve and accelerate the evaluation of e-Government websites. In fact, using these three usability methods in the evaluation of e-Government websites enabled a comprehensive evaluation to be provided, which examined a large and significant number of design issues on the website.

Table 8.12 offers a summary of the results obtained from using the three usability methods. It shows the numbers of issues examined in the first implementation (i.e. the implementation described in Chapters 5-7), and the refined issues for the second implementation. However, because WA analysis was used as the last method in the first implementation, this column (*WA*) shows the number of web metrics for each principle and whether this was a direct (*d*), or a partial indicator (*p*). For some principles, it was possible to ignore the method used; these cases are indicated by X in Table 8.12.

	Principles	HE		UT		WA
		1st	**2nd**	**1st**	**2nd**	
1	Consistency	11	9	10	7	4*d*,5*p*
2	Links and Navigation	17	17	7	7	4*p*
3	Helping Users	21	20	10	10	1*d*, 6*p*
4	Features and Functions	8	5	2	X	3*d*, 1*p*
5	Transactions	6	21	6	21	2*p*
6	Visual Design	11	11	9	9	1d
7	Accessibility for Visually Impaired Users	3	3	X	X	X
8	Security and Privacy	5	5	X	X	1*d*
9	Precision of Information	9	9	6	6	X

Table 8.12: Comparing the inspection methods through the defined principles and their refinement

The above results show how using several usability methods in the evaluation framework allowed an effective analysis to be conducted, as well as the used methods to be refined; this also illustrates the need always to apply this framework in a logical order. In particular, this applies to the potential advantage of using WA, which is able to provide direct indicators of some problems, as well as providing indications of further problems. Moreover, partial indicators can be used to derive inspection using the other methods. Thus, it is possible to change the order of implementing the methods used so that WA could be used first to examine particular issues, followed by the HE and UT methods. This allows the implementation to be accelerated, as well as enhancing the methods used to obtain the most efficient results.

Figure 8.2 shows the structure of the refined evaluation framework for e-Government websites and illustrates that three methods were used. Firstly, web metrics were used; this method contained two kinds of metrics: direct indicators (6 KPIs) and partial indicators (8 KPIs). The results from direct indicators allowed the examined issues to be excluded from being examined by further methods. These results are therefore shown without any links in Figure 8.2. However, the results of partial indicators need

more explanation. For instance, Time on Page (TP) was used to examine several design issues under four principles: ‘consistency’, ‘links and navigations’, ‘helping users’, and ‘transactions’. So, each partial indicator is related to specific heuristic principles, as can be seen in Figure 8.2.

Then, heuristic evaluation was used to examine up to nine principles (depending on the results of the metrics); this allowed a significant number of issues in the examined website to be inspected, (the refined heuristic evaluation can be seen in Appendix 5) After this, the results of heuristic evaluation were used to derive the tasks for usability testing, allowing focus to be placed on particular tasks that need to be examined in order to validate the results of the heuristic evaluation, as well as to obtain the views of end users; as a result, usability testing is used to examine fewer issues. For instance, in the heuristic evaluation, nine issues were examined under the precision of information principle whereas, in the usability testing, only six issues needed to be examined because some issues in the heuristic evaluation checklist asked specific questions which reduced the number of issues requiring examination by usability testing. Similarly, there were no user tests required to examine the ‘features and functions’ ‘accessibility for visually impaired users ‘ and ‘security and privacy’ principles, because specific questions were asked in the heuristic evaluation which allowed the problems to be focused on; thus, these principles could be excluded from usability testing.

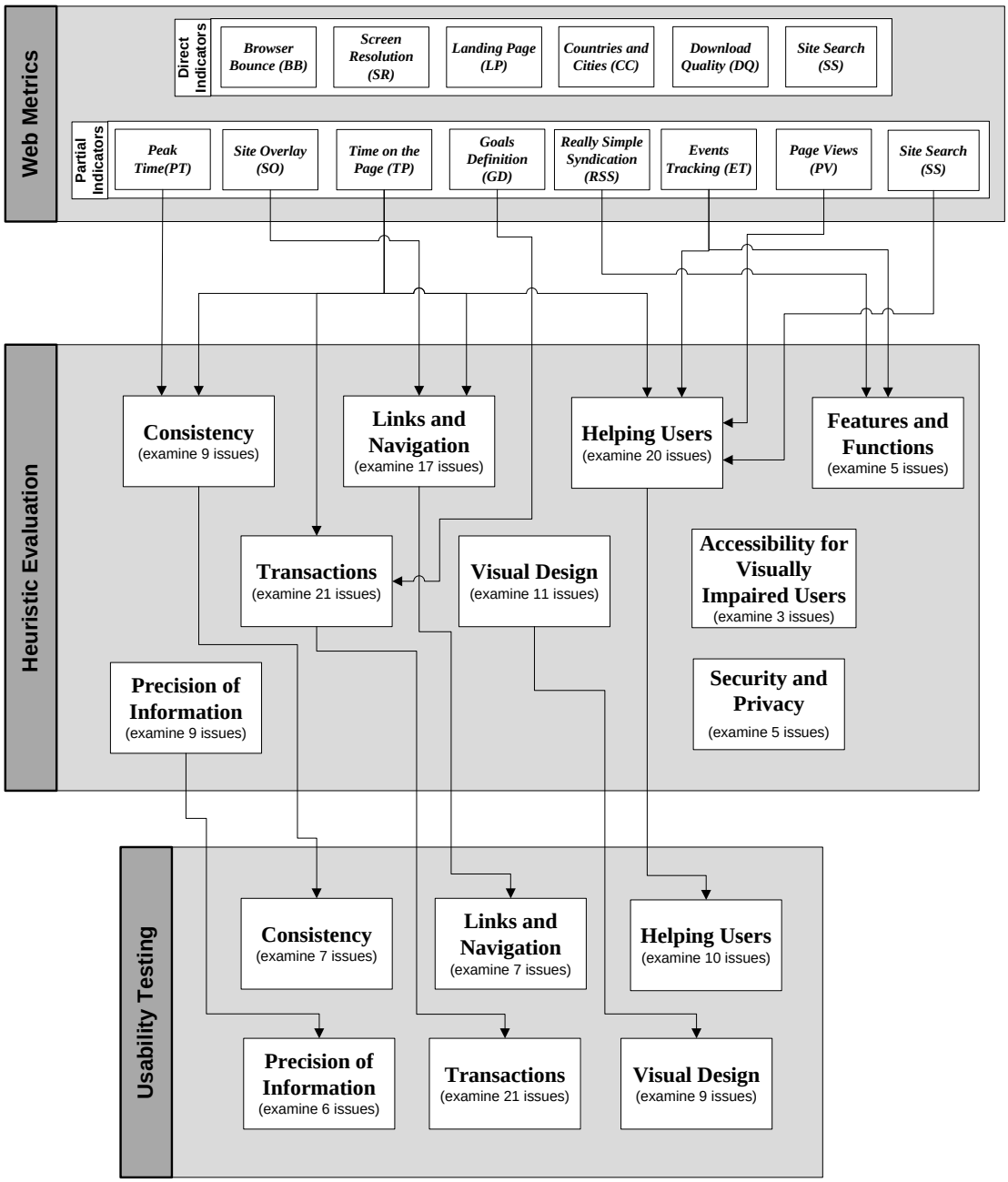


Figure 8.2: The structure of the refined evaluation framework for e-Government website.

Thus, the structure of the refined evaluation framework in Figure 8.2 shows a comprehensive evaluation that involved utilising three methods; this enabled a variety of design issues in e-Government websites to be covered, thereby obtaining an effective evaluation framework. This structure is used in the second implementation, as explained in Chapter 9.

8.5 Summary

This chapter has discussed the first implementation of the evaluation framework for e-Government websites. It was found that not all of the usability problems in the examined website could be identified by using only one inspection method. In particular, each of the usability methods provided useful indications and therefore, by combining all the results under the umbrella of one evaluation framework, a very effective evaluation was produced. This demonstrates the advantages of an evaluation framework that is designed based on several usability methods that combine both qualitative and quantitative measurements.

Furthermore, it has been proved that heuristic evaluation is able to provide a more in-depth investigation compared to web analytics and usability testing methods. In particular, it has been found that web analytics provides some web metrics that are useful in an evaluation of the design of e-Government websites. However, many of the web metrics still need to use qualitative methods to identify the problems clearly. Similarly, usability testing is still required for particular usability principles. Thus, the sequence of the evaluation framework will be amended to use web analytics then heuristic evaluation then usability testing, which should be conducted for specific problems.

Additionally, it was found that there is a need for qualified staff who have sufficient skills to maximise the benefits of web analytic tools and to apply their features properly. In the absence of these skills, other usability methods are clearly required in order to overcome the limitations of web analytics. Despite this drawback, web analytic tools offer some web metrics that can predict usability problems which allow this technology to be used in the early stages of evaluation. This has been used to derive the second implementation of the evaluation framework.

The next chapter, Chapter 9, presents the second implementation applied of the comprehensive evaluation framework on the new version of the Emirate of Makkah website. This will allow a comparison to be made with the first implementation, together with a consideration of any enhancements made in the implementation of the refinements.

Chapter Nine Second Implementation and Applying the Refined Evaluation Framework

9.1 Introduction

This chapter presents the results of applying the refined evaluation framework discussed in the preceding chapter; it also discusses the significance and efficiency of the revised approaches. As with previous chapters, it discusses a case study approach where the framework is applied to the Emirate of Makkah's (EM) website, as an example of the best e-Government website in the Kingdom of Saudi Arabia.

The chapter is structured as follows: Section 9.2 provides a brief of changes that were made on the second version of the EM website, and this shows the effect of the evaluation results of first implementation over the new version. Section 9.3 introduces an analysis of the results of using web analytic tools as the initial method in the evaluation framework for e-Government websites. Section 9.4 analyses the results of heuristic evaluation in order to obtain the evaluators' reviews of the examined site, while Section 9.5 presents an analysis of the usability testing approach applied to the examined site and explains what usability testing found regarding the design of websites as part of the development of a multi-dimensional evaluation framework for e-Government websites. Section 9.6 evaluates the refined evaluation framework and also discusses the ability of each usability method to provide useful information about usability problems. Section 9.7 illustrates some examples to show how the refined evaluation framework can be used in an iterative manner which facilitates the ongoing evaluation of e-Government websites. Then, the summary of the second implementation is presented in Section 9.8.

9.2 New version on the EM site

Prior to the implementation of the refined framework, the EM site received three reports outlining the results of the heuristic, user-test and metric-based evaluations carried out in the first implementation, as can be seen in Appendix 5. This resulted in EM redesigning certain aspects of the website; several enhancements were made and

several drawbacks, which were outlined in the first implementation, were avoided. Issues that have been addressed in the redesigned site can be identified by the √ symbol in Appendix 5. In particular, a number of changes were introduced; these included:

1- Providing a facility to register and login for services, as well as for updating personal information; this was represented in four web pages. This enhancement was indicated in the security and privacy principle in heuristic evaluation (Section 5.3.8) and in the usability testing recommendation (Section 6.5.3).
2- Providing more information in the government agencies' index (governorates and districts) inside the Makkah region. This change can be seen by the addition of one hundred and twenty pages to enhance the issues in this area. This change was highlighted in the heuristic evaluation under the consistency principle (Section 5.3.1) and in the usability testing recommendation (Sections 6.4.2 and 6.5.1).
3- Adding a confirmation page (one page) in the online service request. This issue was mentioned in Section 5.3.5 in the heuristic evaluation.
4- Implementing significant changes in the design of the homepage. In particular, redundant items were removed, the search tool was positioned in a more noticeable place, and the left menu items were removed. Additionally, a new menu template was used across all the web pages on the website. These changes can be seen in Figure 9.1.

The changes noted above meant that a number of changes recommended by the methods in the evaluation framework were implemented. Because of the significant number of these changes that were introduced in the new version of the EM website which constituted a 270% increase in the number of web pages, this led to the need to deploy the revised framework on the new version of EM site. The site map of the new version of the site can be seen in Figure 9.3 where the changes have been highlighted using dashed lines in contrast with the previous version shown in Figure 9.2. This second implementation of the framework therefore used the new version of the EM site, established on 15/06/2009, to perform the analysis.

Figure 9.1 The previous version on the left and the new version of EM site on the right.

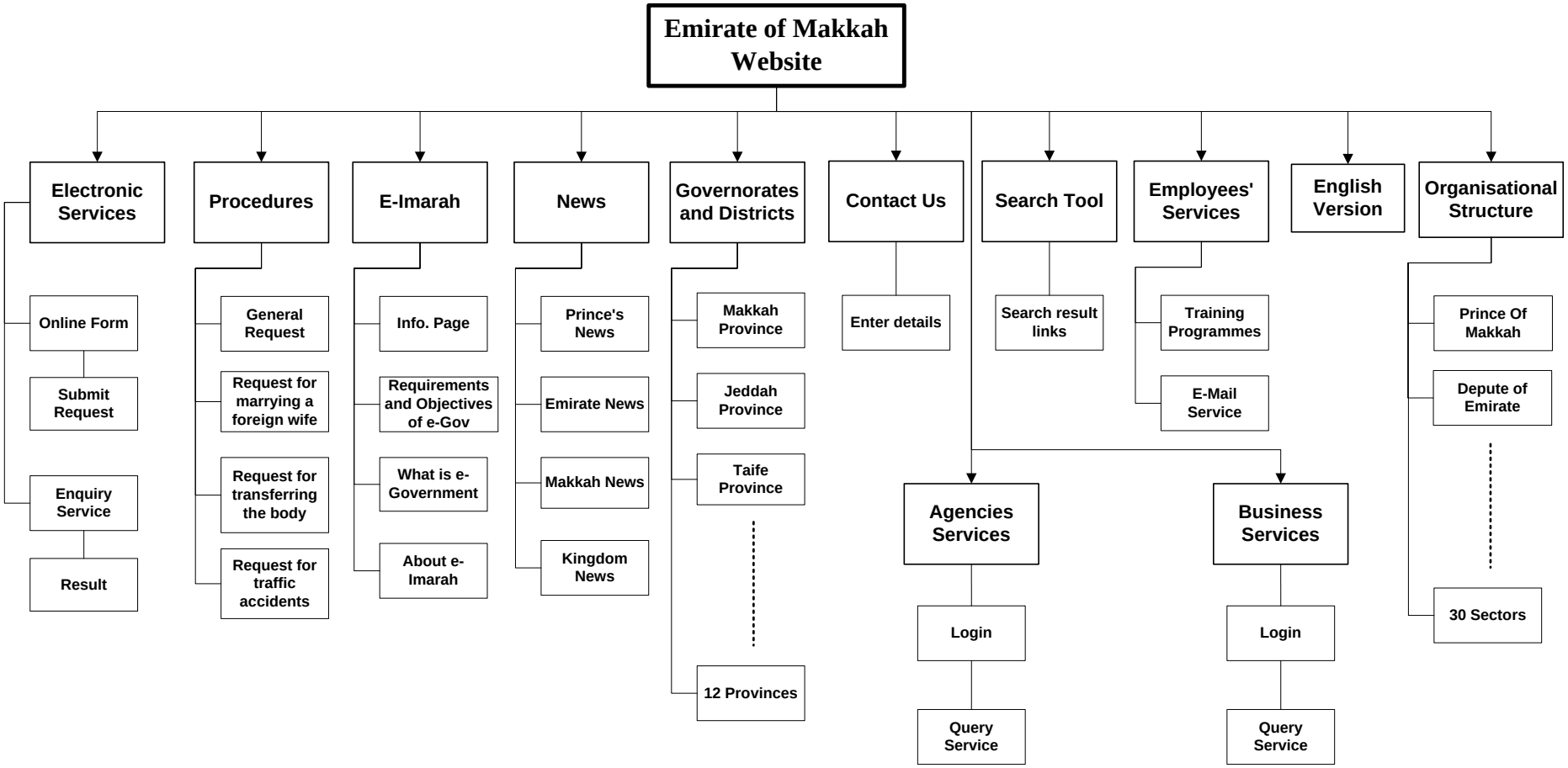


Figure 9.2: Sitemap of the first implementation (previous version) of the EM website

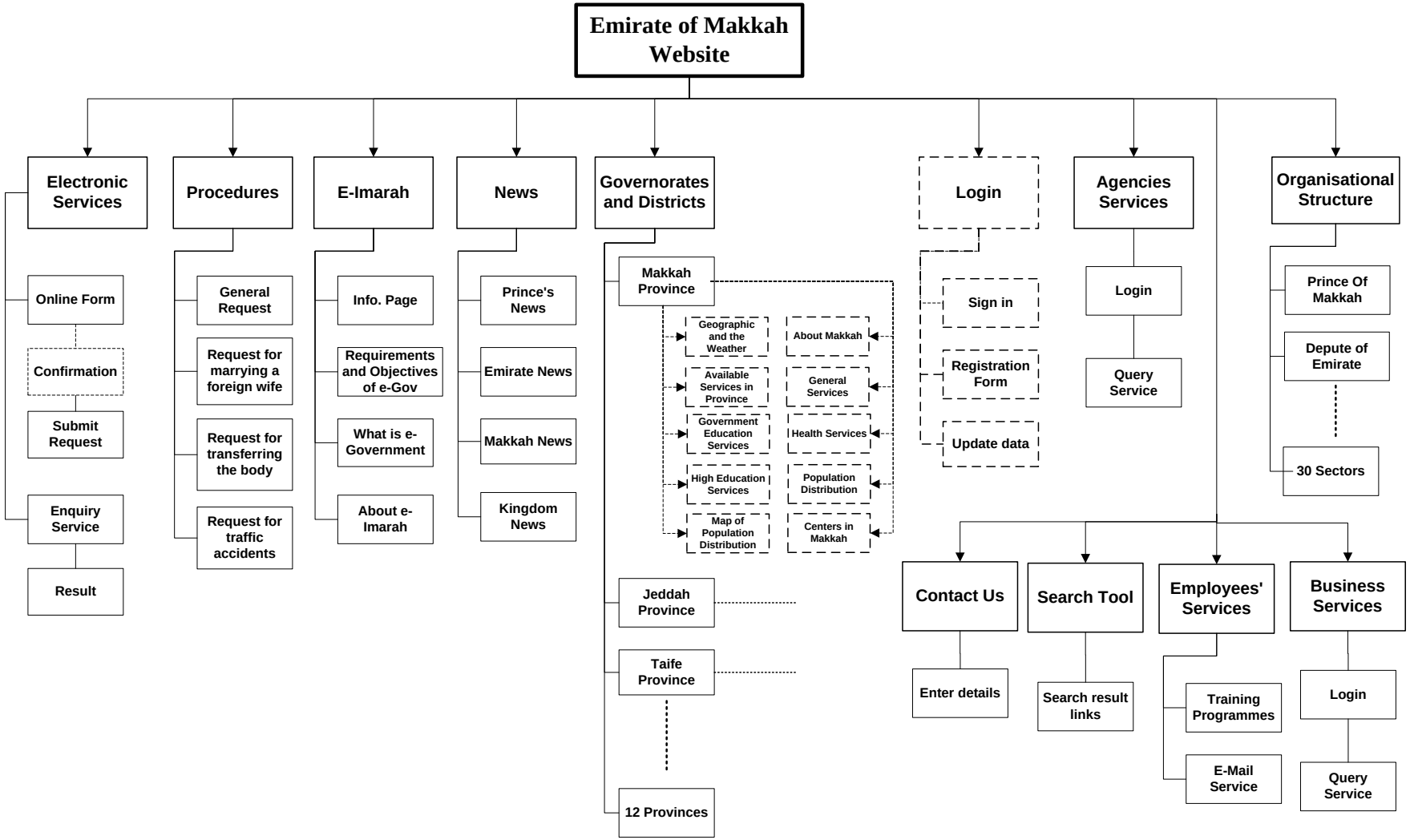


Figure 9.3: Sitemap of the new version of EM website (used in the second implementation)

9.3 Usability Problems Identified by Web Analytic Tools

The period between 15/06/2009 to 01/02/2010 was used to apply the web metrics defined in Chapter 8 using both Google Analytics (GA) and WebLog Expert (WE). However, it should be noted that administrator privileges in GA were given to the researcher in order to avoid some drawbacks found in the first implementation. For example, goals were defined; this allows certain interactions related to registration, online forms and inquiry services to be monitored. Additionally, several problems that were apparent in the first implementation, such as problems related to different time zones (explained in Section 7.4.2) were rectified by adding seven hours to the metrics of GA to obtain real time in Saudi Arabia.

The results of applying the considered web metrics are provided in the following tables. Table 9.1 outlines the web metrics that, depending on their value, should directly indicate usability problems, i.e. the heuristics listed in table 9.1 do not need to be examined in further detail. Because the web metrics listed in Table 9.2 are only indicative of possible problems, these heuristics therefore need to be examined in the subsequent stage. However, potential problems appeared in specific pages, as illustrated in Table 9.2. The issues covered in Table 9.1 and Table 9.2 can be seen in the basic heuristic checklist in Appendix 3.

Web Metrics	Result
Browser Bounce (BB)	The BB metric was used to examine the compatibility of the examined website, as indicated in heuristic 1.1. It was found that most visitors were using Internet Explorer (84%) and the site recorded a 24.62% bounce rate for these users, whereas the rest of the visitors were using other browsers with a higher bounce rate (Appendix 6). Similarly, when considering the use of online forms (the registration form, for example), it can be seen that most users were using Internet Explorer (94%). These results indicate that users with different browsers can navigate the site but with limitations that might be explained by other

Web Metrics	Result
	metrics or heuristic testing.
Screen Resolution (SR)	The SR metric was used to investigate the screen resolutions of the examined site (issue 1.2). It can be seen that that 1024x768 and 1280x800 were the resolutions most used by visitors (Appendix 7). These were common screen resolutions (Krug, 2006) which indicates that most users have resolutions that enable them to view the site properly. So, issue 1.2 can be excluded from examination by further usability methods.
Landing Page (LP)	The LP metric was used to examine whether each page had a title (issue 1.6). By using this metric, it was found that every page had its own, unique page title and so the problem of repeated titles, such as those found in the first implementation, had therefore been solved. Every page did have its own title which might allow users to obtain more information about its contents, and therefore there was no need to examine issue 1.6 by using further methods.
Download Quality (DQ)	The DQ metric was used to examine several heuristics (1.8, 4.1, 4.8, and 8.6): 1- Considering the graphic features used (e.g. images) and whether these were consistently displayed (issue 1.8), it was found that the types of graphic file on the EM site used more bandwidth; they also recorded more incomplete requests (Appendix 8). This can be seen for the image of the header; this was used in all pages and was in JPG format; it shows that the images used on the site produced difficulties. 2- In examining whether audio or video clips were provided in an effective way (issue 4.1), this KPI did not show any use of audio or video clips on the site. 3- In examining the existence of flash files, as indicated in issue 4.8, there was no use of flash files on the site,

Web Metrics	Result
	such as in the last version; other graphical formats had been used. 4- In issue 8.6, which examined the existence of openly accessible private documents, some internal documents were still openly accessible; this is related to security issues. So, issues 1.8, 4.1, 4.8, and 8.6 should be excluded from examination by further usability methods.
Site Search (SS)	The SS metric was used to examine the existence of a search tool (issue 3.1). It was found that the search facility was provided for news only, whereas it was not provided for searching for services. This was determined by filtering for pages containing "/search". So, heuristic 3.1 should be excluded from examination by further usability methods.
Countries and Cities (CC)	The CC metric was used to investigate whether the site was available in other languages (issue 4.2). It was found that this implementation of the site had no English version. This KPI showed that 11% of visitors arrived from outside of Saudi; however, the bounce rate from these visitors was high, e.g. 54% for users from the US (as shown in Appendix 9), indicating that a foreign language version may be necessary. So, heuristic 4.2 should be excluded from examination by further usability methods.

Table 9.1: Results of direct Web Metrics

Web Metrics	Results
Time on the Page (TP)	The TP metric was used to examine a number of heuristics (1.3, 1.10, 1.12, 1.13, 2.12, 3.8, 3.15, 5.8, 5.12). These issues examined several features that can be inspected by looking at the time spent on particular pages. For instance, issue 1.3 examines whether a consistent design was used across all pages within the website. Earlier chapters outline how consistent design could be indicated by monitoring the time spent, as well as the bounce rate, on pages on the site. So, if certain pages exhibited long times or noticeable bounce rates, this might indicate a problem that faced the users. This is applicable for issues 1.3, 1.10, 1.12, 1.13, 2.12, 3.8, 3.15, 5.8, 5.12. This KPI highlighted the pages that recorded high bounce rates, as well as pages that recorded more than average times spent on the site, and this allowed focus to be placed on pages that needed to be examined in more detail. For example, it can be seen that the homepage, the “contact us” page, and the page about the procedures for marrying a foreign wife recorded high average times (Appendix 10). Moreover, this KPI found that other pages, such as the ‘e-Imarah’ page that described the e-Government project, was exhibited a long average time, so this needs further investigation. Also, the “contact us” page showed a high bounce rate. Although, the “contact us” page is considered to be one of the pages from which users may reasonably be expected to leave the site, this page needs to be examined using other methods. This may indicate problems on particular pages which need to be examined by using other inspection methods, and these problems related to issues (1.3, 1.10, 1.12, 1.13, 2.12, 3.8, 3.15, 5.8, 5.12). For example, these results may indicate that consistent design may not be used across all pages within the website (issue 1.3). Similarly, they

Web Metrics	Results
	might be related to the lack of consistent explanations of what is required in data entry fields (issue 1.10). These results also produce results related to the remaining issues (1.12, 1.13, 2.12, 3.8, 3.15, 5.8, 5.12). So, the design of these pages (homepage, contact us, procedure pages, and 'e-Imarah') needs to be reviewed using another method to explore the potential problems that might exist in the search process page. Thus, this KPI highlights the important pages that need to be included in the UT test.
Peak Time(PT)	The PT metric was used to examine the peak access times for the site. This can indicate problems in consistency (issue 1.3) and the ability of users to find the services on the site (issue 1.13). During peak times (Appendix 11), it can be seen that users recorded a longer average time on the site but did not download substantially more pages, and this might indicate a problem in the design of the site. This is an early indication that there is a need for further investigation using other methods. This is a limited result and these heuristics need to be examined thoroughly using the HE and UT methods.
Site Overlay (SO)	The SO metric was used to investigate several issues by monitoring the clicks on the site. For instance, issue 2.7 examined whether the all links were working. The results of using this metric showed that: 1- The SO metric indicates that links did not exist within the body of the text (heuristic 2.3; see Appendix 12 for details). However, because this metric is only indicative, and offers no obvious explanation, this issue needs to be explored by using other methods. 2- The metric informs us that all links are working; hence, there is a possibility to ignore heuristic 2.7 in any subsequent heuristic evaluation.

Web Metrics	Results
	3- For issue 2.4, it was found that appropriate links did not exist within the body of the text on pages. However, it should be noticed that this metric did not show all the clicks on the site. For example, in the online form for updating a user account (see Appendix 13), it can be seen that the buttons did not show any clicks. So, issues 2.3, 2.4 and 2.7 still need to be examined by other usability methods.
Events Tracking (ET)	The ET metric was used to investigate issue 3.9 (whether the site provided documents that could be downloaded) issue 3.10 (the existence of a contact email), and issue 4.4 (the existence of an e-mail list feature that can keep users informed about anything new on the site). The event tracking metric needs some additional code to be added to the target pages. However, EM had not added this code and therefore it was not possible to examine this metric.
Site Search (SS)	The SS metric was used to investigate issue 3.3 (Are the search results described clearly?), issue 3.4 (Is the ranking of search results appropriate?) and issue 3.5(Can the search facility be used in other languages?). To examine this issue, three equations were used, as identified by Hasan et al. (2009): 1- Local Search Engine Usage = (Page Views in search) / (Total Visits) = 0.118613 2- Percent Visits Using Search= (Total Number of Visits during which at least one 'Search Results' page was viewed) / (All Visits) = 0.19% 3- Search Results to Site Exits Ratio = (Total Site Exits from Search Results Page) / (Total Number of Visits to a Search Results Page) = 0.130752. It can be seen that few users used the search tool and these users viewed few pages. This may indicate that a problem

Web Metrics	Results
	exists in using the search tool, or it may indicate that the site is easy and there is no need to use the search tool. So, other usability methods are required to examine these search facilities issues (3.3,3.4 and 3.5).
Page Views (PV)	The PV metric was used to investigate one issue concerned with looking for particular pages. So, by assuming that typical names are used for all pages in the EM site, and by filtering the results, it was found that for issue 3.13 (whether the website contained "contact us" information), that "contact us" page existed which suggests this should be removed from further usability methods. However, one problem emerged concerning the assumption that typical names were used: i.e. it is possible that some pages within the site may not use common or typical naming conventions; therefore other methods should be used. This would be a useful approach if the website is examined by a third party (Yesser). So, issue 3.13, needs to be checked by other methods such as HE.
Really Simple Syndication (RSS)	The RSS metric was used to investigate whether this feature was provided (issue 4.3). The RSS metric could not be used due to the limitations that exist in the EM site. This is because GA needs to add code to monitor RSS and the EM site had not added any extra code. This is similar to the problem with the Event Tracking (ET) metric. So, issue 4.3 needs to be examined by HE.
Goals Definition (GD)	The GD metric was used to examine issue 5.3 (Are users asked to 'confirm' actions before they are executed?), and issue 5.4 (Can users cancel an operation in progress?). One goal was defined on the EM site: i.e. the process of registering new users and entering their data, up to entering their online request (Appendix 14). As can be seen in Appendix 14, that users are

Web Metrics	Results
	able to confirm their online form (issue 5.3), and therefore this issue can be ignored form further examinations. However, for issue 5.4, it was found that fewer than 1% of users left the process for confirming the request (as indicated by the exit between brackets in Appendix 14). Even though only 1% left the process, this still indicates that users were able to exit from the process (as required by heuristic 5.4). However, the metric does not reveal why the users left the process, and therefore further heuristic evaluation is required. In addition, it was not clear whether a cancel button was used to terminate the process, as required in heuristic 5.4. In fact, this information can be obtained by using the ET metric, due to its ability to monitor the use of a cancel button as an event. So issue 5.4 need to be examined by other methods.

Table 9.2: Results of partial KPIs

Web Analytics: Overall Results

It can be seen that the defined KPIs were able to highlight some usability problems and these results therefore influenced the application of heuristic evaluation and usability testing. In particular, the heuristic issues inspected by the direct KPIs will not be examined by other methods. However, many KPIs were only able to provide indications of potential issues, as illustrated in Table 9.2. These indications clearly show the need to use other methods to identify the problems more clearly and therefore, these issues need to be examined by other methods, as will be shown later. Also, when investigating several KPIs, typical page names were used to search for information about particular issues. This process showed that potential problems might exist (for instance, that certain pages might not be present); however, it might also be possible that these pages were present but that they had inappropriate names. This limitation can be overcome by an agency web design team defining guidelines on page naming conventions; this would allow more accurate data to be generated.

Referring to the refined evaluation framework shown in Chapter 8, it is clear that the problems identified by web metrics are divided into two groups: those that directly show usability problems, and those that indicate potential problems without providing sufficient detail about them. The latter type of web metrics, however, need further detail which can be achieved by using qualitative usability methods; in particular, many of the web metrics that provide only indications of problems need specific heuristics to be examined. Table 9.3 illustrates these heuristic principles, as well as the heuristic principles related to each web metric. However, it was found that one issue 5.3 can be excluded from any further examinations, this shows the refinement that can be obtained by WA method.

	Web Metrics	**Heuristic Principles**	**Heuristic Questions**
1	TP	Consistency	1.3,1.10, 1.12,1.13
		Links and Navigation	2.12
		Helping Users	3.8, 3.15
		Transactions	5.8, 5.12
2	PT	Consistency	1.3, 1.13
3	SO	Links and Navigation	2.3,2.4, 2.7
4	ET	Helping Users	3.9, 3.10
		Features and Functions	4.4
5	SS	Helping Users	3.3, 3.4, 3.5
6	PV	Helping Users	3.13
7	RSS	Features and Functions	4.3
8	GD	Transactions	5.4

Table 9.3: The results of KPIs showing the need for further heuristic evaluation

By looking at column 4 in Table 9.3 it can be seen that a number of heuristics still need to be addressed. However, some heuristics (ten in all) do not need any further explanation; therefore, the heuristic check list was amended. (Appendix 15 shows the revised and streamlined heuristic checklist that was given to the heuristic evaluators.)

9.4 Usability Problems Identified by the Heuristic Evaluation Method

As with the first implementation, three web design evaluators, who had a great deal of experience in web design and sound knowledge of web usability, were chosen as heuristic evaluators. Two of these participated in the first implementation, while the new evaluator was equally qualified and experienced, as indicated in Section 3.3.2.1. The designed questionnaire was sent to these evaluators who were asked to perform a heuristic evaluation of the Emirate of Makkah (EM) website. The evaluators were asked to write their notes on the front of each question, if possible. Each evaluator spent about two hours and thirty minutes answering the questions on the EM site, compared to two hours for the first implementation. In other words, an additional 25% of time was spent examining heuristic issues in the second implementation. This was because, despite the ten issues being removed from the checklist, other heuristics had been added as explained in chapter 8. Overall this lead to an increase in the number of heuristic questions that were considered in the refined implementation.

After their evaluation, a discussion was conducted with each evaluator to reach agreement on the problems and potential usability problems that emerged from their evaluations; discrepancies in evaluators' results were searched for and then these differences were discussed until all the evaluators held the same view. This approach for gathering data was illustrated in Section 3.4.2. Figure 9.4 shows the homepage of the examined website (EM). The following sections illustrate this website in terms of the heuristic principles that were examined.

Figure 9.4: The new version of the Emirate of Makkah website

9.4.1 Consistency

Evaluators found that the EM site had several positive as well as negative features, as follows:

- The content of the site was not consistently presented.

- The text and its style in EM were readable and consistent in some pages, such as the homepage, whereas other pages, including the procedures and information pages, had small fonts. Evaluators also found that the text justification was inconsistent across a number of pages.
- Consistent design was not used across all pages within the website. This can be seen in different features on the site: e.g. the menu on the right hand side was not always in the same place (height) and there were some repeated links (as in ”Contact us”) which existed in the top menu and on the right hand side menu.
- There was still a focus on the news and activities of the head managers. One evaluator illustrated this problem by stating:

  “The same problem as before still exists in EM, where their focus is on the news more than services.”
- The most important information was consistently placed in a noticeable position, which makes it easy to locate important information. However, it was found that some repeated items were used which makes it confusing when using them. One evaluator identified this problem as:

  “*The Login boxes are not always consistent, the same field is sometimes called (user name/password) and in other locations (e-mail/password)”*.

- The command buttons (top and right menu) were given a consistent location, which was helpful, and the online services were placed in a noticeable position.
- Headers were easily distinguishable and so were easily readable. This allows users to inspect with ease the contents of each group of commands.
- The level of consistency noted above was also followed in data entry forms; these enable users to be more familiar with the contents.
- Explanations of the data entry forms were not offered in EM. This was found in all online services pages: e.g. create a new account page, and the online form (Figure 9.5).

Of the 9 issues addressed by the heuristic evaluators in the ‘consistency’ section, only 4 were positive. It could therefore be stated that the degree to which the consistency principle was met by the EM site is 44%.

Figure 9.5: A sample of the online form in the EM website

9.4.2 Links and Navigation

In the examined website, some positive heuristics were pointed out by evaluators:

- The navigation was placed in a noticeable position and the groups of links were mainly displayed on the right of the screen which is the most logical place for Arabic speakers. However, services were located in an unclear place in the top menu, as mentioned before. Moreover, these buttons did not indicate which pages had been visited and which had not, and the top menu did not provide indications of the content that would result from following links: i.e. the side view hid its content (Figure 9.4). This could be confusing for users in terms of the pages they had visited so it would be useful to include this feature.
- Inquiry services were located at the top of each page.

- All of links in the examined site were working.
- The link to the homepage was located as the first link at the top of all pages. However, two evaluators suggested that a picture of the logo should implicitly include a link to the homepage. One evaluator identified this as:

  "It is better to have a link on the logo instead of putting it as a separate one. This saves room for other useful links."

However, many problems in the navigational design of the EM site were found by evaluators. These included:

- Some links were grouped (which was good) but it was not always clear what was under the top menu link or who should follow this link. Moreover, links did not clearly indicate what would happen: e.g. if a new page or file would be download. A problem related to this was that colours were not used to indicate links that had been visited.
- There were limited links to other government websites and there was only one link to the Saudi portal in the EM site.
- Outbound links opened in the same window, which may not allow users to keep the existing site open.
- Groups of links were not always used to accelerate the navigation, including the most visited pages and the most frequently downloaded files.
- There was limited use of links within the body of the text. This was found mainly in the news section. This supports the findings of the Site Overlay (SO) metric (Table 9.2) and implies that, in future, SO could be used to identify this issue directly. However, the SO metric contains certain limitations, identified in Table 9.2.
- There were no appropriate menu links to related information. This feature would allow users to navigate easily to related pages.
- Users have to scroll to find information so excessive vertical scrolling on each page was not avoided.
- Repeated links were found in the EM site: e.g. login information, which is considered weak design, as indicated before.

Of the 17 issues addressed by the heuristic evaluators in the 'Links and Navigation' section, only 4 heuristics were positive. It could therefore be stated that the degree to which this principle was met by the EM site is 23.5%.

9.4.3 Helping Users

A few positive heuristic features were identified in the EM site. These included:

- The existence of information regarding contacting the EM site. This result was also indicated partially by the Time on the Page (TP) and Page Views (PV) metrics, as can be seen in Table 9.2. However, a FAQ page, site map and A-Z directory were still missing from the examined site. These problems were found by PV, as indicated in Table 9.2, and this suggests the use of this KPI for these heuristics. However, because the PV metric can only investigate this issue if assumptions are made regarding the use of typical page names this issue still needs to be examined by evaluators.
- The fields in data entry forms were divided into sections and each section contained the title of the data that had to be entered, as can be seen in the 'update user information' page in Figure 9.6.
- Error messages on data entry forms appeared at the head of any form, as well as on next of each field that contained the error. However, although the error message explained how to overcome the problem, it was not applied to all errors in the form, as can be seen in Figure 9.6.

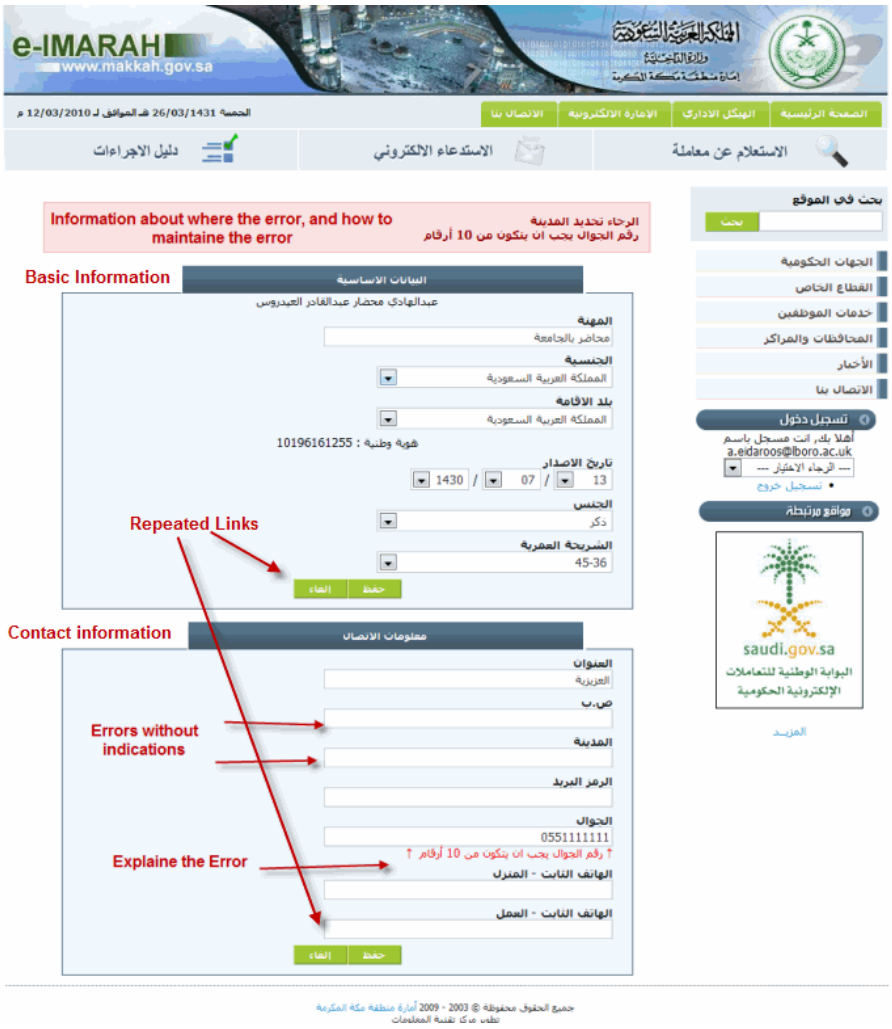


Figure 9.6: Update user information page in the EM site

However, a number of problems were found:

- Evaluators found that the search facility allowed users to search only the news and that a search facility for other services was still not provided. Also, the search facility was limited in a number of ways: e.g. the results did not accurately reflect the topic; these were simply a short paragraph of the news with a link to the particular news item. Moreover, there was no advanced search capability and searches were available only in the Arabic language. It also was noted that commonly used search terms were not provided, and nether was a ranking of search results.
- A feature to download documents was still provided only for employees; such a feature was not provided for citizens.

- The compulsory fields in the data entry forms were not indicated, as can be seen in Figure 9.6, and there were no default values for the entries. This is insufficient for helping users.
- Labels were not used to indicate the field length and fields did not contain a default value; only brief information was offered in the title.
- The explanations of error messages were not clear enough to solve a problem that might have occurred; only a differently coloured label was provided.
- A contact e-mail was not found on the data entry forms. This was provided only on the "contact us" page.

Of the 20 issues addressed by the heuristic evaluators in the 'Helping Users' section, only three heuristics were positive, which is very limited. It could therefore be stated that the degree to which this principle was met by the EM site is 16%.

9.4.4 Features and Functions

Some positive features regarding this heuristic principle were identified by evaluators:

- The site allowed users to copy the contents as well as to paste their information into the fields in online forms.
- A customised printing pages service was available in some pages but, on some other important pages, such as the regulations information page, such a service was not provided.

However, several problems still existed, including:

- The site was provided only in the Arabic language; there was no English version.
- There was no use of RSS and no email list services were provided in the EM site.

Of the five issues addressed by the heuristic evaluators in the 'Features and Functions' section, only three heuristics were positive, which is half of the considered heuristics. It could therefore be stated that the degree to which this principle was met by the EM site is 50%.

9.4.5 Transactions Principle

Evaluators identified a number of positive features in the new version compared to the previous one. These were:

- All the forms were on one page so users could enter data on one page only. However, users were not allowed to save partially completed contents. This lacks flexibility as allowing users to save partly completed forms would encourage them to use online services.
- The attachments were embedded in a suitable box and users could check these easily. However, it was not possible to change the attached files and the names of the attached files were not clear on the confirmation page: i.e. the site had assigned a random number for such files (Figure 9.7) rather than maintaining their original filename. It is important in such cases to allow users to review what will be sent and to allow them to cancel their request if necessary in order to avoid any mistakes. Comparing this result with data provided by the Goal Definition (GD) KPI in WA, shows that KPI such as GD are limited in determining the reason behind the problem presented here. This reinforces the need for deploying a qualitative method.
- A reference number was provided for completed online forms but with the limitation that the details that users entered, such as the attached files and the entered text, were not presented.
- Users were not informed about any delays that might occur although there was no long response time to any click as there was in the first implementation. This result supports the findings of the Download Quality (DQ) KPI in Table 9.1, which showed that flash files were not used compared to the previous version, where such files were a reason for delays recorded on the site. Although DQ showed that other file types recorded problems, this was not recorded by evaluators implying that these files were able to be downloaded without unacceptable delays.

Figure 9.7: Confirmation page for an online process in the EM site

However, a significant number of problems were recorded including:

- There was no use of an appropriate editor to allow users to enter their request letter easily.
- A date stamp was found on the top of all the pages but the time was not provided.
- There were no clear procedures in the online form and users need to navigate to where the procedures are provided, i.e. move to another page. Also, a number of services were introduced without any explanation of their procedures and one evaluator mentioned this problems thus:

  > *"There are about nine services in the online form but only one of them is described in the procedures page. It seems redundant and overlaps the key terms used."*

  This indicates that inconsistent information was found in the site and this may confuse users when applying to use the services.
- There was no email address or contact number to help users solve problems with the forms.
- The forms did not offer users any feedback email concerning the submitted form. Feedback consisted simply of a short message on the screen that informed the user that he/she had submitted a form and a number was given

(see Figure 9.8). Moreover, users were not told about the time required to respond to a request on the online form and users were not informed of which department was currently working on their request.

- With the enquiry service there was no indication of the department that was dealing with the work and their contact email or telephone numbers were not offered either. Moreover, information regarding the progress being made to complete the request and the time required to complete it, was also not provided.

Of the 21 issues addressed by the heuristic evaluators in the 'Transactions' section, only four heuristics were positive, which is less than the quarter of the considered heuristics. It could therefore be stated that the degree to which this principle was met by the EM site is 19%.

Figure 9.8: A number given for a submitted online form

9.4.6 Visual Design (Minimising User's Memory Load)

Evaluators found several positive aspects after considering the visual design heuristics:

- Error messages were placed at the top of the online forms. Moreover, more details found were provided under the fields where an error occurred. However, this feature was not applicable to all fields in the online forms, as can be seen in Figure 9.6.
- The colours used on the site conform to common expectations about colour codes: i.e. they allow the context to be easily distinguished. In addition, the

contrast in brightness between images and background colours was clear and white space was used efficiently.

- Images were primarily used in the logo. However, one picture was used in the top menu in the inquiry service which was not associated with the link. This meant that users needed to click the text instead of using the image.

However, some of the heuristic features had not been adhered to :

- There were groups of links to specific pages and these groups had a title to tell users about the contents; however, this was only implemented for the news section. This was presented in a scrolling side view that enabled the news to be compressed into a small area, which was better than in the previous version. However, the online service links were not provided clearly, as mentioned before. This shows that the priority of services was not presented effectively.
- On certain pages colour/highlighting was not used to indicate the most important parts of the text. This is particularly noticeable in pages containing online forms.
- There was still no facility for users to personalise their page which would have enabled them to interact more with the website.
- The search box did not give users any hints or suggestions about entering data.

Of the 11 issues addressed by the heuristic evaluators in the 'Visual Design' section, seven heuristics were positive, which is a little more than the half of the considered heuristics. It could therefore be stated that the degree to which this principle was met by the EM site is 63%.

9.4.7 Accessibility for Visually Impaired Users

Evaluators found that accessibility features were not applied on the site; captions added to each link or label were also not available. However, two evaluators found that changing the text size in the browser affected all the components on any page and one evaluator mentioned this as follows:

> *"I didn't find special features for disabled people but the Windows features for disabled people work fine with the website."*

Although, this is an improvement on the examined site, it would be useful to add certain features to enable more users to interact with e-Government websites in Saudi Arabia, such as those mentioned in Section 5.3.7.

9.4.8 Security and Privacy

Some of the security features considered in the heuristic checklist had been applied in the EM website:

- Users were logged out when the website was left inactive for a long time.
- The URL did not contain any information about users (e.g. user name or password).

Nevertheless, several features were still absent including:

- There were no links to information concerning the privacy policy. This is similar to the finding of the Page View (PV) KPI in Table 9.2.
- No encryption techniques were employed to show the kind of security that was being used.
- There was no use of a virtual keyboard feature to protect passwords that were entered.

In addition, one evaluator identified a major problem on the "changing a password" page and identified it as below:

> *"The changing password section has a big mistake in it as it does not ask for the current password before changing it."*

This problem highlights a major flaw that should be rectified in the EM site; it also suggests a heuristic that needs to be included in the enhanced checklist. This shows that evaluators were continuing to offer useful suggestions for heuristics that needed to be examined. Of the five issues addressed by the heuristic evaluators in the 'Security and Privacy' principle, only two heuristics were positive, which is less than

the half of the considered heuristics. It could therefore be stated that the degree to which this principle was met by the EM site is 40%.

9.4.9 Precision of Information

Few revisions had been made to the website with respect to information precision and therefore many of the heuristics examined in the first implementation of the framework applied to the second. These included:

- The website uses the official domain name (*.gov.sa*), and the logo appears at the head of each page.
- The agency's structure and the responsibilities of the main divisions and units appear in a prominent location on the site, in the right menu. Also, the organisational charts were found to show the structure and responsibilities of the main divisions and units. However, evaluators found that the details lacked some important information such as telephone numbers, addresses and contact e-mails which might be required by users.

However, the examined website lacked several heuristic features regarding the precision of the information, which included:

- Although a date-stamp was used in all pages, this was limited because it was not associated with an update notation, i.e. site-last-update, which was only found in the homepage; on other pages, such as the online forms and procedure pages, update information was still absent.
- Limited explanations, as well as a lack of detail, were provided for a number of services.
- EM had a general plan for its electronic services but there was no indication of other activity plans that EM would perform in the future.

Of the nine issues addressed by the heuristic evaluators in the 'Precision of Information' section, only four heuristics were positive, which is less than the half of the considered heuristics. It could therefore be stated that the degree to which this principle was met by the EM site is 44%.

9.4.10 Heuristic Evaluation Results

This section compares the findings in the first implementation with those found in the second. Figure 9.9 illustrates the percentage of issues achieved for each principle in the two implementations on the EM website.

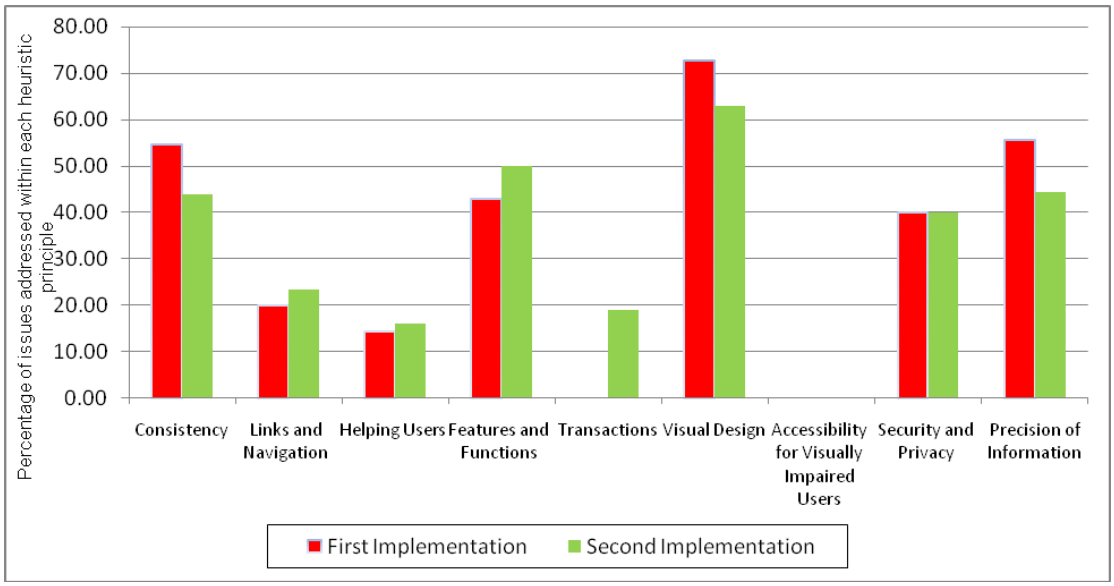


Figure 9.9: A comparison of results using the heuristic evaluation approach for the EM agency in Saudi Arabia.

Figure 9.9 shows that some issues, which occurred between the first and second implementations of the framework, were addressed by redesigning the site. These notably regarded issues that fell under the 'features and functions', 'transactions', 'links and navigation' and 'helping users' principles. However, other issues which were not problematic in the first implementation appeared in the second. These issues tended to fall under the 'consistency', 'visual design' and 'precision of information' principles. It can be seen that the site still needs to pay more attention to usability issues. Lastly, the suggestions of the evaluators were useful in further refining the refined checklist. This was found in the case of changing the name in the data entry forms into a transactional principle. Also, some heuristics were shown to be repeated in some questions; this problem is discussed in Section 9.5.

Thus, it can be seen that heuristic evaluation was able to reveal usability problems to a greater extent than web metrics results as web metrics were able to provide fewer problems for specific issues within main principles. The illustrated usability problems,

as well as the results explained in this section, were used to predict usability problems which could then be used in designing usability testing tasks. This is explored in the next section.

9.4.11 Predicting Usability Problems to Design Usability Testing Tasks

Many problems on the websites emerged from using the heuristic evaluation approach. Previous authors have advised using the results from the heuristic method to predict problems that users might face and then to use these problems to drive usability testing, as addressed in Section 2.6.2. However, in this implementation, web analytics results were also used to derive the tasks in usability testing. So, the issues that emerged, as shown before, were used to design the tasks required in usability testing in order to examine these problems and to identify the 'voice of users'. The following list outlines the issues that need to be addressed in the usability testing and how these issues have been chosen based on the results of the web analytics and heuristic tests. These issues include:

- **Investigating the Site:** A number of usability problems were found in the 'Consistency', 'Help Users', and in the 'Features and Functions' principles. These may be clear from the first reaction of users to the website but they are likely to affect further interactions. So, users need first to be examined regarding their interactions on the site in general terms before going on to in-depth tasks. This includes examining the problems found by KPIs. In particular, the homepage recorded a high bounce rate, and recorded a high average time (TP metric), as outlined in Table 9.2. So, the design of the homepage needs to be examined by users.
- **Navigation:** It was shown that several problems related to navigational features so investigating these problems from the point of view of users is clearly important. This is because users may have difficulty exploring the site and so leave it without fulfilling their needs. In the web analytics results, several metrics indicated potential problems, including the Site Overlay (SO), Event Tracking (EV), and Goal Definition (GD) metrics. However, due to the limitations of these KPIs, as indicated in Section 9.2, the heuristic issues are still in need of further detail by employing usability testing. So, users need to

explore the EM site and investigate the problems that face users while navigating the site.

- **Providing Information:** It was found that information is often presented in an inappropriate way; this comment is related also to the 'Helping Users' and 'Precision of Information' principles which did not score well in the heuristic evaluation. Thus, users might not use the information or it might not be of sufficient depth to satisfy their needs. According to the results from the KPIs, several issues can be included in this task. This was found by examining specific pages, including the 'e-Imarah' page that described the e-Government project, as well as the page of procedures needed for marrying a foreign wife, and the 'contact us' page. These pages recorded a high bounce rate and were in great demand by users; therefore, examining these pages was included in this task. So, users need to explore the EM site, and the problems that users face while obtaining the information from the site also need to be investigated.

- **Online Service:** Providing online services via a website is one of the most advanced features that users are seeking. However, it was shown by HE that many issues under the 'transactions' principle were not met by the EM site and so it is important to examine these services to indicate users' views of these features. In the results from the KPIs, no unambiguous results were given, as indicated in Table 9.2. This indicates that transaction issues need to be examined by utilising other usability methods.

It should be noted that the search facility had been investigated by the heuristic evaluation and therefore there was no need for further detail concerning this issue. This shows that the order of applying the evaluation framework reduces the amount of tasks that need to be examined by usability testing as well as the time need for this method. It was therefore found that four tasks needed to be examined by users via usability testing. This included exploring the homepage of the EM site, exploring the content of pages in the website, examining the features in the site, and performing an online service. These tasks can be seen in Appendix 16.

9.5 Usability Testing

The EM website testing was conducted in the Library Laboratory at Loughborough University; this laboratory has a wireless network connection and the researcher used the same machine, as mentioned in Section 6.2, to record these experiments. Moreover, a similar scenario was used with each user: i.e. the total time spent with each individual user was about two hours. The designed scenario depended on the results of HE and WA but, in particular, the following tasks were followed and participants were asked to:

- Answer verbally a user background questionnaire.
- Answer verbally the questions about their initial impressions of the site.
- Navigate the examined site and locate information.
- Perform real-world tasks (applying for an online service and creating a new account) on the site and perform appropriate searches.
- Finally, answer the post-test interviews: i.e. verbally answer questions about their overall satisfaction.

The refined evaluation framework allows the tasks examined in usability testing to be minimised, as well as reducing the time spent in conducting the UT. This illustrates the usefulness of employing the evaluation framework to derive a more streamlined approach. Participants were asked to answer some primary questions verbally. These were required to obtain background information in order to validate that the participants that were selected. The results can be seen in Table 9.4.

Age	
18-25	0
25-30	0
31-40	5
41-50	
Over 50	
TOTAL (Participants)	**5**

Gender	
Women	1
Men	4
TOTAL (Participants)	**5**

Using a Personal Computer	
Less than 1 year	0
1 year	0
2-4 years	0
Over 5 years	5
TOTAL (Participants)	**5**

Work Experience	
Less than 1 year	0
1 year	0
2-4 years	0
More than 5 years	5
TOTAL (Participants)	**5**

Computer Usage	
Several times a day	5
Once a day	0
Once a week	0
More than once a week	0
Once a month	0
TOTAL (Participants)	**5**

Work Type	
Public Sector	3
Private Sector	2
TOTAL (Participants)	**5**

Using a Government Website	
Never	0
Less than 1 month	3
More than 1 month	0
More than 6 months	2
More than 12 months	0
TOTAL (Participants)	**5**

Table 9.4: A summary of participants' profiles in the second implementation

The following sections illustrate the analysis of the conducted tasks. This includes an analysis of the recorded sessions, as well as the generated problems that the researcher identified from users' feedback.

9.5. 1 Task 1: Exploring the Users' Initial Responses

At the beginning of this task, users were asked to spend five minutes exploring the contents of the homepage without clicking on any link. Then, five questions were asked to discover the participants' perceptions.

When initially exploring the site, each user looked to the right menu; this matched their expectations and indicates that the EM website has positive features regarding the most appropriate position for the menu (on the right) which is useful for Arabic readers. Then, users had to scroll down the homepage, as not all the content could be seen without scrolling. It was observed that users could explore the contents of the homepage easily; they could read the content easily due to the colour or the font used. Moreover, the questions asked of the users indicated that participants felt comfortable because the site used a noticeable logo which gave them an impression of the formality of the site. This reassured participants that the content available to the public would be reliable.

However, users felt that the order of the menu did not match their expectations since they were looking for citizens' services rather than other services for business, or even for government. This was because the top menu, where the citizen services were located, was displayed in a different style which was confusing for users: i.e. it did not indicate its contents. In the EM site, this information was contained in a side view which contains all the electronic services for citizens but participants felt that the way that this side view menu was inconvenient. Due to the findings from the analytics and heuristic testing, the news section in this version was not examined by participants as it was in the first implementation.

The above results indicate that the EM site, to some extent, had some positive features. However, the top menu, where the services for citizens were placed, was the main problem that might affect the use of the online services.

9.5.2 Task 2: Navigation of the Site

In the second task, users were asked to navigate through the EM site and were given ten minutes to do so. At the beginning of the task, users used the right menu and went through each menu item. They appreciated the convenience of placing the navigation menu on the right and used it all the time. This menu was found in a fixed place across all pages on the EM site, which is the most appropriate position. However, the other menu (the top menu) needed to be used in order to access some of the online services. This menu was less usable for the evaluators. This shows a problem in the design of the menu structures where participants struggled in several places. Some of the positive and negative features uncovered include:

1- There was no time delay between clicking the button to open the required page in the navigation. This was noted in all the navigation conducted on the examined site and indicates that the navigation in the new version is easier to operate than in the old one. However, this might be related to using a different Internet connection and carrying out the testing in the UK. Despite this, from the Download Quality (DQ) results, it was found that flash files, such as those used in the previous version, were not used here and this accelerates the navigation. This shows that DQ is useful to examine such problems.
2- On the whole, users found it easy to navigate through the examined site and several factors played an important role in this. For example, the menu template was applied on all pages. This included all the contents of the site, as well as a noticeable link to the homepage. However, the top menu did produce some difficulties for users, such as the embedded links inside this side view.
3- Several problems were encountered on a number of pages, including those for training employees and those containing information about areas in the Makkah region. For example, participants felt that reading the contents was inconvenient because the font which was used was small and therefore inappropriate for comfortable reading.
4- Several pages looked untidy and did not give clear messages. For instance, on the information page about the central Makkah regions (see Figure 9.10), the image is located, without any alignment, next to the description whereas, in other pages, similar images were located under the description. Also, there

was no standard format for such pages, according to some participants. Presenting such information in a standard template would allow users to discover such content more easily. This may account for the lack of coherence in the description of the content which was unclear to users.

Figure 9.10: Areas in the Makkah region page

5- Participants felt that the ‘Procedures’ page contained few descriptions of the necessary details for applying for services. It contained four items, which participants thought to be limited; they expected to find more procedures available on the site.

6- On the electronic services page, as can be seen in Figure 9.11, some users found that this page lacked an appropriate header to tell users about the content. There was also a mass of information provided in a small font and, as a result, users could not identify the content easily. One participant thought that there were some limitations concerning the text:

> *“They say “we built this webpage individually” but it looks like there was a lack of cooperation when building this site.”*

Figure 9.11: Electronic services page

7- In the training programme page, some users felt that there was too much content: i.e. it was just a large block of tables including a great deal of text; no pictures or diagrams were used to explain the contents. This page can be seen in Figure 9.12. Users who navigated to this page started reading it but found it too time-consuming to continue so they moved on to explore other links. This page indicated that excessive vertical scrolling still existed widely in the EM site and that the method of presenting the contents was not motivating for users.

Figure 9.12: Training employees' page

9.5.3 Task3: Examining the use of an online service

At the beginning of this task, participants had to create a new account in order to be able to apply for an online service. So, participants were asked initially to create a new user account on the EM site. Participants took some time to identify where they could accomplish this task because the location for creating a new account was placed under the right menu (Figure 9.4). Two participants advised that the location of 'users' password' or 'create new user' should be at the top; they felt this would be clearer.

Participants then clicked onto the 'create a new account link', which opened a new page that contained only three fields that users should enter: e-mail address, password, and confirmation of password (Figure 9.13). Three users thought that these details were insufficient for creating a new account and suggested that asking for more

details (e.g. national ID, names and addresses) would give users greater confidence in the site. Two users mentioned the lack of security in this page as users were not asked to verify their email or use a clear message to state the degree of security used to protect personal data. This shows there is a need to examine this security issue in the website; on further consideration it may be that this issue could be addressed through the heuristic evaluation.

Figure 9.13: Create a new account page

After submitting the account registration form, participants received a confirmation e-mail that contained the details entered; there was also a link confirming the registration. Although all users felt confident with that email, one user thought that using only the Arabic language was not sufficient; the English language should also be used:

> *"Millions of pilgrims are visiting Makkah every year, and they don't speak Arabic. This should be in English also."*

Participants then clicked on the link which opens the site and a message at the top of the page told users that the registration was confirmed. Users felt that such a message needed to be in a better format (i.e. in a bigger font); they also wanted to know what came next after such messages. One participant described this problem as follows:

> *"What I should to do next? The message is not clear. Is that all?"*

This problem arose because the language used in messages for users was not obvious, and this emphasised the problem identified by evaluators in HE. Users then attempted to find where the login boxes were on the page. Another problem that faced users concerned the title of the user name that had to be entered in the login boxes. They needed to enter ’user name’ but the users entered their e-mail address in the registration process. This confused users about what data they needed to enter. Also, there was another login box at the top of the page, inside the side view. This made users uncertain about which boxes they needed to use. Two users entered their data at the top whereas three users used the box on the right. This shows that, as well as inconsistent labels, there is some repetition that may confuse users - this problem was also highlighted by the heuristic evaluators. Users then entered their email address and password which were accepted. Participants found that there was no clear indication to tell users that they were inside the system. However, users noticed that their email addresses appeared where the login boxes were. Four users suggested that this was not a typical place for the user account to appear and they advised that this should be in a more obvious place, such as under the top menu, and in a noticeable colour or font.

Next, participants continued their task and pushed the online form button. This opened an ‘update account details’ page. Users commented that although this information is required, another way should be used to encourage users to enter it, such as a message to encourage users to complete the registration in the confirmation email. In this form, users needed to enter their personal data: e.g. name, ID (number, date, place of issue), address (street name, destination, P.O. Box), occupation, email, telephone number (home, mobile, job, fax).

When users entered their data, two problems occurred: there was no indication of which fields had to be filled in and there were repeat confirmation buttons, as shown in Figure 9.6. Moreover, when two users made a mistake on this form, the error indicators appeared at the top of the page in a different colour. However, this was not the case for all the fields that contained a problem. Participants corrected the errors and pushed the button; then a message in a small font appeared to say that the data

were entered correctly. Four users suggested that the font needs to be bigger than the existing one.

Participants then clicked the online form to access the desired request, which was an application to marry a foreign wife. The request for the online form appeared with two list boxes and one text box with additional attachments (Figure 9.5). Users selected the first list, which users needed to choose in order to find where the request was provided, which was at the EM centre. Then, having selected the service they needed, users felt confused because a number of requests appeared without any explanation about each request. Although four users clicked on the procedure link where an explanation was supposed to be provided, only four procedures were actually explained whereas, on the online form request, nine other procedures were listed without any link being provided between the two groups of procedures.

All the users felt disappointed by this problem and were stuck for a significant length of time until using the general request procedure was suggested; this was one of the items in the list box. Users then wrote the appropriate letter in the text box but four users thought that an improvement needed to be made to this editor: e.g. change the font size to make it bigger or bolder, as well as changing the alignment of the text.

This shows that the existing technology being used to obtain the data was inadequate because such a feature is required to be interactive. For example, one participant suggested allowing users to enter a letter in an interactive form that is changeable depending on the service that is demanded; this would then show the required fields and would satisfy EM regulations:

> *"Allowing users to enter their information in an interactive form with proper details should be used for each request."*

This is a useful suggestion because it makes the requirements obvious to all users. In addition, it helps in transferring such information without the need to interpret the letter to extract the information. This shows that ordinary manual routines were still influencing the use of the online form.

After participants entered their letter, they needed to attach three documents, as mentioned in the procedures page. Users entered the first file and its name appeared after the loading process; a similar action was performed for the second file. However, users could not enter the third one as the load button became inactive and turned a gray colour without reason. All the users struggled with this problem and this took a while to solve. However, no hints were offered related to this problem: i.e. there was no help or explanation concerning the required attachments, such as the file type or number of files, as users thought there might be. Users thought they might find help or a contact email on the same page but such features were not available in the online forms. Some users went back to the procedures page to check the requirements but they were still confused because the online form would still not accept more documents to be attached.

Other users thought to use the ‘contact us’ page in order to find a way to solve this problem. These users then clicked on the ’contact us’ button to obtain the required help. On the ‘contact us’ page, users found they needed to enter their details: i.e. their name, email, address and their request from the EM site. Although all of the users who went to this page entered these details, two users felt that such personal data should be taken directly from their account and that there was no need to repeat this process. A potential indicator of this problem had already been identified indirectly by the Time on Page (TP) metric where this page reported a high average time on the site. However, it was clear from the data collected from the users that the user testing method provided a much richer and more detailed picture of the precise usability problems.

After that, all users clicked the submit button in the online form to send their request and then a confirmation page appeared with the data already entered. However, the content of confirmation page lacked several features. For example, some users thought that the current data and the time should be included; they also felt that the alignments of the data could be introduced in an official way near to the labels. Another problem that worried users was that when users attached two files, only one attached file appeared in the confirmation page but with a different name, as can be

seen in Figure 9.7. Users felt the need to check the online form again and an obvious button to update the form was used.

Participants returned to the online form and found that the two attachments had disappeared while an unknown file had appeared. This lead to feelings of uncertainty because no explanations were given regarding the action that had been taken. Participants tried again to attach the documents and two files were attached; the submit form was then clicked. Users found themselves again with the same problems in the confirmation page. They felt concerned on that page because no explanations were offered and users found that they needed to submit the form in order to know what action would be taken.

After the participants submitted the form, a short message appeared with a reference number. Participants felt that this message was too short and came with a lack of information regarding the entries (Figure 9.8). Users were then asked to check their email to find a confirmation email. In fact, participants were not given any immediate email feedback regarding the submitted online form. This shows the lack of help provided to users in the EM site.

After that, users were asked to execute an enquiry to find out about their views using the reference numbers given for a number of online requests they had previously made. To do this, the participants used the top menu and selected the enquiry link and wrote the given reference number. Three users tried to click onto the image next to the edit box, as they thought it was a button, but it did not show anything. Then, users hit the enter key. This shows that the use of images here was inappropriate. It was noticed that the status bar which shows the progress of loading files, such as that used in the previous version, was not used here. However, there was no delay in presenting the results.

The result then appeared with the reference number of the request, the date the service application was made, the date when the order was issued from the EM, the agency where the order was to be executed, and the state of the request similar to that in previous version. However, users felt that such information was insufficient as more

information needed to be presented: e.g. details about the department working on the request and when the decision would be taken. This actually shows that the EM site still has the same problems as those found in the first implementation.

9.5.4 Post-test Interviews

After participants had completed all the assigned tasks, some questions were asked verbally to obtain their opinions and suggestions for the EM website. Participants found that the design of the EM site did not match their expectations. There were several reasons for this, as stated by participants:

1- The information provided was not easy to read, due to the styles used and the lack of information provided, and the jargon language used, and users felt that more information could be included:

> *"This site represents one of the most important agencies in the Kingdom; it services millions of pilgrims who come to Makkah every year. They have to provide a real service, and better than what I saw."*

2- Participants stated that the top menu for citizens' services was not clear and did not motivate them to read the contents of the page. Moreover, it was felt that the order of the menu items was not what users were expecting and that links to services were not the priority.

3- The existing online form disappointed the participants and it was thought that enormous work is required to improve this online service. Moreover, all users felt that there was little or no help provided with the online form. The form should contain clear instructions to help users complete the fields efficiently and appropriately. In particular, providing explanations of procedures with each kind of request was essential.

9.5.5 Discussion and Implications of Users' Responses

Two main findings can be determined from the results of the analysis of the usability testing.

1-Firstly, the results from the usability testing emphasised the problems found by the heuristic evaluation defined in Section 9.3. The user tests clearly provided richer data about some of the particular problems that had emerged from the heuristic evaluation: for example, providing an interactive form for online services. More importantly, some problems that were indicated by the web analytic tools: e.g. problems regarding the 'contact us', procedures, and 'e-Imarh' pages, were found to exist but again, examining users was necessary to provide definite details about these problems. Despite this fact, it can be seen that the KPIs used in the analytics stage did provide useful indications that helped to derive the tasks for usability testing. These results support the adapted evaluation framework considered in Chapter 8. Thus, usability testing is still able to produce more detailed information about certain usability problems, therefore this method still needs to be used.

2- Secondly, more problems were defined by observing users' interactions, as well as by listening to users' recommendations. These issues can be utilised to enhance the design of e-Government websites in Saudi Arabia, as well as to enhance the heuristic checklist designed in this research, as explained in the next section. These include:

- Helping users' principle
    - Does the website use clear language that enables the user to identify the contents easily?

- Transaction principle
    - Is the feedback email provided in the English language?
    - Does the feedback email arrive within a reasonable time?

9.6 Discussion of the Second Implementation

In this implementation the order of the usability methods was changed so that web analytics formed the basis of the practical evaluation. This was followed by carrying out a heuristic evaluation in order to examine a number of heuristics. Then, usability testing was undertaken to emphasise and expand the issues examined by the WA and HE methods, and to share users' opinions in order to learn what problems they encountered.

The order of implementing the evaluation methods in the refined evaluation framework allows for focusing on the potential features in the above order. In particular, the use of KPIs in web analytics allows some usability problems to be focused on, which allows qualitative methods to focus on other usability problems. This shows that KPIs are able to identify specific problems. Heuristic evaluation was used to examine other kinds of problem; then, usability testing was used in order to seek the opinion of users on specific problems. Thus, using all of the methods in the refined evaluation framework provides a comprehensive evaluation for the examined site.

It can be seen that each usability method has its own potential advantages; these allow each method to provide valuable results, as follows:

1- *Web Analytics*: in this implementation, a small number of problems were found that could be inspected by the considered KPIs. However, more importantly, the results from the KPIs highlighted the most important issues: e.g. pages that recorded noticeable readings such as average times or bounce rates. Therefore, this was used in deriving usability tests (heuristic tests and user tests) which emphasised the problems in such pages. This illustrates more practically the features that exist in web analytics.

2- Heuristic Evaluation: This method is still able to identify a large number of usability problems. Moreover, the results of usability testing suggested that two more heuristics needed to be included. These were in the helping users principle (1 heuristic) and in the transactional principle (2 heuristics). Moreover, evaluators thought that some heuristic questions were only expansions of others and therefore might constitute some kind of repetition. For example, heuristic 1.1 asked about consistency features in the site whereas other questions were asking for details of this broad question. This note might be used to enhance the designed checklist to avoid any redundancy. However, it is believed that asking more questions produced more accurate results, which enabled the heuristic method to cover a number of usability problems with definite results.

3- Usability Testing: The results from both the previous methods were used to design the tasks in this method. Participants found similar problems to those found by the previous methods but in richer detail. Moreover, some further problems emerged from the users, such as those mentioned in Section 9.5.5, and therefore some issues can be included in HE checklist (three issues). This supports the idea that the usability method is still able to provide useful results and needs to be utilised in the evaluation framework.

It is important, after each implementation of the comprehensive evaluation framework, to review the generated results in order to improve the framework's efficiency. For instance, if issues appear when using the UT method, these issues could be included in the HE checklist in order to accelerate inspection of such problems for future users. This can be seen by considering the first implementation where two consistency issues, two navigation issues, and fifteen issues concerning the transactional principle were added to the HE checklist as a result of user testing. If necessary, these issues then can also be validated by UT or they can be ignored from further application of the UT method. For instance, two more issues were added to HE under the consistency principle when refining the evaluation framework (see Chapter 8) but these issues remained in UT. However when the UT method was deployed, as shown in Section 9.5, no additional evidence was found regarding these issues so it was decided that these issues could be ignored from further evaluation using the UT method. However, in terms of those issues that showed considerable change between the first and second implementations, these might need to continue to be validated using the UT method. In particular, the transactional issues need to be validated; in fact, it is an important principle that users are always able to add further comments.

Further evidence of continual evaluation of the framework can be seen in the following example. In the discussion and implications of users' responses (Section 9.5.5), it becomes clear that an additional heuristic: "Does the website use clear language that enables the user to identify the contents easily?"; should be added to the HE checklist. It is clear that this issue could be partially considered by using Time on Page (TP) metric as users might spend more time on a page owing to the use of jargon. So, this KPI can be used to examine this issue. This illustrates how both the

refined HE checklist can be enhanced and how the indication resulting from KPI can be used.

Consequently, the refined evaluation framework supports the idea of using three evaluation methods in a particular order (WA, TE, then UT). This enables usability problems to be identified in more depth and in a more detailed way, which, in turn, allows the designed sites to be improved more thoroughly.

However, potential limitations probably exist in implementing the contents of all the methods in the refined evaluation framework. In particular, it was found that the qualitative usability methods (i.e. HE and UT) were very costly in terms of both time and money. For example, in HE, three qualified evaluators participated in this study and a number of meetings were conducted with them, as shown in Section 6.2.3 and 9.4. Additionally, in UT, five qualified users participated and about two hours were spent with each user, as shown in Section 9.5. This shows that both HE and UT were costly in terms of selecting appropriate participants and in the time taken to conduct the meetings. Therefore, this might produce limitations in implementing all of the methods in the evaluation framework. Thus, those organisations that would like to perform the refined evaluation framework should have sufficient resources to cover the requirements of all the methods in the framework.

Despite these limitations, WA enables the number of usability issues examined by other qualitative methods to be reduced. Furthermore, WA allows specific problems to be focused on for each subsequent method. Importantly, WA was both faster and less costly than the other usability methods. Thus, the limitations of using HE and UT may be overcome by considering implementing the evaluation framework on two different time bases or periods: a short or long period, as follows:

1- The short-period implementation should be conducted every quarter or monthly, which requires the web metrics defined in Table 9.1 and Table 9.2 to be employed; this can be achieved in a short time and using few steps. Then, these web metrics could be used at an early stage to avoid any difficulties that might later cause serious problems. However, many web

metrics still require further explanation by using HE, and HE itself is able to offer more in-depth analysis. So, HE could be used only to examine those problems that need to be validated or scrutinised; this could be achieved focussing on particular issues related to each KPI. Lastly, UT could be used, if necessary, to check certain problems that could not be inspected thoroughly using the previous methods. This actually shows that qualitative usability methods (HE and UT) are still required for particular principles, which could be considered to examine specific design issues. Thus, implementing the KPIs may indicate problems at an early stage and help to indicate which further methods need to be used. Several samples to show implementation over short periods of time can be seen in Section 9.7.

2- The long-period implementation should be conducted less frequently, e.g. annually. This needs all the contents of the three methods (WA, HE then UT) to be employed. This implementation could be used to refine the evaluation framework and to enhance the version implemented in the short time period. The implementation explained in this Chapter follows the long period implementation where each method was used comprehensively (i.e. every heuristic issue was considered and a full range of user tests were performed).. This kind of implementation might be conducted by those organisations that are responsible for monitoring the e-Government implementations; these are considered to have sufficient resources to enable them to apply the comprehensive evaluation framework.

These two types of implementation are likely to be useful in order to carry out continuous evaluation of the e-Government websites. Furthermore, using two kinds of implementation (short-period and long-period) could help those agencies that might face limitations in terms of their resources in performing all the contents of the methods in the refined evaluation framework. However, both types of implementation should be carefully managed to ensure that the evaluation is used to identify all usability problems. The following section explained by examples the using of a short period implementation.

9.7 Using of the Refined Evaluation Framework on a Short, Regular Basis (Short-period implementation)

In order to illustrate how the refined evaluation framework could be used on a short, regular basis (e.g. monthly or quarterly), this section provides some examples to explain its use. Therefore the following three examples briefly explain how HE or UT tests can result from specific KPIs . The examples are:

Example 1- Suppose that the Site Search (SS) metric for monitoring the search tool on the site showed that few users used the search tool and that these users viewed few pages. This might indicate that the search results were not described clearly, or the results were not ranked properly, or the search could not be performed in another language. Although this KPI can be used as a direct indicator (to examine the existence of a search tool), this metric can also provide partial indications of other issues. Figure 9.14 shows that this KPI needs further heuristic evaluation to investigate the highlighted issue in the 'helping users' principle. It can also be seen from Figure 9.14 that there is no need to apply the UT method for any findings identified by the SS metrics.

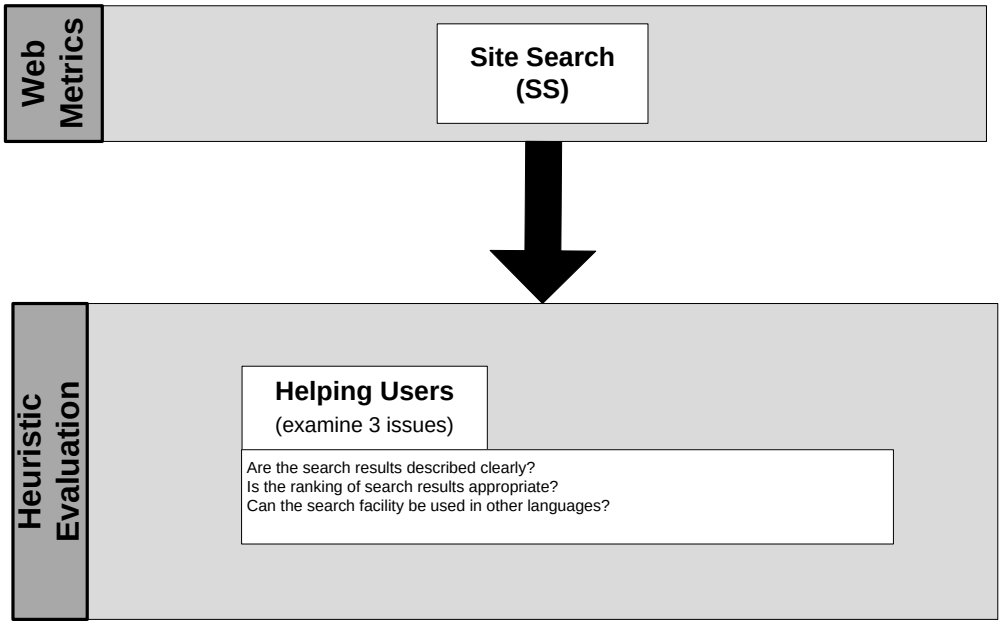


Figure 9.14: Example 1, the using of SS KPI in the evaluation framework.

Example 2- Suppose that the Time on Page (TP) metric shows an unexpectedly high reading for the time spent on particular pages on the examined site (e.g. See Table 7.8). Figure 9.15 shows that this may be due to issues covered by four heuristic principles: ‘consistency’, ‘links and navigations’, ‘helping users’, and ‘transactions’. This can be seen in more detail in Figure 9.15 where the actual issues related to the TP KPI can be seen in the heuristic evaluation box. Therefore these 10 issues (covering 4 heuristic principles) need to be examined by the heuristic evaluators. Figure 9.15 also shows that after the HE, only three further issues related to transactional issues need subsequent evaluation by the UT method. Lastly, those pages that show unusually high readings for the TP KPI should form the basis of the tasks to be undertaken in the user-test method.

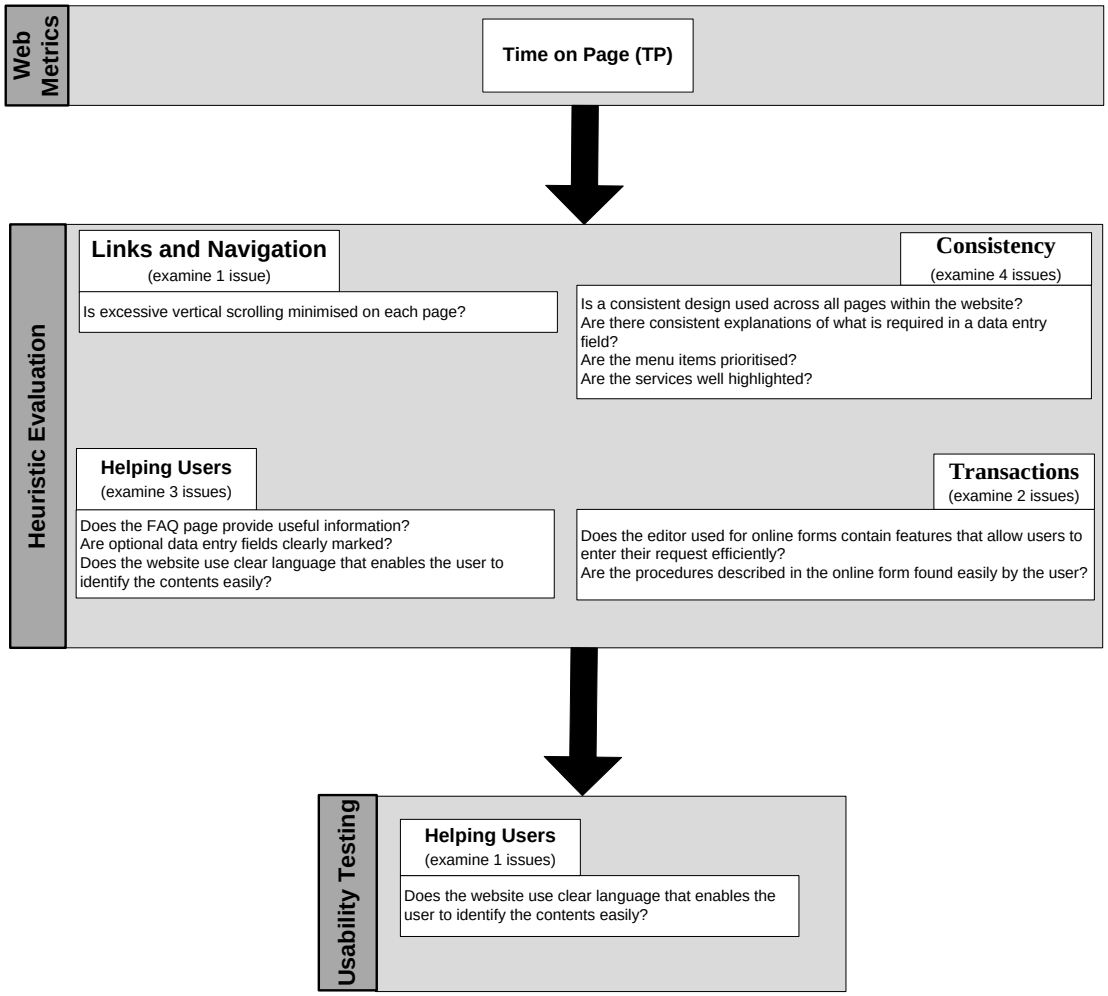


Figure 9.15: Example 2, the using of TP KPI in the evaluation framework.

Example 3- Suppose that the Download Quality (DQ) metric, showed that some graphics or multimedia files showed a considerable number of incomplete requests (e.g. See Section 7.3.7.2 and 7.3.7.3). Because this is a direct KPI, the KPI can clearly indicate the most often downloaded files, which may recorded the highest incomplete requests; they also used a considerable amount of bandwidth. This is an indication that such kinds of file may be causing problems and their use needs to be reviewed to avoid causing problems for users. Therefore there is no need for the further use of the HE or UT methods.

The above examples have shown briefly the way in which certain KPIs are used within the evaluation framework to instigate particular heuristic or user tests. Appendix 17 shows the HE issues that need to be investigated should the other KPIs identify potential issues.

9.8 Summary

This chapter has discussed the second implementation of the refined comprehensive evaluation framework on the new version of the Emirate of Makkah website. The implementation consisted of using three methods in a specific order so web analytic tools were used first, followed by heuristic evaluation and then by usability testing. This order of implementation offers the opportunity for each method to examine particular issues which, in turn, allows the amount of issues examined by each method to be reduced. Moreover, this order allows the tasks for the usability methods to be derived in a more effective way. Thus, the adopted evaluation framework provides a comprehensive evaluation that enables e-Government websites to be evaluated effectively. Additionally, the implementation of the refined evaluation framework should be conducted over short and long periods; this allows the evaluation of e-Government websites to be both ongoing and comprehensive. The next chapter (Chapter 10) presents a discussion and the findings of this research.

Chapter Ten: Discussion

10.1 Introduction

This chapter discusses the results achieved in this research through the two implementations introduced in Chapters 4-9; it is conducted by referring to the considered aim and objectives outlined in Chapter One and the literature review offered in Chapter Two. The chapter begins with Section 10.2 that explores the feasibility of employing the designed evaluation framework for e-Government and includes feedback from three government agencies in Saudi Arabia. This section discusses both the effectiveness of the evaluation methods used as well as their difficulties. Section 10.3 offers an assessment of the considered evaluation framework for e-Government websites and Section 10.4 provides a summary of the chapter.

10.2 The Feasibility of the Designed Evaluation Framework

In order to obtain feedback regarding the final revised evaluation framework, further interviews were conducted with three agencies: the Emirate of Makkah (EM), Yesser, and the Saudi e-Government Achievement Award (*eAward*). These agencies were introduced in Section 2.3.3. Three senior managers and three technical staff participated and two main issues were discussed in the interviews: the effectiveness of the designed evaluation framework and the possibility of using this evaluation framework in government agencies in Saudi Arabia. These interviews were based on in-depth semi-structured interviews, as illustrated in Section 3.8.1. The interview schedule is outlined in Appendix 18. The issues which arose in the interviews are explained in the following sections.

10.2.1 Overview of the Designed Evaluation Framework

It was felt that the designed evaluation framework covers wide areas that are included in e-Government. A senior manager in Yesser said:

> *"I am happy to see this broad evaluation framework that is using the latest technologies; it is really good work."*

Similar feelings were also expressed from the *eAward* and EM agencies. It was thought that this evaluation framework is indeed able to investigate usability problems in e-Government websites.

However, some concerns concerning the designed evaluation framework were expressed regarding the fundamental responsibility for performing an evaluation using the framework. In other words, who would be responsible for carrying out the evaluation. A participant in Yesser stated:

> *"The use of several usability methods to perform the evaluation of e-Government websites highlights the need for qualified staff as well as sufficient support to accomplish this evaluation, and our agencies are not prepared for that right now. Yesser should perform this evaluation."*

A senior manager in EM agreed with this and stated that the staff at EM are too busy carrying out their daily work. However, a senior manager from *eAward* partially disagreed with this opinion because he felt that improving any agency should come from the inside of each agency and said that some of the evaluation methods could be applied internally:

> *"The development should start from inside each agency. Yes, this evaluation needs qualified people to do it but, where this does not exist, each agency can use part of this evaluation. I can see that web analytic tools could be the first step to doing this."*

The components of the designed evaluation framework for e-Government websites involve using several usability methods, which allow a detailed analysis of the examined website to be made. However, it could be difficult for each agency to implement this individually in Saudi Arabia because of the lack of qualified people, as well as a lack of support in terms of insufficient budgets. In particular, however, Yesser would seem to be in an appropriate position to perform this evaluation for all the e-Government websites in Saudi Arabia although this route should not rule out developing each agency individually. For example, each government agency could play a gradually increasing role in carrying out this evaluation. In particular, the defined KPIs could be monitored by each agency and this would offer several benefits such as protecting the site by using the *Download Quality KPI* to find openly

accessible documents. This could be helpful in encouraging regular development in each agency. In other words, the framework could be used as a developmental tool by each agency as well as part of an ongoing summative assessment process deployed by Yesser.

A related issue regarding the evaluation framework concerned the time needed to implement all the usability methods. A member of Yesser voiced some concerns about the amount of time that would be required to implement and analyse the several usability methods identified in the evaluation framework:

> *"Currently, the time needed to implement these methods could be a problem, because we are looking to perform this evaluation quickly. It also needs some changes in our structure as it needs some staff to perform such work."*

A participant from *eAward* agreed with this statement because *eAward*, as well as Yesser, has found itself under pressure to produce evaluation reports quickly and therefore there were some worries about the time required to perform this evaluation. For the EM site, it was stated that they could not perform all the methods in the evaluation by themselves because members of staff were busy, and no particular member of staff was assigned to carry out this evaluation.

It is time-consuming to perform all the methods in the designed evaluation framework and the evaluation of an e-Government website should be undertaken by using several methods because of the need for the evaluation to be wide in its scope, as indicated in Section 2.2.3 and in Chapter 9. The combination of using both qualitative and quantitative methods means that each usability method is able to focus on specific issues, and therefore the evaluation framework is able to provide a holistic, and more in-depth, evaluation of e-Government websites. If the evaluation of e-government websites is to be taken seriously then multidimensional frameworks, such as that presented here, are necessary. By using web metrics at an early stage in the process, evaluation time can be reduced as time is not spent evaluating aspects of the site that are causing few problems. However, although the importance of evaluation was generally understood by the interviewees, this importance and the time required to perform extensive evaluation does not seem to be fully appreciated. Although the work outlined in this thesis was received very positively by various government

agencies in Saudi Arabia, it may be that further education on the importance of evaluation and the time involved is needed.

10.2.2 Limitations in the Designed Evaluation Framework

A member of *eAward* mentioned that the study focused exclusively on citizens whereas e-Government covers more sectors:

> *"e-Government websites target not only citizens, but in addition they target businesses, other government agencies, and visitors from other countries and people who just seek information about Saudi for any reason."*

This is an interesting comment which highlights important sectors within the e-Government remit, as explained in Section 2.2.1. In particular, the three main sectors are: government to citizens, government to government, and government to businesses; this study focuses mainly on government to citizens. The reason for this limitation was that some difficulties were encountered in gaining agreement to access certain critical data from several agencies in Saudi Arabia: e.g. acquiring access to a Google account and being provided with some documents; as a result, the Emirate of Makkah website was chosen. This agency has achieved a national award three times as the best website in Saudi Arabia and this made it a challenge to examine this site. However, there were limited services in the selected agency (for example, many services were for citizens only) and therefore other sectors in e-Government were not well covered.

Moreover, participants from Yesser and *eAward* thought that distributing surveys would be useful in this evaluation framework as these could be used to obtain users' views in contrast with usability testing. In fact, a number of important issues surround the use of surveys: for example, the design of the survey is important in terms of identifying how it can be analysed (i.e. whether a quantitative or qualitative method should be used). Thus, any survey method needs further exploration if it is considered for use and this requires further examination, in terms of validation and verification, of the whole evaluation if such a method is used. In this research, however, the usability methods combine quantitative or qualitative results that together provide insightful evaluation for the e-Government website. For instance, usability testing is a

qualitative method that observes the interactions of users while they are performing tasks; it provides details concerning the problems that users may face on the site. On the other hand, as in this research, web analytic tools provide results that can be categorised as quantitative data.

10.2.3 Factors Negatively Influencing the Evaluation Framework

During the interviews, further concerns were discussed regarding the application of the designed evaluation framework in Saudi Arabia as a developing country. Several issues regarding management and technical themes were discussed, as explained in the following sections.

10.2.3.1 Technical Issues Affecting the Implementation of the Evaluation Framework

The arguments offered in this area concerned the evaluation methods being used and their limitations. In the interviews, the following limitations of each usability methods were pointed out:

1- Using Web Analytic tools:

a. Limitations of the defined KPIs in web analytic tools:

It was thought that the defined KPIs might not accurately define a number of problems. A member of *eAward* thought that the defined KPIs were not able to provide an analysis that was sufficiently insightful:

> *"For some KPIs such as, in the list at the top, Time on Page and Peak Time KPIs; these might not be excellent KPIs because they may not properly describe the problems on the site."*

Similarly, the same issue was mentioned by participants from EM where a particular metric was highlighted:

> *"Using only bounce rate or exit page metrics, you are unable to find problems."*

Moreover, a member of Yesser mentioned the same:

> *"Despite the problems found by the KPIs, it is still a small number of problems."*

Despite one interviewee suggesting that bounce rates and exit pages may not be the most useful metrics, this interviewee was unable to offer more appropriate metrics that would help to pinpoint usability issues. In fact, in this research, the most appropriate KPIs to evaluate e-Government websites were identified. It was shown previously, however, in Section 9.6.3, that web analytics precisely identified only a small number of problems so the participants' criticism may be valid if such metrics are used alone without a clear link within the evaluation framework. This is due to the following reasons:

1- In the designed evaluation framework, it was identified that a number of metrics did not directly identify particular problems. In other words, they were partial indicators of problems; such problems need to be investigated using other qualitative usability methods. However, these metrics are useful for pointing out the potential problems that might occur and are therefore useful for deriving the tasks to be undertaken using other usability methods, as indicated in Section 8.4 and Section 9.3.11. This is one practical contribution that this research has made.

2- It was shown in Section 9.6 that the implementation of the refined evaluation framework should be carried out over two time periods (long and short periods). In the short period implementations, the use of KPIs enables particular issues to be identified within the HE and UT methods, as illustrated by examples in Section 9.7. Therefore, using KPIs in the short period implementations possibly accelerates the evaluation and enable this evaluation of e-Government websites to be continuous. This is one of the contributions made by this research.

b- Limitation of using the free tagged page tool to collect data traffic

Using a hybrid method to collected data from log files and tagged page approaches was challenging in this research; it expands the results generated from traffic data. However, interviews from both Yesser and *eAward* felt that it could be inappropriate

to analyse both approaches for several reasons. For example, by using the free Google Analytics tool, increased anxiety was felt about the confidentiality of government data. Such worries concur with views expressed in the literature which addresses problems concerning privacy in using a third party to collect cookies' data, as identified in Section 2.5.3.1. However, the UK's approach, which makes a clear statement of policy on the use of cookies, could be adopted, as indicated in Section 4.4.4. In addition, the example of the US might be useful in addressing this problem. In the United States, the Government Office of Management and Budget (2009) advises using cookies with specific configurations; this includes how privacy is maintained. Furthermore, the Federal Trade Commission Agency is responsible for monitoring the use of cookies by businesses in the United States (McCarthy and Yates, 2010). This management structure could be useful for implementation in Saudi Arabia. For example, Yesser or *eAward* could state the configurations for using these cookies and could also be responsible for monitoring the use of cookies.

c- Authority to obtain access to log files and the tagged page tool

A Yesser member, as well as the senior manager of *eAward*, thought that it was difficult to have log files as well as having access to the tagged page tool. In this research, as indicated before, only one website was formally examined because of the lack of cooperation of several agencies in Saudi Arabia. Their reluctance to cooperate was due to the need to obtain the log files and gain access to their Google Analytics account. However, as Yesser is the body that is responsible for implementing e-Government in Saudi Arabia, it does have the necessary authority to access such data if it so wishes.

2- Using the Heuristic Evaluation Method

The Emirate of Makkah did not undertake the heuristic evaluation method by itself. There were several reasons for this: firstly, this work requires paid evaluators and EM did not have a budget available for this; additionally, the Emirate of Makkah considered that such work needed a member of staff to analyse questionnaires and all its staff were busy with their daily tasks.

Nevertheless, a Yesser employee believed that such an evaluation should be conducted by Yesser, as indicated previously. Actually, this usability method is costly in terms of finding evaluators; it also needs qualified staff to perform the evaluation and then to objectively analyse the results. This shows that an independent organisation, such as Yesser or *eAward*, is more able to perform such an evaluation. However, if any government agency wishes to use such a method, it needs a sufficient budget, as well as a particular member of staff to carry out the analysis. A member of *eAward* highlighted some concerns about the scale used to record the evaluators' views in the designed checklist:

> *"Why yes or no? What about using a scale of 1 to 5 or a similar one; for most of the checklists, you need a better scale."*

This is an interesting comment because using a scale for questions would add a statistical dimension, enabling the views of evaluators to be analysed and thus allowing for a more in-depth analysis. However, in the designed checklist, two closed-ended choices (Yes, No) were provided as answers. This approach was chosen because it produced definite decisions which reduced the ability of evaluators to be indecisive and choose 'middling' answers (Saunders et al., 2007, p.360; Pickard, 2007, p. 187). Furthermore, evaluators cost money, which increases the cost of the evaluation. Although, for e-Government websites, such costs may be fairly minimal when seen in terms of the large project that is currently being undertaken in Saudi Arabia and so it might be helpful to use more evaluators and to change the questionnaires' answers into a scale, there is still a need to support this method by allocating a sufficient budget and, as the final interviews with *eAward*, Yesser and Emirate of Makkah showed (see section 10.2.4), there are major concerns about the ease with which this budget could be found.

Further comment was obtained from an *eAward* participant about the need to consider the suitability of using mobile phones to access e-Government websites:

> *"What about accessing the website from mobile devices? I suggest adding one or more questions in the checklist regarding this. The numbers of people accessing the Internet through mobile phones are increasing, so this should be taken into consideration."*

This dimension was deliberately omitted from the methods derived for this research. However, it should be noted that visitors using mobile phones on the examined site showed a slight increase, as indicated in Section 7.3.6.2 (i.e. 1.52% of visitors to the examined site were using mobile phones). In fact, this is a challenge for e-Government websites, which are attempting to provide greater access to government services (Ntaliani et al., 2008). Thus, further research to examine the evaluation of e-Government websites for mobile phones would be interesting.

3- Using the Usability Testing Method

In the EM site, the existing method of usability testing is performed based on feedback about problems in the site sent in by e-mail. This feedback is usually sent to all members of staff in the computer department at the EM. However, this approach to usability testing is far from accurate for of two reasons. Firstly, usability testing requires the opinions of actual users whereas EM use their own IT staff to carry out this testing, as indicated in Section 2.5.2. Secondly, usability testing is actually an observation method that records users while they are performing particular tasks, as indicated in Section 2.5.3; using emails does not allow such an approach to be conducted. These limitations occurred because of problems with allowing users to enter the Emirate of Makkah building, as well as the need for a particular member of staff to perform the analysis, which the EM did not have. These limitations are similar to those mentioned before in Section 10.3.2 concerning the role of Yesser in performing this evaluation. This shows the need for Yesser to adopt usability methods in their strategy for evaluating e-Government websites. As a result, the current and future plans need to state clearly how usability methods will be implemented in each agency; they should also identify how this work will be monitored. This would be useful in promoting both the work and the use of this method.

10.2.3.2 Management Issues Affecting the Implementation of the Evaluation Framework

In this area, the interviewers highlighted several issues related to management. It was generally felt that the staff in the computer department were currently fully occupied with their daily work; there was also a lack of training sessions provided for the IT staff and, as a senior EM manager mentioned, more qualified staff are required:

> *"We have a limited number of specialists for our daily systems; it is too difficult to have more staff. We made a request to have more qualified people two years ago and nothing has happened so far. Also, no professional training is available for our staff to cover the requirements of e-Government. It is the problem of a limited budget."*

In line with the literature regarding the management issue, Sarantis et al. (2009) emphasised the need to change the management of e-Government in order to respect the wider scope of e-Government development. This is because the wide scope in developing e-Government can produce complex problems. These concerns have been highlighted in this research on e-Government in Saudi Arabia several times, including in Section 2.2.7 and Section 4.2. Thus, the points noted above emphasise the need for a significant amount of work to be done in managing the government's work and, in particular, its staff. This is an important area that needs to be examined carefully and improved in order to gain the most effective work from staff.

Moreover, the budget for the Emirate of Makkah is within the budget of the Interior Ministry and the money allocated to Emirate of Makkah to develop their website was thought to be insufficient. Therefore, the Emirate of Makkah site was built internally without any contracts with specialists to build and, in particular, to maintain the website. This limited budget reflects the progress that has been made. For example, the technician for the website is also the systems administrator for all the working systems in the Emirate of Makkah (there are about 12 systems); he is busy with his current work and this has therefore resulted in the second version of the Emirate of Makkah site not performing as well as may be expected, as explained in the second implementation discussed in Chapter 9.

A senior manager from Yesser agreed with the idea of providing a 'ring-fenced' budget to each individual agency in Saudi Arabia, and identified the approach that is currently used by Yesser to address this problem:

> *"Most of the agencies are in need of qualified persons to perform their work online in a good website, but the agencies supported by Yesser have solved*

> *this problem by getting a third party to carry out developments on their site in order to avoid this problem."*

This might be a useful solution to the problem of the limited budget allocated for the development of e-Government, especially since Yesser will be the body responsible for the evaluation of e-Government. However, two related issues are important regarding the approach used currently by Yesser. Firstly, the vision for the development of e-Government should be wider than merely transforming the current processes into an online version. This is because all government work will be in an online format and therefore the current staff will need to be gradually integrated into the new systems. Thus, the current staff need to participate in future developments and it may not be appropriate for a third party to undertake the entire development. Secondly, the Yesser budget is still limited, as investigated in Section 4.3.5, and therefore this may increase the amount of time required to transfer government work into an online version. A participant from Yesser agreed with this and stated Yesser's approach to this problem:

> *"The lack of a sufficient budget is facing all sectors in e-Government in Saudi Arabia and we are planning to increase our budget for the new plan period of the next five years; it will be doubled to 10 billion Riyals."*

Despite this large increase in the budget, it may still be insufficient to accelerate the development in e-Government in Saudi Arabia. This is because this increase covers the plan for the next five years; it is also still far short of the expenditure committed in developed countries for the development of e-Government, as addressed in Section 2.3.4. According to the literature, it has been shown that developing countries are still lagging behind in terms of increased implementation and utilisation of online services (Elshikh et al., 2008). In the case of Saudi Arabia, Al-Shehry et al. (2008) broadly defined a number of factors affecting e-Government in Saudi Arabia: for example, changing management and enhancing organisational structures. However, the importance of providing sufficient funds for e-Government and the influence this will have on the implementation of e-Government has not yet been addressed in the case of Saudi Arabia. In fact, the results of this research have shown clearly that providing an adequate budget is a major factor that the Saudi government needs to consider more carefully; it needs to support the development of e-Government more

generously. So, the Saudi Government should pay more attention to providing sufficient funds for the development of e-Government as this will help to accelerate the work in order to provide online services.

In this regard, it would be useful to follow the findings of this research in terms of implementing the evaluation framework over both long and short periods. In particular, it was shown in Section 9.6 that a short-period implementation of the refined evaluation framework can be used without applying of all of the framework's contents: i.e. the use of KPIs followed by examining small and particular issues with HE and UT. This enables a partial inspection to be made of important problems using a relatively cheap method. Thus, each agency in Saudi Arabia should use the short-period implementation and perform it regularly to evaluate its website; this enables evaluation to be continuous. However, Yesser should perform the long-period evaluation, as well as monitoring the short-period evaluations. This solution enables the implementations to be separated and allows an organisation to monitor effectively the continuous implementations; thus, useful and efficient results can be obtained regularly.

10.3 Assessment of the Considered Evaluation Framework for e-Government Websites

This section discusses the aim, objectives and research questions against the results of the case study and its refinement, as well as the feedback identified in the previous sections. This discussion explains the adopted evaluation framework and then assesses each usability method to indicate its contribution.

10.3.1 The Adopted Evaluation Framework

This research has, in practical terms, employed a theoretical evaluation framework for e-Government websites provided by Thompson et al. (2003). The contents of this evaluation framework produced useful quantitative and qualitative results that were able to offer insightful views of the problems facing e-Government websites. It was found that the use of several usability methods enabled detailed problems to be defined. As seen in the literature, much research still uses few usability methods to

assess e-Government websites. For example, Verdegem and Verleye (2009) devised a comprehensive model for measuring user satisfaction that used a quantitative survey, focus groups and interviews but without using any other usability methods. Furthermore, Magoutas and Mentzas (2010) proposed a semantic adaptive framework for monitoring citizen satisfaction with e-Government services; this was conducted by using questionnaires in order to obtain citizens' views; no use was made of other usability methods. Other research, carried out by Alshawi and Alalwany (2009), developed evaluation criteria for an effective assessment of e-Government. In their approach, qualitative data were obtained from interviews with senior and operational staff; a survey was also used to obtain citizens' perspectives. In line with the literature, however, the use of a few evaluative methods may produce incomplete and misleading results, as discussed by Wood et al. (2003) and Barnes and Vidgen (2006), as indicated in Section 1.5. Other research by Hasan (2009) proposed a usability framework for e-commerce websites. Hasan's research used three usability methods: usability testing, heuristic evaluation and then web analytics, using only tagged pages. In contrast, this research has employed two implementations and was found that the order of implementing the methods is vital in order to obtain most effective results. In particular, this research has used firstly web analytics (hybrid approach which covers tagged pages and log file analysis), then heuristic evaluation methods, this is followed by usability testing where the results of pervious methods were used to derive usability testing tasks.

Thus, the combination of usability methods used in this research has allowed a practical implementation and has attempted to respond to the powerful demand for a better e-Government evaluation approach. The designed evaluation framework, which used a logical sequence of different usability methods, allowed detailed usability problems to be identified, as well as assigning particular method for evaluating particular issues. Importantly, the implementation of the refined evaluation framework over two periods (short and long) enables the evaluation of e-Government websites to be continuous, as indicated in Section 9.6. This enabled improvements to be made to the design of e-Government websites in Saudi Arabia in particular, and could be generalised for other countries in the world.

10.3.2 Usability Methods in the Evaluation Framework

In this research three usability methods were used (web analytic tools, heuristic evaluation and usability testing). These methods have been used in two different orders to examine their ability to discover usability problems. This section discusses each method in order to explain the benefits of the preferred order of implementation.

10.3.2.1 Web Analytic tools

In this research, the combination of using log file analysis and the tagged page approach offered several useful indicators. It was found that critical problems were identified by the KPIs that were used; e.g. download quality metrics showed openly accessible documents. However, other metrics showed noticeable readings without any details of the existing problems, e.g. pages with high bounce rate. Therefore, such indicators were categorised as partial indicators that drew attention to problems but which were in need of further explanation by using other usability studies. Greater benefit accrued from partial indicators in deriving particular tasks for usability testing; this was undertaken in the second implementation in Chapter 9. Additionally, it was found that KPIs are useful in order to implement the evaluation framework. In particular, in a short-period implementation, KPIs can be used, followed by HE and UT which are used to examine a small number of issues. This allows a quick, cheap and continuous evaluation to be conducted. Then, long-period implementations should employ all the contents of the methods; this should be used to refine the evaluation framework, as illustrated in Sections 9.6.

However, some concerns have been raised about the use of Google Analytics, as illustrated in Section 10.4.1. These concerns have been addressed by advising the use of a similar approach as that used in the United States, as indicated in Section 10.4.1. Recent research that investigates the use of web analytic tools still uses only one approach at one time: e.g. the tagged page approach in Plaza (2009) and the log file approach in Black (2009). This research, however, has shown the benefits of using a hybrid approach although, as explained in Section 1.3.3, few research projects have advised the use of both approaches regarding data traffic. This approach has been practically implemented in this research where the use of a hybrid approach enables data traffic to be investigated in more depth.

Similarly, recent research by Black (2009) advised that analysing traffic data is only needed in usability studies to expand the results: e.g. when using usability testing to examine user behaviour. In fact, this research has also come to this conclusion and leans towards examining the implementation of quantitative and qualitative usability methods which allow for more in-depth evaluation of e-Government websites.

10.3.2.2 Heuristic Evaluation and Usability Testing Methods

The heuristic evaluation method was used to examine a large number of design issues by using the feedback of three evaluators. This usability method was able to identify a considerable number of usability problems. In particular, nine heuristic principles, that contained more than ninety heuristics, were examined. However, these were still the views of evaluators and their views are claimed as suggestions for improving the site. Therefore, further explanation is required to identify the motivations behind the behaviour of local users. This would allow a detailed explanation of usability problems to be obtained, as well as the views of local users. Despite this limitation in the heuristic evaluation method, the results of heuristic evaluation are useful for deriving particular tasks in usability testing. This allows specific problems that need further explanation to be focused on as well as enabling the observation method to be then used for specific problems.

As illustrated in Section 2.3.5, heuristic evaluation is able to identify the tasks that are required to be examined in usability testing. Thus, this research sought to integrate this usability method with the quantitative method of web analytics. This allows the number of heuristics to be slightly reduced. Thus, heuristic evaluation is able to investigate the most significant number of visible usability problems in the website. In line with the literature, recent research by Thyvalikakath et al. (2009) has found that heuristic evaluation is helpful in determining the usability problems at an early stage in usability testing. This has actually been implemented in this research and following this approach has been shown to be useful. More importantly, this research shows how to use web metrics to concentrate on particular potential problems that can then be used to design usability testing.

Lastly, the usability testing method was used at the end of the evaluation, and the results of both the web analytics and heuristic evaluations were used to derive the tasks of this method. This order of implementing the different inspection methods was highlighted in research for using the results of heuristic evaluation to derive the specific tasks in usability testing, as indicated in Section 2.3. In this research, however, it was found that the results of the quantitative method (web analytics) were helpful in focusing on particular pages that needed to be examined by users. So, this identified how each usability method could be used.

10.4 Summary

This chapter outlined how the aim and objectives have been achieved in this research. It also illustrates the practicability of the designed usability evaluation framework for e-Government and explains the different issues surrounding its use. Furthermore, particular limitations regarding management and technical issues are also discussed; this includes views concerning each usability method. It has been found that there is a need for better understanding of the scope of e-Government in Saudi Arabia, which is in need of a massive budget in order to push forward its development.

Chapter Eleven: Conclusions and Recommendations

11.1 Introduction

This chapter presents the conclusions of this research and discusses how its aims and objectives have been achieved. Moreover, the chapter presents research limitations and offers recommendations for future work. The chapter is structured as follows: Section 11.2 introduces the objectives of this research in the light of the results that have been achieved. Section 11.3 provides a summary of the contributions of this study, Section 11.4 illustrates the limitations of this research, and Section 11.5 suggests future research that might be undertaken from the findings of this work.

11.2 Achieving the Objectives of the Research

The aim of this research was to develop a user-centred multidimensional usability evaluation framework for e-Government websites that can be used iteratively to encourage and improve usage in Saudi Arabia. In order to achieve this aim, an existing evaluation framework created by Thompson et al. (2003) was adapted in an attempt to raise awareness of using different usability evaluation methods in the e-Government sector in a developing country in order to gain the benefits offered by this technology. Thus, four objectives were presented in Section 1.3. The following section presents a summary of the main conclusions which illustrate the achieved objectives of this research. These are as follows:

11.2.1 Objective One: To explore the opinions of government officials and web developers in Saudi Arabia towards e-Government in general and towards methods by which e-Government websites are evaluated.

This objective was met by collecting documents and conducting interviews; Chapter Three illustrated the reasons behind using these approaches. Application of these approaches began with the researcher conducting interviews and collecting documents from representatives (i.e. the management) of the Yesser programme, an organisation that has been created to control the development of e-Government in Saudi Arabia. The same approaches were conducted with three more Saudi agencies: the Emirate of Makkah, Jeddah Council, and the Institute of Public Administration. The data were

then analysed, and the issues that influenced the development of e-Government in Saudi Arabia, as well as the approaches used to evaluate their websites, were addressed in Chapter Four. It was found that several factors influenced the implementation of e-Government in Saudi Arabia, including: management issues, a lack of resources, problems with the Internet infrastructure, and a lack of knowledge of web analytics.

11.2.2 Objective Two: To evaluate the e-Government websites of the Emirate of Makkah.

This objective was met by selecting appropriate usability evaluation methods. First of all, the literature was investigated to find out what would be the most appropriate approaches that could be used to obtain a multidimensional evaluation framework of the usability of e-Government websites. It was found that using only one or two usability methods would not produce an insightful evaluation. Therefore, it was found that using both qualitative and quantitative approaches would facilitate the production of a more in-depth evaluation. In particular, three methods were used in a specific order: firstly, heuristic evaluation was utilised, then usability testing and lastly the web analytic tools. Chapter Two offered a literature review concerning these usability methods.

In the heuristic evaluation stage, a heuristic check list was designed; three evaluators that had suitable experience in web design were employed to respond to the checklist. Chapter Three illustrated the explanations of the heuristic method used and the designed checklist. This checklist was used to examine the websites of the Emirate of Makkah and of Jeddah Council in order to examine the design of a range of agencies in Saudi Arabia. However, the other methods were applied to the Emirate of Makkah website only because of worries concerning confidentiality in giving access to such sources. The results of the heuristic evaluation revealed a substantial number of usability problems. These results were used to derive the tasks in the usability testing; five users participated in the employment of this method, and Chapter Three presented the details of this approach.

In the deployment of the web analytics method, access to Google Analytics and a copy of the log files were obtained from the Emirate of Makkah. A combination of

these two methods of analysing traffic data was used as a hybrid approach to examine the potential metrics of traffic data. Chapter Three addressed the procedures that were undertaken regarding the above usability methods.

11.2.3 Objective Three: To consider how Thompson's (2003) methods can be adapted and combined with web analytic tools to produce a new comprehensive usability evaluation framework.

The data collected by the usability methods that were applied to the Emirate of Makkah website were analysed. Each method was analysed separately and this allowed the main problem areas discovered by each method to be identified. Chapter Three summarises how the usability methods were analysed and Chapters Five, Six and Seven summarise the problem areas identified on the sites using the three methods. Chapter Eight illustrates the analysis of the first implementation where it was found that:

- Each usability method has its own potential features; these allow each method to provide different insights.
- The heuristic evaluation method was the basis of the practical evaluation and the results of this method provided detailed and exhaustive information regarding problems in the examined sites. These findings are important as they represent evaluators' opinions and so these results were used to design the usability testing method that examined the existing problems in more detail.
- Usability testing was useful for specific heuristic principles, including consistency, helping users, transactions, visual design and security and privacy; these showed a noticeable need for usability testing. Furthermore, it was found that user testing highlighted the need for further heuristics which were then used to enhance the proposed checklist.
- The KPIs provided indications of problems but these could not pinpoint specific details in the majority of the defined usability principles. In particular, the KPIs were shown to provide direct indications for a small subset of only four principles: consistency, helping users, features and functions, and security and privacy. Therefore, when evaluating a website, further justifications are required by other methods. This is because the outputs of the KPIs were only partial indicators of what was happening on the site; they did not show the

reasons for such problems. Therefore, other usability methods needed to be used to clarify the outputs of the KPIs and expand the evaluation area.

- However, the qualitative usability methods, i.e. heuristic evaluation and usability testing, were very costly in terms of selecting appropriate participants and in the time taken to conduct the evaluation sessions. Conversely, web analytic tools were able to provide a number of KPIs that indicated potential usability problems in a site in only a few steps. These KPIs can therefore be used at an early stage to avoid any difficulties that might later cause serious problems.

Following this, the processes which had been used to evaluate the Emirate of Makkah website were themselves evaluated and refined in Chapter Eight. The procedure was enhanced in terms of the order in which the usability methods were applied. In particular, this included changing the order in which the methods were implemented by first using web analytic tools; these were able to provide some direct indications of problems that might exist. Furthermore, these tools were found to be helpful in identifying particular pages that might contain problems and were therefore used to help derive the tasks utilised in the usability testing. Heuristic evaluation was used next to examine wide areas of the website, but it was still deemed necessary to acquire users' views to verify the heuristic results. Thus usability testing was carried out using particular tasks that were generated from the results of the previous methods, i.e. web analytics and heuristic evaluation methods. This design allowed potential problems to be focused on, and also allowed more detailed analysis to be undertaken. Moreover, it explained how the designed evaluation framework could be implemented in practical terms to obtain the most useful results. This enabled refinements to be made to Thompson's framework so it could be used to provide ongoing improvements to e-Government services.

11.2.4 Objective Four: To apply the new combined usability evaluation framework, produced from Objective Three, to examine the new version of e-Government website in the Emirate of Makkah.

A second implementation was undertaken in order to examine the refined framework from Objective Three. Web analytics was applied first, followed by heuristic evaluation and then usability testing. This implementation was applied to the new

version of the Emirate of Makkah website and Chapter Nine explained the results produced from this second implementation. The following results were identified:

- The order of implementing the evaluation methods in the refined evaluation framework allowed the potential features of the web analytics to be focused on; this also allowed several usability problems to be highlighted. Furthermore, this meant that the number of heuristics which needed to be examined could be reduced by using other qualitative methods similar to those found in the first implementation. In addition, the results from the KPIs highlighted the most important issues: i.e. pages that recorded noticeable readings such as average times or bounce rates. As a result, this method was used to derive further usability tests. Importantly, however, it was found that the implementation should be carried out over two kinds of period: long (e.g. annually), and short-period implementations (e.g. every quarter or monthly), where KPIs can be used first, followed by examining a small number of issues using HE and UT. This allows continuous evaluation to be achieved quickly and cheaply.

- The heuristic evaluation was able to identify a large number of problems; these results were used to derive the tasks for the usability testing in order to understand the information needs of the people who intend to use the examined site. Thus, the results from both the KPIs and heuristic evaluation methods were used to design the tasks employed in the usability testing method. So, this allows focus to be placed on small but definite problems that need the views of users on the target site. Participants emphasised similar problems to those discovered by the previous methods but some further problems emerged from the users. This supports the idea that the usability method is still able to provide useful results and needs to be utilised in the evaluation framework.

11.3 Contribution of the Study

This research investigates a new area in the evaluation of e-Government websites. It outlines, through a detailed literature review, evaluation frameworks for such websites but also shows that this area is very limited in terms of using comprehensive evaluation frameworks that involve both qualitative and quantitative usability

methods. Thus, this research has made an important contribution to the literature in this field by:

- Expanding and developing an existing evaluation framework for e-Government websites (that devised by Thompson et al., 2003) and applying it on a real e-Government website. This involved the use of several approaches, such as interviews and document analysis, as well as a range of different usability methods. In particular, this research utilised both qualitative (heuristic evaluation and usability testing) and quantitative (web analytics) usability methods. The novelty of this research, and the reason that this study has extended knowledge in the field of the evaluation of e-Government websites, was in using features of web analytics tools and combining these within the evaluation framework; this enabled a wide range of usability problems to be discovered. Thus, expanding and developing the evaluation framework of Thompson et al. (2003) has contributed to the field by providing effective indications of usability problems in e-Government websites.

- This study used a hybrid approach with web analytic tools, employing both tagged pages and log files analysis. This approach allowed more web metrics to be used with the e-Government websites which, in turn, permitted the inspection of a greater number of usability problems.

- The potential advantages of web metrics results were demonstrated in the refinement of the framework after the first implementation. In particular, the ability of web metrics to inspect specific usability problems more quickly than using other methods was demonstrated. The results from the web metrics were also used in the refined framework to reduce the number of issues examined by heuristic evaluation; they were also partially used to derive the usability testing tasks.

- The refined version of the designed evaluation framework was applied in order to validate the refinements that had been made. This was conducted on a new version of the examined site and showed the features in the refined framework. This shows another feature of the contribution made by this research: indicating a method to apply the evaluation continually by conducting implementations over

two time periods: short cycle and long cycle. In the short implementation, that could be conducted quarterly or monthly, KPIs are used to identify further use of a small number of heuristic inspections or usability tests. Conversely, in the long-period implementation, which might be conducted annually, all the three methods (WA, HE and UT) are used in their entirety to achieve a comprehensive evaluation, as well as to refine the evaluation framework. This evaluation framework should be equally useful for other developing countries.

- This study has identified and examined the current development of e-Government in the Kingdom of Saudi Arabia. This is an important step in understanding the drawbacks surrounding the development of e-Government in Saudi Arabia in particular, but also in developing countries in general. In addition, several important issues and factors which affect e-Government in Saudi Arabia are discussed in this research, such as the lack of resources allocated to e-Government, as well as the inadequate scope of e-Government projects. As a result, this research contributes to highlighting those factors which influence the development of e-Government projects.

- This research further contributes by indicating the kind of management structure that needs to be in place in order for the evaluation framework for e-Government websites to be implemented effectively. In this research, it was found that Yesser, the organisation involved in controlling the development of e-Government in Saudi Arabia, should be responsible for applying this evaluation framework. However, some limitations, such as limited budgets and staff, still exist in Saudi Arabia, as indicated in Section 10.2.3. Consequently, in order to implement this evaluation framework effectively, a management body such as that described in this research, needs to be in place and to receive strong support. Lastly, although the refined evaluation framework was applied in Saudi Arabia, this e-Government evaluation framework can be used in other developing countries.

11.4 Limitations of this Study

In conducting this research, several limitations were found which could influence its findings. These limitations were:

- The practical implementation was applied to only one e-Government website in Saudi Arabia. This might have influenced the results obtained. In addition several

implementation issues were encountered. For example, applying the evaluation framework to e-Government websites was not easy, especially in terms of accessing the analytic tools and obtaining the log files. This influenced the decision to examine only one e-Government website. Moreover, the refined evaluation framework was tested by collecting data from the same e-Government website. This could have influenced the types of problem covered in the suggested framework and might not be representative of all e-Government websites in Saudi Arabia. Furthermore, only long-period implementation was used on the examined site; the short-period implementation was not employed on a continual basis.

- The sample size for the usability testing consisted of five users. This was somewhat small. It is widely believed that acquiring more data is always desirable. Similarly, in heuristic evaluation only three evaluators participated; this was also a limited number. However, since the framework contained several usability methods which allowed more results to be obtained than from other methods, including the fact that usability testing was used to emphasise the results of heuristic evaluation, it can be argued that the sample size was adequate.
- The lack of standard web metrics could have influenced the results. The defined KPIs were selected on the basis of their availability from the analytics packages used. Additional web analytics packages may have provided more metrics and KPIs that may have provided greater detail in some issues. Although this is an obvious drawback, it should be remembered that the aim of the research was to develop a usable framework and it seems likely that, in developing countries at least, free tools would be more acceptable given the budget constraints.
- A final limitation of this study is that the proposed evaluation framework requires both short- and long-term implementation cycles. However, because it is time consuming to observe the results of the evaluation framework, it has not been possible to make the associated changes to the examined website recommended by the final implementation of the framework. Therefore, it has not been possible to record, in quantifiable terms, improvements in the website.

11.5 Recommendations for Future Work

In order to overcome the limitations identified in this research, a number of recommendations are suggested here for future research:

- Further research should be undertaken on a greater number of e-Government websites in order to investigate the relationship between the usability problems identified on each agency's website. This should include the implementation of the refined evaluation framework over both types of period (i.e. short and long); Yesser should manage this evaluation.
- Further research should be undertaken with regard to the management of e-Government and its influence on applying e-Government technology in developing countries.
- Further research should be undertaken with regard to applying the evaluation framework to another sector that provides online services. For example, information retrieval websites or e-commerce websites provide a number of services and so, to remain effective, these ideally need to be monitored to identify any usability problems that may exist. A number of research studies have already been undertaken in this sector but using the evaluation framework considered in this research could produce more efficient evaluations.
- Research should be undertaken to test further the refined evaluation framework considered in this research. Specifically, it was found that there is currently a lack of standardisation regarding key terms in the web analytic tools used in this research, as indicated in Section 8.3. Therefore, only one provider of web analytic tools that provide both the tagged pages and log file analysis should be used. This would enable log files and tagged page analysis to be undertaken which would then allow a hybrid approach to be used in the analysis of the traffic data that is to be measured and evaluated. This would also allow the lack of standards in web metrics to be partially overcome.

Appendices

Appendix 1: Interview questions (Yesser version)

1	**Introduction**
	- The purpose of this research. - What do I need to know from your organization. - Data protection
2	**Current situation of e-Government project?**
	1- Why online services are required? 2- How did you acquire your knowledge of e-Government practices? 3- Do you think the existing government websites have achieved the national plan, and if so to what extent? 4- What are the limitations to implement e-Government? 5- What is the percentage of government agencies that are already able to provide their resources online in comparison with those that are still attempting to do so? 6- For those agencies that do provide online resources, what is the percentage of such work from their normal works? 7- What is your current approach to improve the efficiency and effectiveness of the existing services? 8- Are you influenced by any demand from businesses or citizens to provide online services?
3	**Current situation of e-Government evaluation?.**
	1- What are your approaches to measure the progress of online services provided by government agencies, and what are the limitations to do so? 2- Do you focus more on improving the efficiency inside the government's agencies more than looking for the citizens needs? 3- Do stakeholders (citizens, businesses, and government agencies) participate in evaluating e-Government projects, and to what extent? 4- Are you using any tools to monitor, analyze and control the implementation of e-Government? 5- Are you satisfied that the results are officially used? 6- Are you using any usability methods to identify the problems in e-Government project? 7- Do you think that the quantitative approach to measure progress can give you more in-depth views?

4	**Planning for the future?**
	1- Do you have any future plan for the e-Government project other than that on your website? 2- Are there any plans to enhance your evaluation procedures, e.g. observation studies, quantitative analyses? a. Is there any technology you are planning to use to monitor, analyze and control the implementation of e-Government? b. Is there any focus on user's opinion in your new plan?

Appendix 2: Interview questions (Developer's version)

1	**Introduction**
	- The purpose of this research. - What do I need to know from your organization. - Data protection
2	**Current position of e-Government project?**
	1- When was the existing website introduced? 2- Who was the designer? 3- Aim of design? 4- Who are the potential users? 5- When was the last version work? 6- What are the main purposes of your website? 7- Do you have public and private sections on your site? 8- What services are available for the private section? 9- Who are the main stakeholders on your site: citizens or businesses? 10- Which services are available online? 11- Do you have services on your site particularly for other agencies in Saudi Arabia? 12- If so, what kind of services are they using? 13- Did you market the site? If so how? 14-Do you receive any feedback from your users? 15- Who will handle users' queries? 16- What percentage of your resources are available online? 17- Is the national plan for e-Government useful for you? And why? 18-Did you test your website before making it accessible on the Internet?
3	**Maintain your website**
	1- What are your objectives in order to maintain the quality and level of service provided by your website? 2- What are your approaches to maintain web contents and keep your site up-to-date? 3- How do you archive the old content and make it available for users? 4- Are you doing the maintenance in house? 5- Do you have your own web server or it is hosted elsewhere? 6- How do you review your website for errors? And what are your procedures to do so, e.g. Checking links, spelling,

	maintenance tools? 7- How often do you perform the maintenance? 8- - Are you using any tools to monitor website traffic?
4	**Current situation of e-Government evaluation?**
	1- What is your current approach to improve the efficiency and effectiveness of your websites? 2- Are users (citizens and businesses) participating in this evaluation, and if so to what extent? 3- Are you using any usability methods to identify what users need? 4- What are the criteria you are using in such tools? 5- Do you use any web analytics tool? 6- If so, it is useful for you? 7- Are you using a free tagged pages tool? And if so why? 8- Are you analyzing log files?
5	**Web metrics used?**
	1- What web metrics do you use (log files and tagged pages)? a. How frequently is it checked? b. At what depth do you usually look? c. Do you use KPI metrics? 2- Are there any shortcomings in such web metrics? Do you have any examples? 3- Do you think that the output of such tools is used efficiently by the management to improve the online services provided?
6	**Planning for the future?**
	1- Do you have any future plan for your online services? 2- Is there any focus on user's opinion in your new plan? 3- Is there any web analytics tool you are planning to use? 4- How do you think that the output of such tools can improve you online services

Appendix 3: Heuristic evaluation Checklist for the first implementation

Heuristic Evaluation Checklist

Target website: ……..
http://www.makkah.gov.sa/

Date: **Time start:** **Time finish:**

Evaluator name:

1. Consistency:
The website should always show consistency with web standards.

#	Review Checklist	Yes	No	Comments
1.1	Is the site compatible with all web browsers?	☐	☐	
1.2	Do the pages display clearly given the screen resolutions commonly used by users?	☐	☐	
1.3	Is a consistent design used across all pages within the website?	☐	☐	
1.4	Is all content on the site consistently presented?	☐	☐	
1.5	Are texts and links consistently described by meaningful labels?	☐	☐	
1.6	Does each page have a title to describe the contents?	☐	☐	
1.7	Is the most important information consistently placed in a noticeable position?	☐	☐	
1.8	Are graphic features used (e.g. images, consistently displayed)?	☐	☐	
1.9	Are headers easily distinguishable, so they are readily noticed by the user?	☐	☐	
1.10	Are there consistent explanations of what is required in a data entry field?	☐	☐	
1.11	Do data entry forms follow a consistent presentation and format?	☐	☐	

2. Links and navigation

The website should always allow users to navigate easily, through appropriate links.

#	Review Checklist	Yes	No	Comments
2.1	Are groups of links displayed in the most logical way, using good practice?	☐	☐	
2.2	Is the navigation area placed in a noticeable position, so the user can easily use it?	☐	☐	
2.3	Do pages contain appropriate menu entries to link to related information?	☐	☐	
2.4	Are there appropriate links within the body text on pages?	☐	☐	
2.5	Are links within body text labelled appropriately (e.g. click here labelled is avoided)?	☐	☐	
2.6	Are links shown in standard colours?	☐	☐	
2.7	Do all links work?	☐	☐	
2.8	Do link colours indicate visited and unvisited links?	☐	☐	
2.9	Do outbound links usually open in a new window?	☐	☐	
2.10	Do all sub pages contain a link to the homepage in noticeable place?	☐	☐	
2.11	Do links clearly indicate what will happen (e.g. new page or file download)?	☐	☐	
2.12	Is excessive vertical scrolling minimised on each page?	☐	☐	
2.13	Are there a group of links to the most visited pages?	☐	☐	
2.14	Are there a group of links to the most downloaded documents?	☐	☐	
2.15	Does the site provide inquiry services in a noticeable place?	☐	☐	

3. Helping users:

The website should enable users to discover and perform search on the site. Also, it should help users to recognize error messages, which should be provided in understandable language that helps users solve problems.

#	Review Checklist	Yes	No	Comments
3.1	Are there search capabilities on the site?	☐	☐	
3.2	If applicable, are advanced search facilities provided?	☐	☐	
3.3	Are the search results described clearly?	☐	☐	
3.4	Is the ranking of search results appropriate?	☐	☐	
3.5	Can the search facility be used in other languages?	☐	☐	
3.6	Is information on commonly used search terms provided to users?	☐	☐	
3.7	Can a FAQ page be easily located?	☐	☐	
3.8	Does the FAQ page provide useful information?	☐	☐	
3.9	Does the website provide documents that can be downloaded?	☐	☐	
3.10	Is there a contact email on every page?	☐	☐	
3.11	Is it easy to find a site map?	☐	☐	
3.12	Is it easy to find an A-Z directory?	☐	☐	
3.13	Does the website contain *Contact Us* information?	☐	☐	
3.14	Does the website allow users to enter their query in feedback form?	☐	☐	
3.15	Are optional data entry fields clearly marked?	☐	☐	

#	Review Checklist	Yes	No	Comments
3.16	Do fields in data entry forms contain default values where appropriate?	☐	☐	
3.17	For user input fields, is there clear information about how these fields should be filled out?	☐	☐	
3.18	Have labels been used to indicate field length?	☐	☐	
3.19	Does the website warn users if they are about to make a possible error?	☐	☐	
3.20	Are data-entry error messages displayed in an observable location?	☐	☐	
3.21	Do data entry error messages explain how to solve the error?	☐	☐	

4. Features and Functions:

E-Government require to efficiently use the Web features and functions, which enable stakeholders to interact more with e-Government website.

#	Review Checklist	Yes	No	Comments
4.1	Are multimedia resources (e.g. video clips) provided in an effective way (i.e. downloading in reasonable time)?	☐	☐	
4.2	Is the site available in other languages?	☐	☐	
4.3	Is there an RSS feed to keep the user informed of anything new in the site?	☐	☐	
4.5	Is there an email list feature that can keep users informed about anything new on the site?	☐	☐	
4.6	Are users allowed to copy the contents?	☐	☐	
4.7	Are users allowed to paste text to specific text boxes?	☐	☐	
4.8	Are users able to print the contents of pages?	☐	☐	

5. Data Entry Forms

E-Government should allow stakeholders to input their data in appropriate place. This should include clear highlights on commonly sought information in the site in an appropriate way that users can become familiar with.

#	Review Checklist	Yes	No	Comments
5.1	After the user completes an action, does the feedback indicate that the next action can be started?	☐	☐	
5.2	If there are noticeable delays in the website's response time, is the user kept informed of the system's progress?	☐	☐	
5.3	Are users asked to 'confirm' actions before they are executed?	☐	☐	
5.4	Can users cancel an operation in progress?	☐	☐	
5.5	If users can go back to a previous page, can they change their choice on the earlier page?	☐	☐	
5.6	For data entry pages with many fields, are users able to save partially filled forms?	☐	☐	

6.Minimize user's memory load (Visual design)

User should not have to memorize information throughout the website. Instructions should be accessible from any part of the website and able to be seen through the website

#	Review Checklist	Yes	No	Comments
6.1	Are messages placed where the eye is likely to be looking on the screen?	☐	☐	
6.2	Have items (links, images, text) been grouped under logical headings?	☐	☐	
6.3	Have headings been separated to allow users to easily identify each group?	☐	☐	
6.4	Is there good colour and brightness contrast between image and background colours?	☐	☐	
6.5	Is colour used appropriately to emphasize important information?	☐	☐	
6.6	Does the website offer the feature of personalized pages to suit different citizen profiles?	☐	☐	
6.7	Is the search text box able to suggest relevant keywords, to the initial entered letters?	☐	☐	
6.8	Does the colour of text differ from the background colour, so text can be easily read?	☐	☐	
6.9	Do the colours used on the site conform to common expectations about colour codes?	☐	☐	
6.10	Is white space used efficiently within pages?	☐	☐	
6.11	If images are used as visual cues, do they match cultural conventions?	☐	☐	

7. Accessibility for visually impaired users

The E-government website should be for all citizens including those people with special needs to use the site. These questions will examine a subset of w3C priority guidelines for visually impaired users.

#	Review Checklist	Yes	No	Comments
7.1	Can disabled users easily access and navigate the site?	☐	☐	
7.2	Is there a special version of the website for visual impaired users?	☐	☐	
7.3	Does the website allow users to control fonts and colour to aid reading for impaired users, so visually impaired users can easily access and navigate the site?	☐	☐	

Note: W3C guidelines, which generally includes: (Caldwell et al, 2008)
1- Elements in the content must be suitable for being used.
2- The site content must be able of being perceived.
3- The web content must be able to work with current and future technologies.
4-Content and controls must be able of being understood.

8. Security and Privacy

Government sites are required to be protected against the problems caused by hackers. Citizens' information must always be protected when they working online on a government website.

#	Review Checklist	Yes	No	Comments
8.1	Does the site have a clear link to privacy policy information?	☐	☐	
8.2	Does the website use encryption techniques appropriately when acquiring user data?	☐	☐	
8.3	Where applicable does the website employ virtual keyboards for password input?	☐	☐	
8.4	If the user has signed into the system, does the text in the URL contain any information about the user?	☐	☐	
8.5	Does the website log out users when the website is left inactive for a considerable time?	☐	☐	

9. Information truth and precision

Essential information should be precise and correct, as inaccuracies may affect the citizen. So the government has a responsibility to keep their websites up to date, accurate and properly maintained.

#	Review Checklist	Yes	No	Comments
9.1	Does the domain name refer to the official government website (.gov.sa)	☐	☐	
9.2	Is information clearly date stamped?	☐	☐	
9.3	Does the agency logo appear on a prominent place on the page?	☐	☐	
9.4	Is there a clear description explaining what the agency does in a prominent location in the site?	☐	☐	
9.5	Does the organization chart explain the senior management organization in the agency?	☐	☐	
9.6	Does the agency structure and responsibilities of main divisions and units appear in a prominent location on the site?	☐	☐	
9.7	Does the agency provide the list of services provided, so users have a clear view about the website?	☐	☐	
9.8	Are services' requirements well explained, so users can recognize the benefits and affects of applying services?	☐	☐	
9.9	Does the site contain the planned projects in the agency?	☐	☐	

Appendix 4: User Testing Forms

- Legal form
- Pre-test questionnaire
- Users’ tasks
- Post-test interviews.

Legal Form

Purpose:	The purpose of the study is to evaluate the Emirate of Makkah website. The study will acquire your views on the usability of the website.
Study Environment & Recording	The study take place in Umm Al-Qurqa University where you will be observed as you use the website. During the study, which should last approximately two hours, all of your interactions on the website will be recorded by special software and you will be observed by the researcher. By signing this form, you give your consent to this data being used by the researcher to evaluate the site. However all the data will be anonymous - your name will not be associated with the data.
Information Collected	During the study you will also be asked to fill out two brief questionnaires, and answer some questions on how you used the site. As before all this information will be anonymous.
Non-disclosure Agreement	During this study, the researcher will ask you complete tasks on a government website, and to speak aloud as you undertake the tasks. When speaking aloud you should express your thoughts, doubts and any confusion you may have – in fact please indicate any positive or negative expressions related to ease of use of the site and your feelings when using the site. Please note that it is the website that is being examined not your performance. Any information you acquire relating to this website is confidential and proprietary, and is being disclosed to you only so that you can participate in this study.
Comfort	The researcher has scheduled breaks for you, but you may take break at any other time you which. Just inform the researcher that you would like to do so.
Freedom to Withdraw	You may withdraw from this study at any time.
Freedom to Ask Questions	If you would like to ask any questions, you can ask the researcher now or at any time during the test.

If you agree with the above terms, please indicate your acceptance by signing below:

Printed Name: ……

Signature: ……..

Date: ……

Pre-test Questionnaire:

For the following questions below, circle the answer of your choice:

1- What gender are you?
Female Male

2- Which age range do you belong to?
18-24 25-31 32-40 40-50 50+

3- What is your job title?

4- How would you describe your work?

5- How long have been doing this kind of work?
- Less than 1 year - 1 year - 2-4 years - 5-10 years

6- How long have you been using personal computers?
- Less than 1 year - 1 year - 2-4 years - Over 5 years

7- How often do you use the internet?
Several times a day Once a day Once a week
More than once a week Once a month

8- How long have you used Emirate of Makkah website?
- Never - Less than 1 month - More than 1 month
- More than 6 months -More than 12 month

User Tasks:

Task 1 *١٠ minutes*

This is the homepage of Emirate of Makkah web site. Could you please give me your initial reactions to this homepage. Feel free to explore this page as you would using your mouse, and I will ask you some questions after that. But, please remember to speak aloud, and do not click on any link right now.

I will give you ten minutes to do this task, and I will let you know when the time has finished.

(Questions that I will ask)

1. Please give me your first impressions about the layout of this page and what you think of the menu choices, colours, texts ,graphics, photos used in this site?
2. Please describe the options you see on the homepage and what you think they do. Feel free to move around the page, but again without clicking on anything right now.
3. If you were exploring this site, what would you click on first? (Without clicking on anything yet)
4. What do you think is the purpose of this site?
5. Who do you think this site is intended for?

Task 2 *10 minutes*

I will give you ten minutes to freely explore this web site. You can go anywhere you would like to go on the site, but please remember to speak aloud as you do so.

I will tell you when the ten minutes has finished.

Task 3 *10 minutes*

I will give you ten minutes to use the local search facility in this site. I would like you to find when the existing prince became the head of Emirate of Makkah, please use this term in search "تعين الأمير خالد" - go anywhere you would like to go on the web site to do so, but please remember to speak aloud as you do so.

I will tell you when the ten minutes has finished.

Task 4 *5 minutes*

I will give you five minutes to find more information about two provinces under the Emirateof Makkah (Al-Jamoum and Al-Kamel areas), Please go anywhere you would like on the web site to do this task, but please remember to speak aloud as you do so.

I will tell you when the five minutes has finished.

Task 5 *25 minutes*

I will give you twenty five minutes to apply for an online service provided by the Emirate of Makkah website. This service is to record a problem that needs official acceptance from the Emirate of Makkah. In particular, you will applying for a permit to transfer a corpse (a dead body). Go anywhere you would like to go on the web site to complete the task, but please remember to speak aloud as you do so.

I will tell you when the twenty-five minutes has finished.

Task ٦ *5 minutes*
I will give you a number of pervious online request had been provided to Emirate of Makkah. Please go anywhere you would like on the web site to do this task, but please remember to speak aloud as you do so.

I will tell you when the five minutes has finished.

Interview questions:

1- What are your overall impressions of the Emirate of Makkah web site?

2- If you had to give the site a grade, from 1 to 5, where 1 was excellent and 5 was bad, what grade will you give it, and why?

3- Would you use this website to apply for services instead of going personally to the Emirate of Makkah? If so, why?

4- What were the main problems that you experienced, if any?

5- What do you like least about the online services provided?

6- What do you like best about the website?

7- What is your impression of the search capability?

8- When applying for online service for a permit to transfer a corpse record, did this form concern you about the acceptance of your request?

9- Is there anything that you feel is missing on this site? (e.g. in content or in site features/functions)

10- Are there materials you would like to see added to the site? If so, which?

Appendix 5: Evaluation reports sent to the EM site, after the first implementation

The following reports were delivered to the Emirate of Makkah following the first deployment of usability testing methods. In these documents a√ symbol indicates that this issue was addressed by EM as a result of these documents.

Assess the design of Emirate of Makkah website
Heuristic Evaluation Test

24/08/2008

1 - Introduction:
The website of the Emirate of Makkah is one of the best e-Government websites in the Kingdom. It is an early start to e-Government project in the Kingdom, where the project began in 2002 and was assessed as the best e-Government websites by the Digital Excellence Award (*eAward*) from third place in 2005 and second place in 2006 and first place in 2007, and this illustrates the extent of the considerable effort and continued to advance the e-Government service in the governor of Makkah. Moreover, it shows a continuous workshop for the betterment of the services provided by applying the latest techniques to achieve their works.

2- Objective of the evaluation:
This work is to cover one part of the scientific research of the researcher (Abdulhadi Eidaroos) to evaluate e-Government websites. This test is to find out the ease of use and to measure the usability against the wide design issues particularly for e-Government websites

3 - The rules of the test:
The test rules have been devised from the recent trends in heuristic evaluation method for evaluating the websites, which is a way to examine the considered website against the designed heuristic checklist that contains nine principle of design that cover wide area. Three evaluators that have great experience in web design were answered this checklist.

4- Evaluation Results:
There are nine principle of design that consist ninety one heuristics. The following sections illustrate the problems found by using heuristic evaluation method according to each heuristic principle. In addition, there will be using of symbols indicate whether or not the problem was addressed in the new version of the Emirate of Makkah website.

4-1 Consistency

1- The EM site was not compatible with all web browsers.√

2- No consistent design used across all pages, this needs standard templates for all pages in the EM site. √

3- Using repeated title of pages to describe the contents. √

4- Limited using of titles to describe the text on several pages (government agencies' index page). √

5- Existing of long pages, which contain information that needs to be categorized (e-Government Project and Training Program). **X**

4-2 Links and Navigation:

1- The link to the homepage was found in the bottom of any pages, which is not useful, this should be in the top in a noticeable palace. √

2- The colour of visited links was not changed, and these links were used non-standard colour. **X**

3- Limited number of links to other government websites (only Saudi Portal). **X**

4- Limited use of links within the body text, this is useful feature to enrich the information provided. **X**

5- Not all links were working (English version of EM site, and main news links). √

6- Lack of clarity in some of the links of what will result from their use, (training plan). **X**

7- No use of links to the pages most visited, and the most download it files. These are useful feature that facilitate navigation. **X**

4-3 Helping users

1- No use of advanced search on the site. **X**

2- Lack of clarity in search Results (no details of each result it is only a link to another page). **X**

3- No use of the ranking of the generated results of search fitted as they relate to the keywords entered. **X**

4- The search can be made by only Arabic, this is limited, it should be available be English as well. **X**

5- No use of the commonly used search terms, and FAQ. **X**

6- There was no contact email on each page to report any problems that may face users. **X**

7- No use of sitemap of the site and no index pages. **X**

8- No use of default values in data entry form, and no indication for field length was used. **X**

9- No help was provided in data entry form. **X**

10- In the data entry form users were not warn users if they are about to make a possible error. **X**

11- Error messages in data-entry form were not displayed in an observable location, and it did not contain sufficient help for users to maintain the problems. √

4.4 - Features and functions:

1- No use of multimedia resources (e.g. video clips) on the site, and No use of RSS services. **X**

2- No use of mailing list for users. **X**

3- No use of custom printing in all pages. √

4- Users cannot customised the EM site (change colour, a distinctive links). **X**

5- The site is available in only Arabic language, this should be available also by English.**X**

4-5 Transactions

1- The presence of noticeable delays in the website's response time and users not being kept informed of the system's progress. √

2- Users being unable to confirm their online request before submitting it. √

3- Users not being able to cancel an operation in progress. **X**

4- The inability of users to save partially the data in the online form. **X**

5- The lack of detailed help after completing the form for users using these forms. **X**

4-6 Visual design

1- Messages were not placed where the eye was likely to be looking on the screen. √

2- The site did not offer a feature which enabled pages to be personalised in order to suit different citizens' profiles. **X**

3- The search text box did not suggest relevant keywords to match the letters that were entered initially. **X**

4-7 Accessibility for visually impaired users

The site did not provide any features specifically to help visually impaired users. **X**

4-8 Security

1- The site did not contain a page offering privacy policy information. **X**

2- The site did not use encryption techniques when acquiring user data. **X**.

3- The site did not allow users to create a user account on the EM site. **X**

4-9 Precision of information

1- The information provided was not date stamped. **X**

2- There was no clear description in a prominent location in the site explaining what the agency does. **X**

3- The site did not provide information in a prominent location on the site about the structure of the agency and the responsibilities of its main divisions and units. **X**

5-Conclusion

1 - This evaluation is a part of the scientific research of the researcher (Abdulhadi Eidaroos), and the researcher undertakes to maintain the privacy and confidentiality of information learned from the results of EM site.

2 – The results in this report is a scientific evaluation of the EM site and it is not to criticize or infringe the major effort in this site, and the findings in this report is advised to be used in your future work in any new versions of EM site.
3 – It was noticed that EM site did not contain any properties for disable people with and it is challenging features that are not available in any government websites in the Kingdom. So, EM site can be the first site to implement this feature. X

Assess the design of the Emirate of Makkah website
User Testing
04/04/2009

1 - Introduction

The website of the Emirate of Makkah is one of the best e-Government websites in the Kingdom. It represents an early stage of the e-Government project in the Kingdom, as the project began in 2002, and was assessed as the best e-Government website by the Digital Excellence Award (*eAward*), moving from third place in 2005 to second place in 2006 and to first place in 2007. This illustrates the extent of the considerable efforts that have been made to improve the e-Government services in the governorate of Makkah. Moreover, it shows the continuous work that has been carried out in terms of providing better services by applying the latest techniques to achieve this goal.

2- Objective of the evaluation

This work covers one aspect of the scientific research of this researcher (Abdulhadi Eidaroos) to evaluate e-Government websites. This test was carried out to find out the ease of use of the site and to measure its usability in order to meet the needs of users by recording both their observations and the problems which hindered their use of the Emirate website.

3 - The rules of the test

The test rules were devised from the recent trends in usability testing of websites, a way to examine the considered website to find out the real problems faced by stakeholders of the site. So, five users from the target population of EM were examined in this test.

4 - Evaluation of the site

Five tasks were generated from the previous test (heuristic evaluation) to cover this test. This section provides details of the problems that existed according to each task, together with the suggestions that emerged for the development of the site.

4-1 Homepage

It was found that the design of the homepage was average but also showed several powerful features in the design of the site. In particular, it was observed that users could explore the contents of the homepage easily. Users were able to read the content with ease because of the font and/or the colour used. Furthermore, participants felt comfortable because the site had achieved a significant rank in the Digital Excellence Award, as advertised on the site. Furthermore, users found that the homepage of EM gave them an impression of formality. This was noticed in the logo, representing the Interior Ministry to which the EM belongs. In addition, the existence of a right menu was highlighted by users; this matched their expectations. However, some problems emerged from the users. These problems are explained in the following table, together with recommendations to overcome these problems.

Problems	Recommendations	Maintained in the second version
Repeated command names in the top menu and in the right side menu list; this generated confusion among users.	Remove repetitions in the names of items in the menus.	√
Menus did not focus well on the services; they were not arranged well.	Change the order of menu items and focus on services that can be implemented through the site.	√
The time mentioned on the homepage was not accurate.	Use accurate time.	**X**
Lack of a clear message concerning the work carried out by the Emirate and the services provided to citizens.	Provide a clear message regarding the work of the EM.	**X**
News was given priority on the homepage which did not help users locate the services.	Reduce the amount of news on the homepage.	√
Users found that there were shortcuts to the online services, situated on the left side of the homepage. It was felt that providing such services was suitable for the site but that they were not easy to find.	Remove the left side menu on the homepage and combine its services in the menu on the right.	√

4-2 Navigation of web pages

The navigation of the site showed a number of problems. The following table explains the problems that emerged from users, as well as their suggestions to overcome these problems.

Problems	Recommendations	Maintained in the second version
There was a time delay in moving from one page to another. Users had tested different types of communication and navigation was slow.	Reduce the delays in navigation.	√
There is no clear link to the homepage in order to return to it.	Provide a link to the homepage in a noticeable place on all pages.	√
There is no contact email or phone number on each page to report any problems or crashes.	Provide an email and contact number on each page.	**X**
There is a lack of adequate information and an updated page in the procedures pages.	Provide more information details on the procedures pages.	**X**
Information in the services page was not clear; the information on the training page was long, as was the length of the page; and the	Add more information in the services page and reduced the amount of text on the training page.	**X**

Problems	Recommendations	Maintained in the second version
information displayed was not classified.		
Lack of clear instructions in the procedures page.	Make the instructions clear and allow users to download the instructions for the EM services.	**X**
Information in the government agencies' index page was not clear. This needs to be well organised and to provide more information.	Expand the information in the government agencies' index page and organise the information in a more orderly way to allow better categorisation.	√
A number of pages were found without appropriate titles to describe their contents.	Add appropriate titles for each page on the site.	√
Visited and non-visited links were not indicated.	Allow the colour of the visited links to change to let users know which links they have already visited.	**X**

4-3 Search features to help users

Very limited features were found in the EM site. The following table illustrates the problems that were discovered and the recommendations of users.

Problems	Recommendations	Maintained in the second version
The search tool was at the bottom of the page and was found in the homepage only.	Change the placing of the search tool to make it more noticeable; at the top of the homepage is advised. Also, apply a search tool in all pages in the site.	√
Results were generated as links without sufficient detail with each link.	Allow users to read only a little information that might help in locating the data.	**X**
Inaccurate results were generated by the search tool.	Index all services which might improve the generated results.	**X**
No ranking was available for the generated results.	Add ranking for the generated results.	**X**
There was a time delay in navigating the generated results.	Study the reason for this delay.	**X**

4-4 Transactions:

This task showed a considerable lack of features in terms of the data entry forms. The following table states the problems, together with the suggestions of users.

Problems	Recommendations	Maintained in the second version
There were no initial values to facilitate the entry of users.	Provide initial values in the fields to help users enter data accurately.	**X**
Adequate assistance to guide the user to write data was lacking.	Provide a clear guide that will help users to fill in the request.	**X**
There is no current date and time in the form of the call.	Add data and time notation in the online form.	**X**
The editor included limited features to allow users to enter their request.	Improve the feature in the edit box, allow WYSIWYG (e.g. increase the font, change the font or colour)	**X**
Users were allowed to enter only two attachments, whereas some services needed more.	Expand the edit box to accommodate the number of documents that need to be attached	**X**
There was a lack of detail regarding what was required for the attached files.	Provide a hit to users to tell them about the specification of the attached file: e.g. the kind of image file.	**X**
The edit boxes that included the attachments were small and did not allow users to check their entries.	Expand the size of these boxes to allow users to check their entries.	√
A message to approve acceptance appeared at the bottom of the page but this pointed out a need to submit documents manually. This confused users.	Improve the approval of acceptance message.	**X**
Users were not allowed to save partially the request.	Allow users to save their work on an online form so they can complete the work instead of providing a new version.	**X**
No confirmation page existed to allow users to check their entries before submitting their request.	Provide a confirmation page to allow users to check their entries before submitting their requests.	**X**
There were no clear details concerning acceptance after submitting the request (i.e. after files and/or the main body of text were entered). Also, there was no time indication of when the work was accepted, and there was no way of printing the transaction message.	Provide clear details about the request that was just accepted in the system. This should be provided with sufficient details concerning what was entered by users so that they could print it.	**X**
No email was sent that contained details of the request submitted to the EM.	Inform users about the details entered with their requests.	**X**
More suggestions	Enable users to create accounts and to supply their data automatically without the need to re-submit this each time they use the site.	√

4-5 Using the Inquiry service

Some useful features were found in this regard. For example, it was found that a status bar is useful for keeping the user informed about what is happening during the process of retrieving the searched request. However, several problems were recorded; the following table states the problems and the suggestions of users in their regard.

Problems	Recommendations	Maintained in the second version
Although a status bar appeared while retrieving the information, it took a long time to retrieve the information.	Enhance the speed of retrieving this information.	**X**
Limited information appeared in the results.	Give users more detail about the procedures undertaken following their requests (e.g. the department dealing with it, the work that remains to be done, contact phone numbers or emails, and the time needed to complete the users' requests).	**X**
More suggestions	Provide some restrictions in the inquiry service (e.g. include a user name and password) so the data can be more confidential.	**X**

5- General comments

After the participants had completed all five assigned tasks, they were interviewed to obtain their opinions after completing the given tasks. The following table states their comments and shows whether these comments were followed up or not.

Comment	Maintained in the second version
The information provided was not easy to read due to duplication and a considerable amount of information was provided: e.g. in the government agencies' index page.	√
Most participants felt that the existing format emphasised news which took up too much space. This seemed to be the focus of the site, when the focus should be on services.	√
It was felt that the EM site was not clear enough in showing specific content for people living in all the different regions of Makkah. Furthermore, users felt that more information could be included.	√
The link to the homepage, which was thought essential, was not located in its expected place and four users found themselves lost in the site.	√
Participants stated that the considerable amount of text in several pages did not motivate them to read the contents of the page.	**X**
In terms of the search tool, it was felt that this was not helpful in locating information and needed to be improved.	**X**
The time taken to navigate and submit the online forms was found to be too long yet users were not informed that this would take a long time.	√

There was a limited use of date indication with all the information contained in the website. This is the official site so is thought important to include the dates of procedures, especially when the procedures change over time.	**X**

Conclusion

1 - This evaluation is part of the scientific research carried out by the researcher (Abdulhadi Eidaroos) who undertakes to maintain the privacy and confidentiality of information learned from the results of studying the EM site.

2 – The results in this report form a scientific evaluation of the EM site; they do not in any way criticise or infringe the considerable efforts made in this site. Instead, the findings in this report are offered as advice to be used in future work on any new versions of the EM site.

3 – It was noticed that the EM site did not contain any facilities for disabled people; these are challenging features that are not available in any government websites in the Kingdom. So, the EM site could be the first site to implement such features.

Assess the design of Emirate of Makkah website
Web Analytic Tools Test
06/10/2009

1 - Introduction:
The website of the Emirate of Makkah (EM) is one of the best e-Government websites in the Kingdom. It is an early start to e-Government project in the Kingdom, where the project began in 2002 and was assessed as the best e-Government websites by the Digital Excellence Award (*eAward*) from third place in 2005 and second place in 2006 and first place in 2007, and this illustrates the extent of the considerable effort and continued to advance the e-Government service in the governor of Makkah. Moreover, it shows a continuous workshop for the betterment of the services provided by applying the latest techniques to achieve their works.

2- Objective of the evaluation
This work covers one part of the scientific research of the researcher (Abdulhadi Eidaroos) to evaluate e-Government websites. This test was conducted using Web Analytic Tools to analyse the design of the site in order to measure its usability and to discover what design problems existed in the e-Government websites.

3 - The rules of the test
The analysis was carried out by combining the reports of two analytic tools: tagged pages in Google Analytics (GA) and log files using WebLog Expert (WLE). This combination provided further results which could be used in the evaluation of the examined site.

4- Evaluation results
Two main indicators were identified during the analysis: direct indicators and partial indicators. The former is able to explain the problems whereas the second provides little information about the problems. The analysis covers a time range from 07/09/2007 14:36:39 to 02/09/2008 09:40:10. The following section illustrates the results found in the Emirate of Makkah website.

4-1 Using direct indicators
4-1-1 Browser problems (Bounce Rate + Browser Visits)
It was found that the Internet Explorer browser was most commonly used (93.83% in GA and 76.32% in WLE) while other browsers were less popular. Moreover, by using GA, the users who used the Opera browser were shown to spend the highest average time on the site; these visitors also exhibited a high bounce rate. In addition, other browsers showed considerable levels of bounce rate (the percentage of single-page visits or visits in which the person left the site from the landing page). In fact, these findings actually support the findings of the heuristics evaluation recorded in the previous reports which showed that the EM website does not facilitate browsing of its site using different browsers with the result that users can face difficulties in using the site. This indicates that Web Analytic Tools can allow problems regarding browsers to be identified at an early stage.

4-1-2 Download quality (Bandwidth + Incomplete Requests+ Error Type)
It was found that errors in downloading, occurred very frequently during the examined period; the highest number was recorded in May 2008. Interestingly, many errors were of the "page not found" type which shows that these errors occurred mainly on the English version of the EM site. This might indicate that many errors existed in such pages and also that the

English version was in demand by some users. This therefore helps developers in EM to know that this section of the site needs to be examined, the errors corrected, and that the section should be better maintained in future.

Problems were also found in identifying those images that were frequently used that might cause problems. In particular, it was found that header files, which appeared in all pages, took up a considerable amount of bandwidth, as well as appearing in the most incomplete request metrics. This indicates an existing usability problem concerning the images used in the EM site. This information could help developers to make judgments about the use of images on the site. For example, heavily used images should be optimised for size as well as quality. This is actually an important issue which could accelerate the navigation time of the EM site, as found in several tasks in the usability testing report. Related problems were found regarding the use of flash files which were shown to be one of the most frequently downloaded files. However, it was also shown that such files recorded the highest number of incomplete requests; they also used a considerable amount of bandwidth. This is an indication that such kinds of files may be causing problems and their use needs to be reviewed to avoid causing problems for users.

Importantly, it was found that a particular file, *ipa-plan28-29.zip,* recorded the highest bandwidth and 38.87% of incomplete requests. This was a noticeable value that indicates problems in downloading such files. Information such as this could result in simple amendments being made to the website, such as indicating to users that this is a large file that will take a substantial amount of time to download. However, closer inspection of these results showed that most of these downloaded files were related to internal work within the Emirate of Makkah that should not be publicly accessible, such as local reports. It was easy to access to these files as there were no restrictions limiting access to them. This is actually a security problem. So, such files must be protected to keep the work strictly confidential. This shows the usefulness of using this metric to monitor any lack of security on the site.

4-1-3 Landing pages (Bandwidth + Incomplete Requests+ Error Type)

It was found that the same title was repeated for several different pages; this indicates a failure to allocate separate titles to each page, which might confuse visitors.

4-1-4 Countries and cities (Average Time + Pages/Visit + Bounce Rate + Country + Bounce Rate +Page Not Found + Count of Error)

It was found that new visitors from the US and the UK viewed more pages but recorded a high bounce rate. As before, the high bounce rate metric indicates that there may be a problem but they do not indicate what the problem is. If the site values visitors from these countries, then these results indicate that further forms of testing, e.g. heuristic evaluation, should look into the reasons behind these results.

4-2 Using partial indicators

There are several web metrics of this kind but these provide only partial indications of the problems. In particular, five metrics were identified, as illustrated in the following table, which shows these metrics, their contents and the tool that such metrics should be used with.

	KPI	**Contents**	**Tool**
1	*Page Views (PV)*	The number of page views for particular pages	GA
2	*Time on the Page (TP)*	Average time on a page + bounce rate	GA
3	*Peak Time (PT)*	Page views + bandwidth	WLE

The metrics above were useful to show the visitors' trends, depth of visits, and activity by time on the web pages in the Emirate site. For example, it was found that users spent more time on peak time and navigated fewer pages. However, these were limited results, and it was found that partial web metrics do not provide reasons why a particular behaviour was observed. Therefore, further user or heuristic studies need to be conducted.

5- Overview of using web analytic tools

It was found that web analytics tool were able to identify some definite problems on the site in a short time and at little cost. In contrast, previous reports illustrated that heuristic evaluation and usability testing cost more and involved spending more time in order to find and examine appropriate participants, as well as the time taken to analyse the results. This shows the power of features in web analytics to evaluate e-Government websites. However, the number of problems identified by web analytics was limited in contrast with the problems identified by heuristic evaluation and usability testing. Therefore, the researcher changed the order of implementing the methods used in order to find the most useful implementation that would allow e-Government websites to be assessed efficiently.

Nevertheless, some limitations were faced in implementing web analytic tools:

1- The grant given to the researcher in Google Analytics did not allow some features to be implemented. So, access as a full user of Google Analytics needs to be granted as this would allow goals to be defined in terms of examining the funnels of transactions made on the site.

2- Some JavaScript code should be added in order to monitor the search, RSS and event tracking for some pages on the site. This would allow the usage of some features on the site to be analysed. For this enhancement, research could provide help in implementing this.

6-Conclusion

1 - This evaluation is part of the scientific research carried out by the researcher (Abdulhadi Eidaroos) who undertakes to maintain the privacy and confidentiality of information learned from the results of studying the Emirate of Makkah site.

2 – The results in this report form a scientific evaluation of the EM site; they do not in any way criticise or infringe the considerable efforts made in this site. Instead, the findings in this report are offered as advice to be used in future work on any new versions of the EM site.

3-The data analysed and produced in this report were the site's traffic data; internal data inside the Emirate of Makkah, which were fully respected, were not accessed.

4-The researcher will improve the evaluation framework for e-Government websites so that this can be implemented on any e-Government websites. However, it was found that the Emirate of Makkah is to publish a new version of its website and so the researcher could help in evaluating the new version. However, it is hoped that the limitations faced by this research, as indicated above, will be overcome.

Appendix 6: Browser Bounce (BB) metrics

	Browser	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	Internet Explorer	92,422	5.25	00:04:25	50.62%	24.98%
2.	Firefox	9,687	4.26	00:03:59	49.88%	37.48%
3.	Chrome	3,260	5.20	00:04:29	67.18%	32.98%
4.	Safari	2,942	2.90	00:04:17	83.41%	47.72%
5.	Opera	437	4.15	00:03:53	57.21%	46.22%
6.	Opera Mini	257	4.28	00:19:19	75.10%	33.46%
7.	Mozilla Compatible Agent	79	4.44	00:08:38	100.00%	26.58%
8.	Mozilla	50	1.80	00:01:37	70.00%	66.00%
9.	NetFront	29	3.59	00:03:19	72.41%	41.38%
10.	BlackBerry8900	21	2.24	00:02:29	33.33%	28.57%

Appendix 7: Screen Resolution (SR) metrics

	Screen Resolution	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	1024x768	42,323	5.25	00:04:22	49.79%	25.58%
2.	1280x800	36,407	5.28	00:04:38	52.36%	25.68%
3.	800x600	7,789	5.43	00:04:32	43.56%	25.46%
4.	1280x1024	7,026	4.84	00:04:08	44.63%	26.87%
5.	1366x768	4,375	5.15	00:04:27	59.86%	29.81%
6.	1152x864	3,912	4.75	00:03:51	46.47%	28.55%
7.	1440x900	3,168	4.49	00:03:53	54.29%	38.10%
8.	1280x768	2,394	5.00	00:04:15	53.17%	27.15%
9.	240x320	1,556	3.53	00:06:34	98.78%	26.16%
10.	1280x720	1,435	5.44	00:05:11	45.78%	24.18%

Appendix 8: Download Quality (DQ) metrics

Most Requested Images (by WLE)

	Image	Hits	Incomplete Requests	Visitors	Bandwidth (KB)
1	http://www.makkah.gov.sa/images/header.jpg	25,695	62	19,092	333,431
2	http://www.makkah.gov.sa/images/search_process.png	25,393	28	18,994	125,156
3	http://www.makkah.gov.sa/images/rules_and_procedures.png	25,382	27	18,975	123,100
4	http://www.makkah.gov.sa/images/process_request.png	25,468	27	18,971	131,170
5	http://www.makkah.gov.sa/images/main-but-2.png	24,954	25	18,673	72,939
6	http://www.makkah.gov.sa/uploads/saudi.gov.gif	25,013	25	18,627	99,038
7	http://www.makkah.gov.sa/images/main-but-4.png	24,911	26	18,579	73,967
8	http://www.makkah.gov.sa/images/bg_menu.jpg	33,576	41	18,564	163,758
9	http://www.makkah.gov.sa/images/tableft5.gif	26,246	0	18,492	1,687
10	http://www.makkah.gov.sa/images/tabright5.gif	26,056	0	18,470	8,659

Most Requested File Types (by WLE)

	File Type	Hits	Incomplete Requests	Bandwidth (KB)
1	Jpg	1,244,433	689	15,965,973
2	Png	924,710	985	3,891,003
3	Htm	654,080	0	10,268,198
4	Php	483,277	0	1,684,466
5	Css	453,756	545	2,087,527
6	Js	444,226	1,265	11,256,006
7	Gif	325,897	954	5,036,968
8	Doc	3	0	575
9	Docx	1	0	36
	Total	**4,530,386**	**4,438**	**50,190,776**

Appendix 9: Countries and Cities (CC) metrics

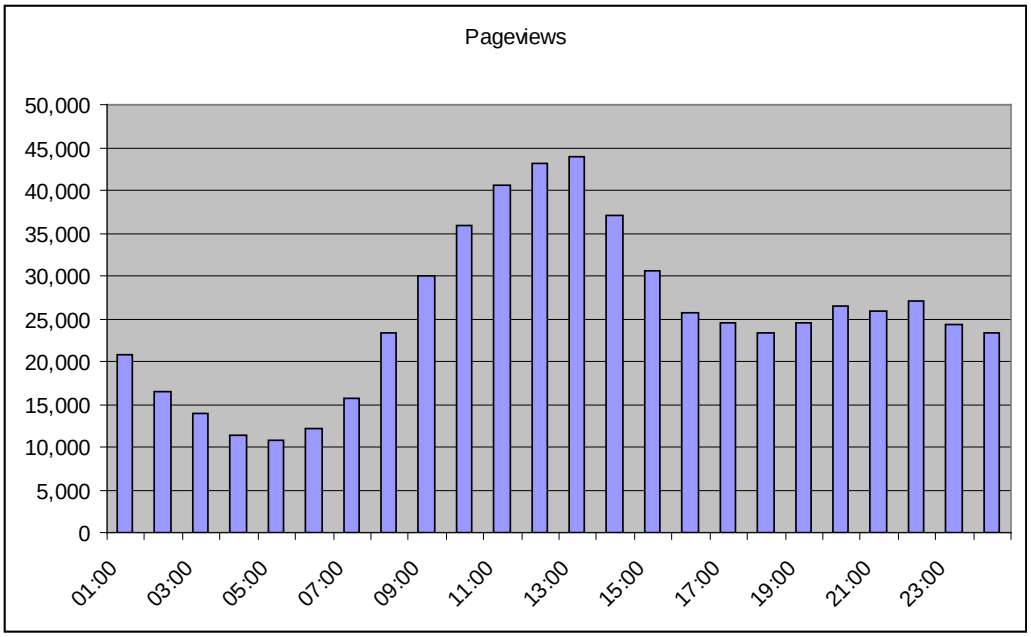
	Country	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
1.	Saudi Arabia	107,126	5.28	00:04:34	49.05%	23.89%
2.	Egypt	2,759	6.23	00:05:53	53.90%	36.68%
3.	United States	2,100	3.34	00:02:33	70.76%	54.00%
4.	United Kingdom	693	4.38	00:03:18	67.97%	42.28%
5.	Morocco	508	2.50	00:02:36	85.83%	61.61%
6.	Jordan	485	3.55	00:03:05	77.11%	48.45%
7.	Algeria	471	1.94	00:01:59	91.72%	71.76%
8.	United Arab Emirates	461	2.88	00:01:53	79.39%	59.00%
9.	France	370	3.41	00:02:18	59.73%	44.59%
10.	Pakistan	274	2.62	00:02:43	80.66%	62.04%

Appendix 10: Time on the Page (TP) metrics

	Page	Pageviews	Avg. Time on Page	Bounce Rate	% Exit
1.	/	132,005	00:01:21	23.36%	25.07%
2.	/process	53,482	00:00:47	14.60%	15.12%
3.	/page/23 (e-Imarh page)	30,062	00:00:53	10.88%	14.87%
4.	/contact-us	15,901	00:02:39	33.54%	26.01%
5.	/login	15,564	00:00:40	14.29%	8.47%
6.	/page/43	15,233	00:00:37	29.77%	13.29%
7.	/page/328	12,299	00:00:43	10.34%	10.25%
8.	/page/21	11,777	00:00:54	28.57%	14.30%
9.	/page/53	9,454	00:00:26	16.34%	5.09%
10.	/procedures/2/2	8,551	00:01:29	34.87%	26.10%

Appendix 11: Peak Time (PT) metrics

Hour of the day	Page Views	Visits	Pages/Visit	Bounce Rate	Avg. Time on Site
01:00	20,775	3,825	5.43	27.71%	00:04:41
02:00	16,400	2,925	5.61	29.44%	00:04:31
03:00	13,870	2,487	5.58	29.88%	00:04:23
04:00	11,281	2,052	5.5	30.51%	00:04:16
05:00	10,756	1,958	5.49	29.26%	00:04:15
06:00	12,186	2,330	5.23	28.80%	00:04:09
07:00	15,677	3,201	4.9	27.96%	00:04:51
08:00	23,322	4,857	4.8	25.88%	00:04:43
09:00	30,032	6,163	4.87	26.04%	00:04:53
10:00	35,851	7,822	4.58	24.02%	00:05:06
11:00	40,655	7,977	5.1	22.73%	00:04:52
12:00	43,199	8,086	5.34	22.38%	00:04:56
13:00	43,968	8,414	5.23	23.46%	00:04:45
14:00	37,107	7,088	5.24	25.03%	00:04:11
15:00	30,649	5,849	5.24	25.29%	00:04:06
16:00	25,670	5,086	5.05	28.00%	00:04:07
17:00	24,598	4,812	5.11	28.24%	00:04:21
18:00	23,236	4,732	4.91	29.63%	00:04:06
19:00	24,474	4,879	5.02	28.61%	00:04:34
20:00	26,405	5,137	5.14	29.14%	00:04:29
21:00	25,831	5,088	5.08	29.40%	00:04:32
22:00	27,116	5,044	5.38	29.26%	00:04:29
23:00	24,332	4,714	5.16	29.57%	00:04:20
00:00	23,302	4,289	5.43	28.07%	00:04:21

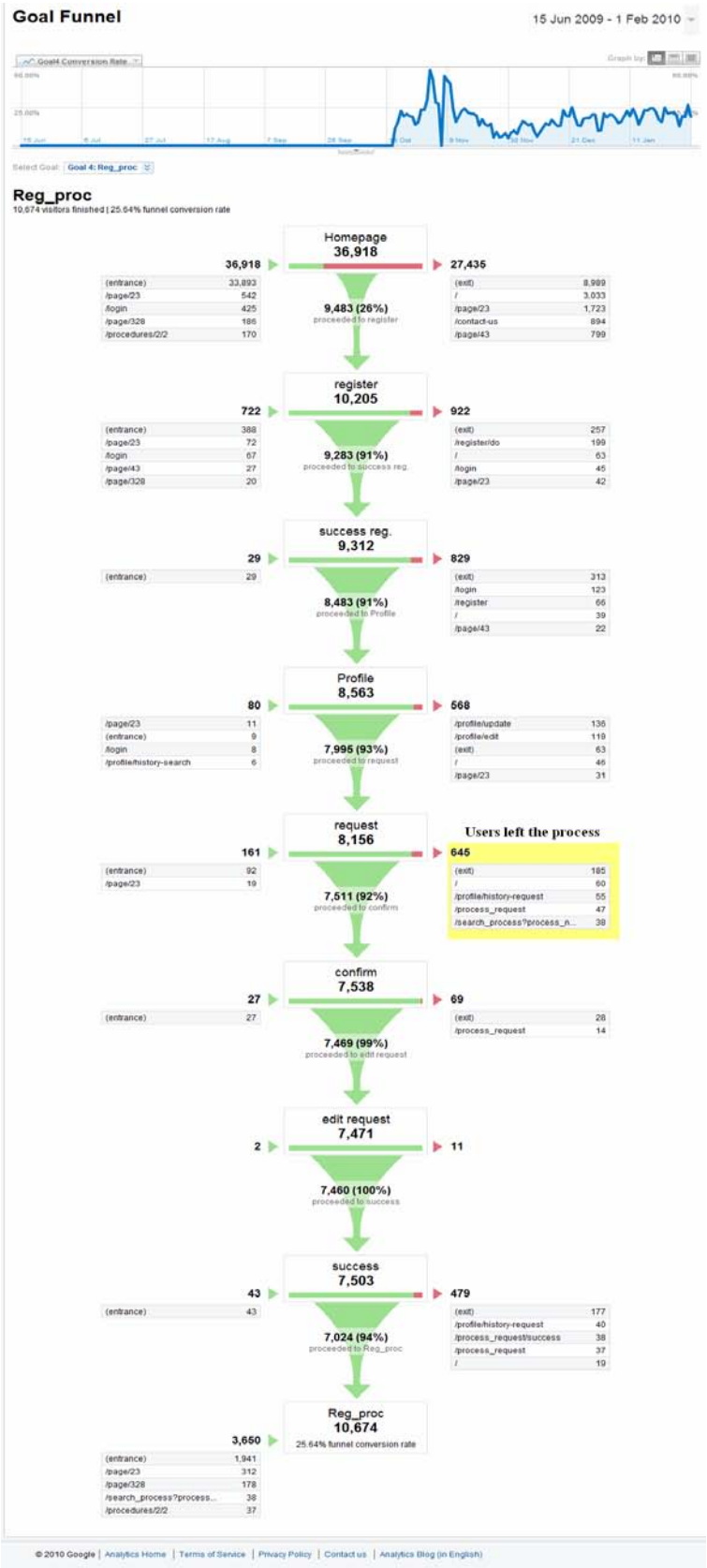


Page views on the EM site for each hour in a day in WLE

Appendix 12: Site Overly (SO) metrics

Appendix 13: Updating Account Details Page

Appendix 14: Goal Funnel for Online Process



Appendix 15: Refined Heuristic Evaluation Checklist

Heuristic Evaluation Checklist
Target website:
http://www.makkah.gov.sa/
Date: **Time start:** **Time finish:**

Evaluator name:

1. Consistency:
The website should always show consistency with web standards.

#	Review Checklist	Yes /No	Comments
1.1	Is a consistent design used across all pages within the website?		
1.2	Is all content on the site consistently presented?		
1.3	Are texts and links consistently described by meaningful labels?		
1.4	Is the most important information consistently placed in a noticeable position?		
1.5	Are headers easily distinguishable so they are readily noticed by the user?		
1.6	Are there consistent explanations of what is required in a data entry field?		
1.7	Do data entry forms follow a consistent presentation and format?		
1.8	Are the menu items prioritised?		
1.9	Are the services well highlighted?		

2. Links and navigation

The website should always allow users to navigate easily, through appropriate links.

#	Review Checklist	Yes/No	Comments
2.1	Are groups of links displayed in the most logical way, using good practice?		
2.2	Is the navigation area placed in a noticeable position so the user can easily use it?		
2.3	Do pages contain appropriate menu entries to link to related information?		
2.4	Are there appropriate links within the body text on pages?		
2.5	Are links within the body text labelled appropriately (e.g. the “click here” label is avoided)?		
2.6	Are links shown in standard colours?		
2.7	Do all links work?		
2.8	Do link colours indicate visited and unvisited links?		
2.9	Do outbound links usually open in a new window?		
2.10	Do all sub-pages contain a link to the homepage in a noticeable place?		
2.11	Do links clearly indicate what will happen (e.g. a new page or file will download)?		
2.12	Is excessive vertical scrolling minimised on each page?		
2.13	Is there a group of links to the most visited pages?		
2.14	Is there a group of links to the most downloaded documents?		
2.15	Does the site provide inquiry services in a noticeable place?		
2.16	Is the menu offering the services clear?		
2.17	Does the site inform users about the processes while they wait for a response?		

3. Helping users:

The website should enable users to discover and perform search on the site. Also, it should help users to recognize error messages, which should be provided in understandable language that helps users solve problems.

#	Review Checklist	Yes/No	Comments
3.1	If applicable, are advanced search facilities provided?		
3.2	Are the search results described clearly?		
3.3	Is the ranking of search results appropriate?		
3.4	Can the search facility be used in other languages?		
3.5	Is information on commonly used search terms provided to users?		
3.6	Can a FAQ page be easily located?		
3.7	Does the FAQ page provide useful information?		
3.8	Does the website provide documents that can be downloaded?		
3.9	Is there a contact e-mail on every page?		
3.10	Is it easy to find a site map?		
3.11	Is it easy to find an A-Z directory?		
3.12	Does the website contain Contact Us information?		
3.13	Does the website allow users to enter their query in feedback form?		
3.14	Are optional data entry fields clearly marked?		
3.15	Do fields in data entry forms contain default values where appropriate?		
3.16	For user input fields, is there clear information about how these fields should be filled out?		

#	Review Checklist	Yes/No	Comments
3.17	Have labels been used to indicate field length?		
3.18	Does the website warn users if they are about to make a possible error?		
3.19	Are data-entry error messages displayed in an observable location?		
3.20	Do data entry error messages explain how to solve the error?		

4. Features and Functions:

E-Government require to efficiently use the Web features and functions, which enable stakeholders to interact more with e-Government website.

#	Review Checklist	Yes/No	Comments
4.1	Is there an RSS feed to keep the user informed of anything new in the site?		
4.2	Is there an e-mail list feature that can keep users informed about anything new on the site?		
4.3	Are users allowed to copy the contents?		
4.4	Are users allowed to paste text to specific text boxes?		
4.5	Are users able to print the contents of pages?		

5. Data Entry Forms

E-Government should allow stakeholders to input their data in appropriate place. This should include clear highlights on commonly sought information in the site in an appropriate way that users can become familiar with.

#	Review Checklist	Yes/No	Comments
5.1	After the user completes an action, does the feedback indicate that the next action can be started?		
5.2	If there are noticeable delays in the website's response time, is the user kept informed of the system's progress?		
5.3	Are users asked to 'confirm' actions before they are executed?		
5.4	If users can go back to a previous page, can they change their choice on the earlier page?		
5.5	For data entry pages with many fields, are users able to save partially completed forms?		
5.6	Does the current date and time appear in the online form?		
5.7	Does the editor used for online forms contain features that allow users to enter their request efficiently?		
5.8	Does the form include an email address or telephone number for help if the user is struggling when using the form?		
5.9	Does the form clearly show the number of document attachments that are required so that the user can enter these in the appropriate boxes?		
5.10	Are the attachments embedded in clear boxes so the user can check these easily?		
5.11	Are the procedures described in the online form found easily by the user?		
5.12	Are users told how long it will take to conduct the request?		
5.13	Does the feedback page inform the user about the reference number that is given,		

#	Review Checklist	Yes/No	Comments
	their request, and the attachments provided?		
5.14	Does the feedback email contain the given reference number for the request?		
5.15	Does the feedback email contain a confirmation of what was entered, as well as the names of the attachment documents?		
5.16	Does the feedback email contain a telephone number and email address so users can follow up their request?		
5.17	Does the enquiry service give an indication of which department is currently dealing with the request, and what it is doing?		
5.18	Does the enquiry service indicate the time needed to process the request?		
5.19	Is the contact number provided of the department that holds the request in the enquiry service?		
5.20	Does the enquiry service protect user data, such that the user needs authorisation to utilise this service?		

6.Minimize user's memory load (Visual design)

User should not have to memorize information throughout the website. Instructions should be accessible from any part of the website and able to be seen through the website

#	Review Checklist	Yes/No	Comments
6.1	Are messages placed where the eye is likely to be looking on the screen?		
6.2	Have items (links, images, text) been grouped under logical headings?		
6.3	Have headings been separated to allow users easily to identify each group?		
6.4	Is there good colour and brightness contrast between image and background colours?		
6.5	Is colour used appropriately to emphasise important information?		
6.6	Does the website offer the feature of personalised pages to suit different citizens' profiles?		
6.7	Is the search text box able to suggest relevant keywords to match the letters entered initially?		
6.8	Does the colour of text differ from the background colour so text can be easily read?		
6.9	Do the colours used on the site conform to common expectations about colour codes?		
6.10	Is white space used efficiently within pages?		
6.11	If images are used as visual cues, do they match cultural conventions?		

7. Accessibility for visually impaired users

The E-government website should be for all citizens including those people with special needs to use the site. These questions will examine a subset of w3C priority guidelines for visually impaired users.

#	Review Checklist	Yes/No	Comments
7.1	Can disabled users easily access and navigate the site?		
7.2	Is there a special version of the website for visual impaired users?		
7.3	Does the website allow users to control fonts and colour to aid reading for impaired users, so visually impaired users can easily access and navigate the site?		

Note: W3C guidelines, which generally includes: (Caldwell et al, 2008)
1- Elements in the content must be suitable for being used.
2- The site content must be able of being perceived.
3- The web content must be able to work with current and future technologies.
4-Content and controls must be able of being understood.

8. Security and Privacy

Government sites are required to be protected against the problems caused by hackers. Citizens' information must always be protected when they working online on a government website.

#	Review Checklist	Yes/No	Comments
8.1	Does the site have a clear link to privacy policy information?		
8.2	Does the website use encryption techniques appropriately when acquiring user data?		
8.3	Where applicable, does the website employ virtual keyboards for password input?		
8.4	If the user has signed into the system, does the text in the URL contain any information about the user?		
8.5	Does the website log out users when the website is left inactive for a considerable time?		

9. Information truth and precision

Essential information should be precise and correct, as inaccuracies may affect the citizen. So the government has a responsibility to keep their websites up to date, accurate and properly maintained.

#	Review Checklist	Yes/No	Comments
9.1	Does the domain name refer to the official government website (.gov.sa)		
9.2	Is information clearly date stamped?		
9.3	Does the agency logo appear in a prominent place on the page?		
9.4	Is there a clear description in a prominent location in the site explaining what the agency does?		
9.5	Does the agency structure and responsibilities of main divisions and units appear in a prominent location on the site?		
9.6	Does the organisational chart explain the senior management's organisation in the agency?		
9.7	Does the agency offer a list of services that are provided so users have a clear view about the website?		
9.8	Are services' requirements well explained so users can recognise the benefits and effects of applying services?		
9.9	Does the site contain information about the planned projects of the agency?		

Appendix 16: User Testing Form for the second implementation

Legal Form

Purpose:	The purpose of the study is to evaluate the Emirate of Makkah website. The study will acquire your views on the usability of the website.
Study Environment & Recording	The study take place in Loughborough University where you will be observed as you use the website. During the study, which should last approximately two hours, all of your interactions on the website will be recorded by special software and you will be observed by the researcher. By signing this form, you give your consent to this data being used by the researcher to evaluate the site. However all the data will be anonymous - your name will not be associated with the data.
Information Collected	During the study you will also be asked to fill out two brief questionnaires, and answer some questions on how you used the site. As before all this information will be anonymous.
Non-disclosure Agreement	During this study, the researcher will ask you complete tasks on a government website, and to speak aloud as you undertake the tasks. When speaking aloud you should express your thoughts, doubts and any confusion you may have – in fact please indicate any positive or negative expressions related to ease of use of the site and your feelings when using the site. Please note that it is the website that is being examined not your performance. Any information you acquire relating to this website is confidential and proprietary, and is being disclosed to you only so that you can participate in this study.
Comfort	The researcher has scheduled breaks for you, but you may take break at any other time you which. Just inform the researcher that you would like to do so.
Freedom to Withdraw	You may withdraw from this study at any time.
Freedom to Ask Questions	If you would like to ask any questions, you can ask the researcher now or at any time during the test.

If you agree with the above terms, please indicate your acceptance by signing below:

Printed Name: ……

Signature: ……..

Date: ……

Pre-test Questionnaire:

For the following questions below, circle the answer of your choice:

1. What gender are you?
    a. Female Male

2. Which age range do you belong to?
    a. 18-24 25-31 32-40 40-50 50+

3. What is your job title?

4. How would you describe your work?

5. How long have been doing this kind of work?
    a. - Less than 1 year - 1 year - 2-4 years - 5-10 years

6. How long have you been using personal computers?
    a. - Less than 1 year - 1 year - 2-4 years - Over 5 years

7. How often do you use the internet?
    a. Several times a day Once a day Once a week
    b. More than once a week Once a month

8. How long have you used Emirate of Makkah website?
    a. - Never - Less than 1 month - More than 1 month
    b. - More than 6 months -More than 12 month

User Tasks:

Task 1 *١٠ minutes*

This is the homepage of Emirate of Makkah web site. Could you please give me your initial reactions to this homepage. Feel free to explore this page as you would using your mouse, and I will ask you some questions after that. But, please remember to speak aloud, and do not click on any link right now.

I will give you ten minutes to do this task, and I will let you know when the time has finished.

(Questions that I will ask)

1. Please give me your first impressions about the layout of this page and what you think of the menu choices, colours, texts ,graphics, photos used in this site?
2. Please describe the options you see on the homepage and what you think they do. Feel free to move around the page, but again without clicking on anything right now.
3. If you were exploring this site, what would you click on first? (Without clicking on anything yet)
4. What do you think is the purpose of this site?
5. Who do you think this site is intended for?

Task 2 *10 minutes*

I will give you ten minutes to freely explore this web site. You can go anywhere you would like to go on the site, but please remember to speak aloud as you do so.

I will tell you when the ten minutes has finished.

Task 3 *5 minutes*

I will give you five minutes to find more information about two provinces under the Emirateof Makkah (Al-Jamoum and Al-Kamel areas), Please go anywhere you would like on the web site to do this task, but please remember to speak aloud as you do so.

I will tell you when the five minutes has finished.

Task 4 *25 minutes*

I will give you twenty five minutes to apply for an online service provided by the Emirate of Makkah website. This service is to record a problem that needs official acceptance from the Emirate of Makkah. In particular, you will applying for a permit to transfer a corpse (a dead body). Go anywhere you would like to go on the web site to complete the task, but please remember to speak aloud as you do so.

I will tell you when the twenty-five minutes has finished.

Interview questions:

1. What are your overall impressions of the Emirate of Makkah web site?

2. If you had to give the site a grade, from 1 to 5, where 1 was excellent and 5 was bad, what grade will you give it, and why?

3. Would you use this website to apply for services instead of going personally to the Emirate of Makkah? If so, why?

4. What were the main problems that you experienced, if any?

5. What do you like least about the online services provided?

6. What do you like best about the website?

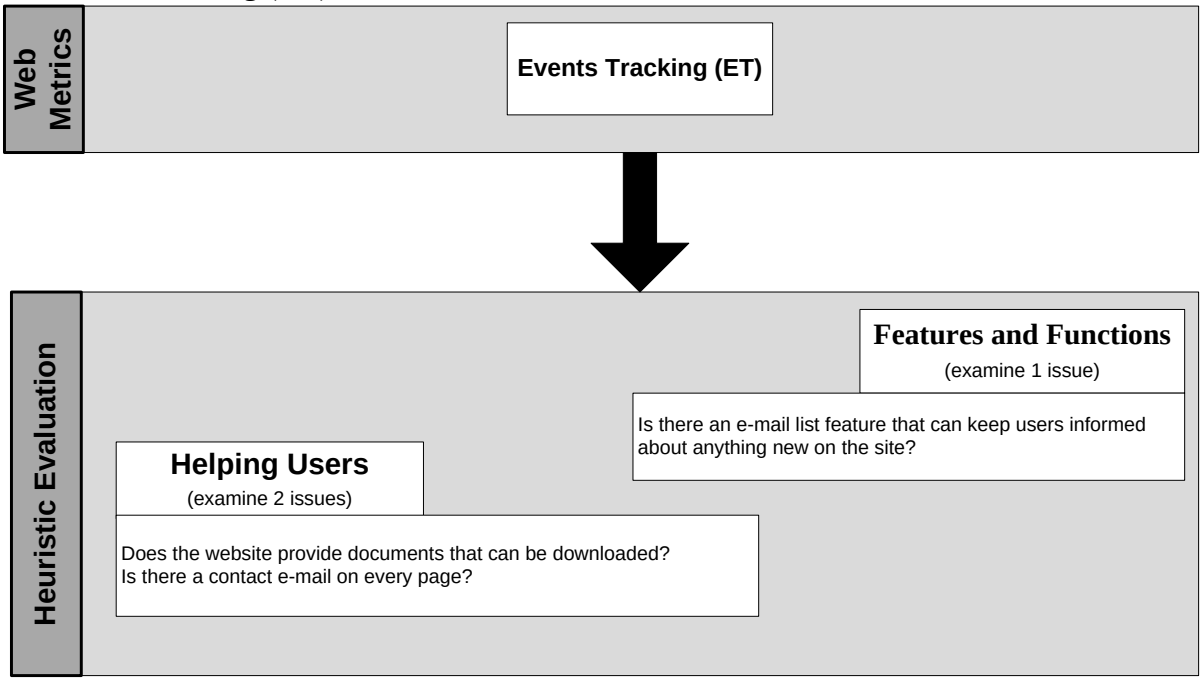
7. When applying for online service for a permit to transfer a corpse record, did this form concern you about the acceptance of your request?

8. Is there anything that you feel is missing on this site? (e.g. in content or in site features/functions)

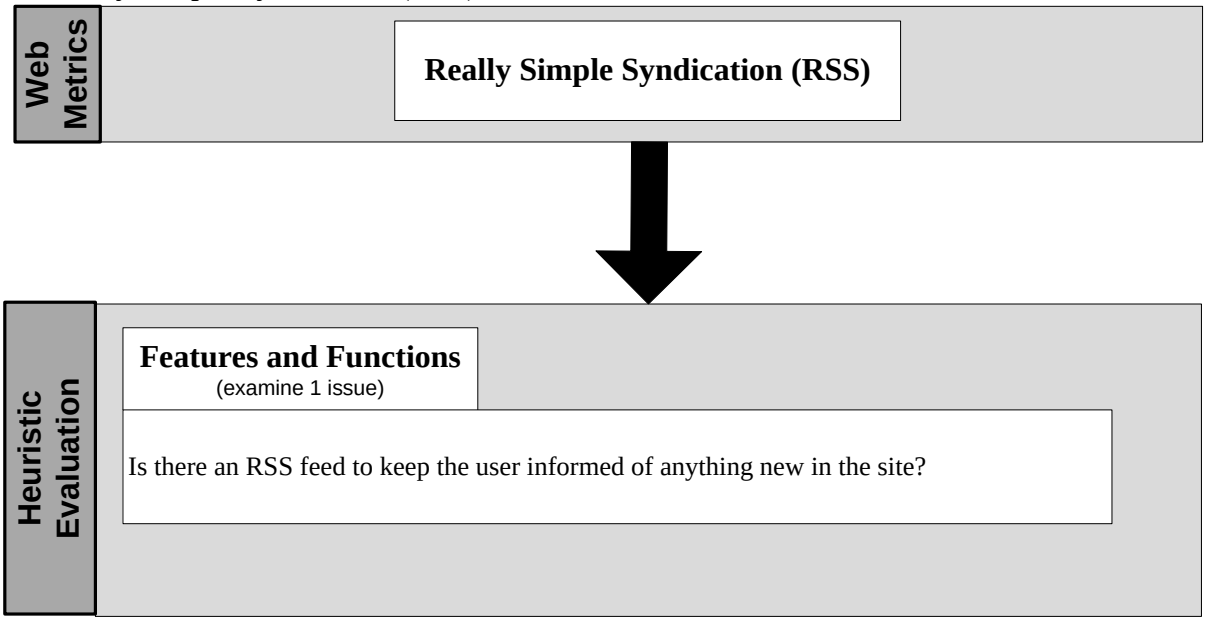
9. Are there materials you would like to see added to the site? If so, which?

Appendix 17: The rest of KPIs structure in short-period implementations

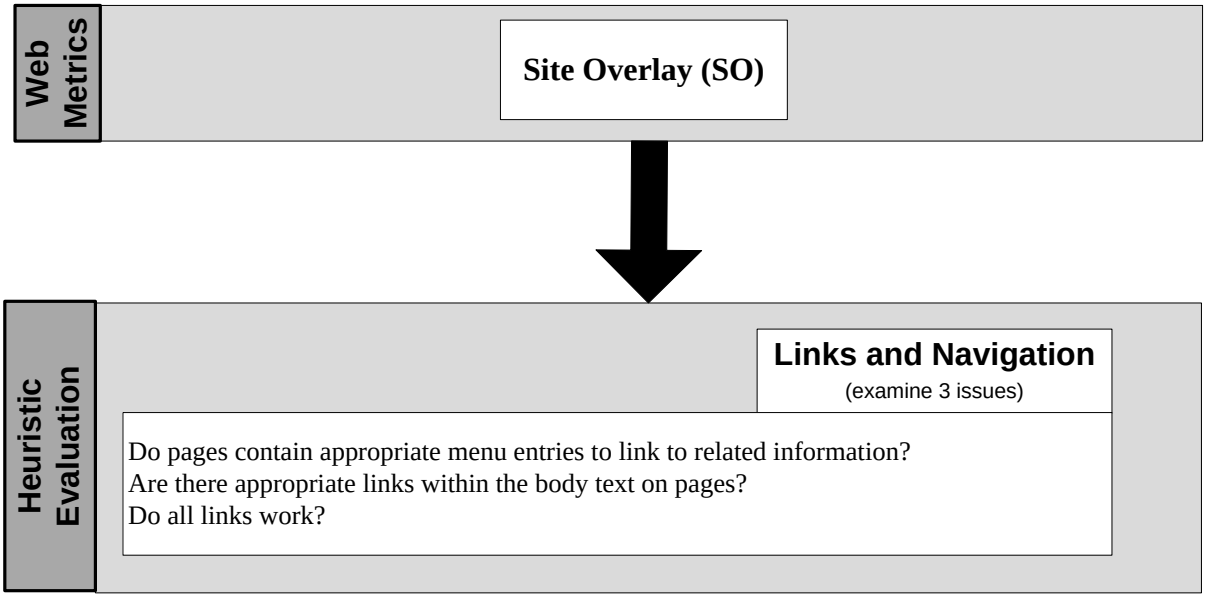
1- Events Tracking (EV)



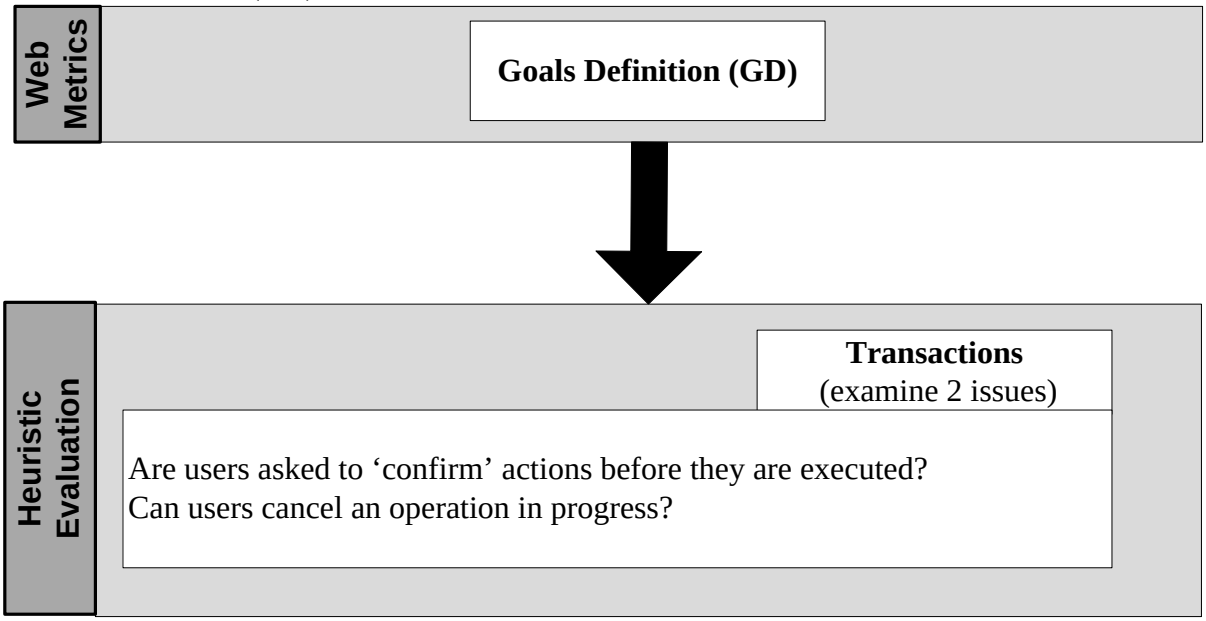
2- Really Simple Syndication (RSS)



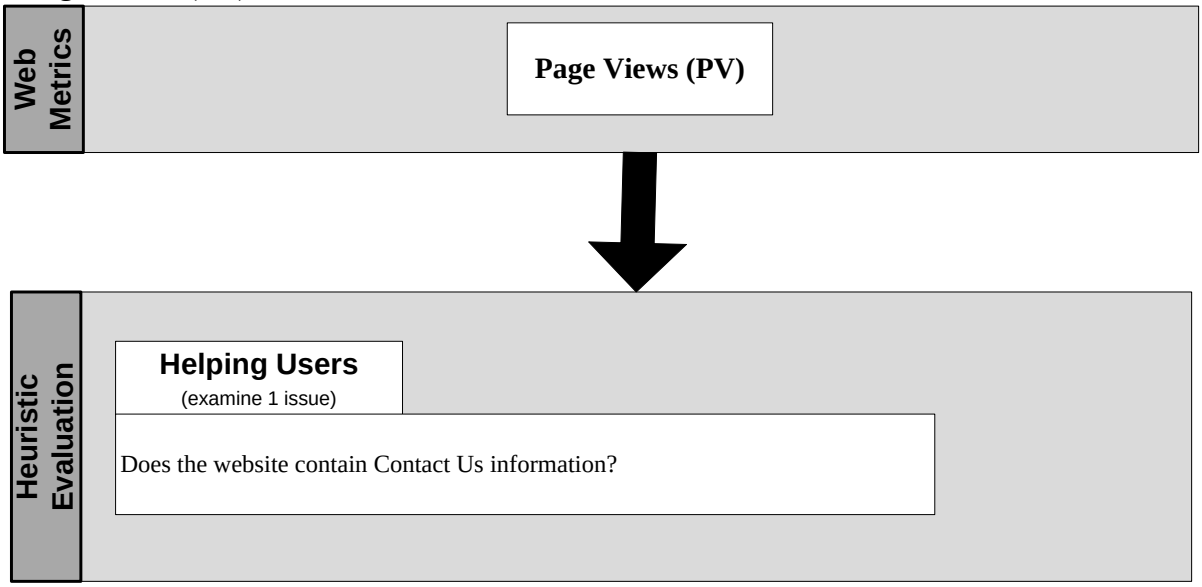
3-Site Overlay (SO)



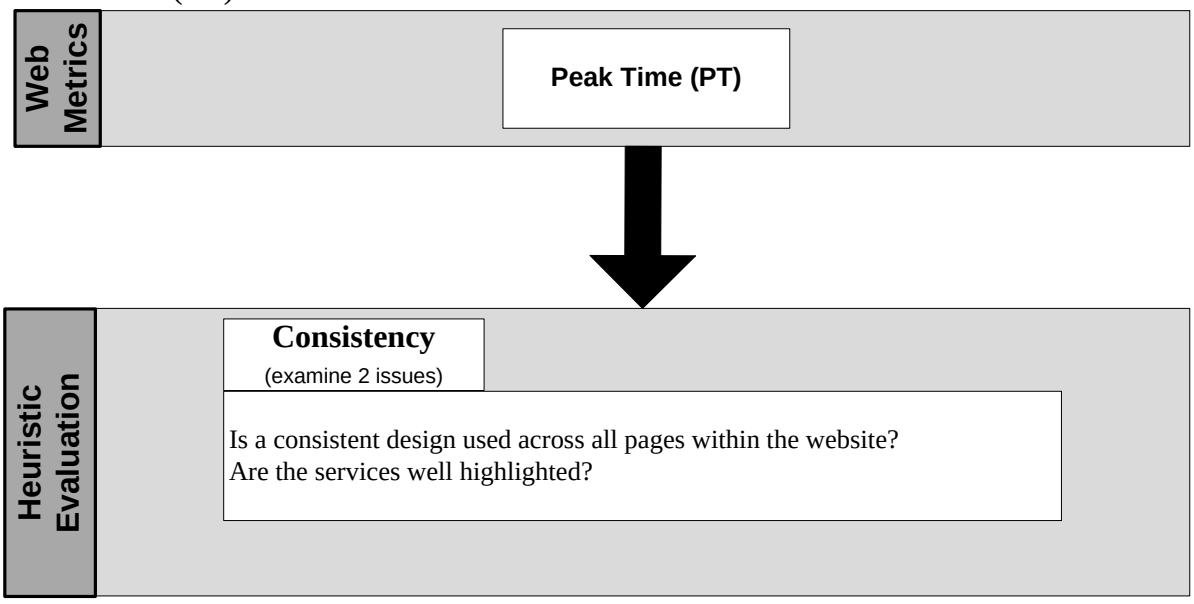
4-Goals Definition (GD)



5-Page Views (PV)



6-Peak Time (PK)



Appendix 18: Feedback Interview Schedule

1	**Introduction**
	- The purpose of this research, and the results achieved in the first implementation. - What do I need to know from your organisation. - Data protection.
2	**Overview of the Designed Evaluation Framework**
	1. Do you think that the designed evaluation framework for e-Government websites can give you more efficient evaluation? 2. What do you think is good in this evaluation framework? 3. Do you think the existing government websites is able to use this evaluation framework, and to what extent?
3	**Limitations in the Designed Evaluation Framework**
	1. Are there any limitations do you think in the supposed evaluation framework? 2. What are the factors that you think may affect applying this evaluation framework in Saudi Arabia? 3. Is there anything you would like to add?

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