Lund University

School of Economics and Management

Department of Informatics

Technical Factors Affecting the Adoption of E-Government

Master thesis, 15 ECTS, INFM03 in informatics

Presented : 2012-5-30

Authors : Yaqoob Al-Rahbi; Suleiman Al-Harrasi; Sami Al-Wahaibi

Supervisor: Fernebro, Lars

Examiners: Olerup, Agneta and Pierce, Paul

Title : Technical Factors Affecting the Adoption of E-Government

Authors : Yaqoob Al-Rahbi; Suliman Al-Harasi; Sami Al-Wahaibi

Publisher : Department of Informatics

Supervisor : Fernebro, Lars

Examiners : Olerup, Agneta and Pierce, Paul

Presented : 2012-5-30

Thesis Type : Master Thesis

Language : English

Key words : E-government adoption, Technical factors, IT Infrastructure, IT Standards, IT Security, Technical expertise.

ABSTRACT

As a major step to development, countries try to implement e-government and encouraging the public to use e-services instead of traditional ways. It is obvious that adoption of e-government has increased in many countries over the world, but the rate of adoption varies from country to country, and also the factors which are affecting the adoption of e-government differ from developing countries to developed countries.

The purpose of this research study is to identify and describe the technical factors affecting the adoption of e-government from the management prospective of e-government projects in turn, to enhance the e-services of those projects and to improve the development process of e-government adoption by illustrating the level of importance for technical factors in the current e-government stages. This study has considered Oman government as an example as it hopes to be helpful for other governments which are at the similar level of e-government stages and close circumstances with Oman.

This study has found four technical factors that affecting the current adoption of e-government initiative in six government agencies in Oman. Those factors are ICT infrastructure, IT security, IT standards and technical expertise. Moreover, it found that each one of them has a different level of importance in the management process. The most important factor that Oman government needs to be considering in the current stages of e-government is ICT infrastructure. Furthermore, it found two non-technical factors that support these four technical factors to be functioning appropriately which are IT Governance and citizens' awareness.

This study has brought up different ways of managing these technical factors in order to accomplish the adoption of e-government through these factors which affect the adoption. These different ways are: set a unit as a coordinator to guide the management of these factors to fasten the adoption, with centralized the e-government initiatives the implementation should be decentralized upon the agency itself, setting up framework for example ICT infrastructure framework and security frame work to standardise the processes in a way that assist to speed up e-government adoption, and the last one is to gain experience from pioneers and other consultancy offices.

In addition to that, the management of those factors could be affected by external pressures like internet facility in the country, government regulations, the private sectors attraction for technical expertises and citizens' awareness about security issues.

To our parents, wives and children.

Acknowledgement

In the name of Allah, the Entirely Merciful, the Especially Merciful. [All] praise is [due] to Allah, Lord of the worlds – The Entirely Merciful, the Especially Merciful, Sovereign of the Day of Recompense. It is You we worship and You we ask for help. Guide us to the straight path – The path of those upon whom You have bestowed favor, not of those who have evoked [Your] anger or of those who are astray. Qur'an 1:1-7.

After sincerely thanking Allah for all blessings and guidance, we would like to thank several individuals for their assistance, encouragement, support and guidance.

In the first place, we owe special thanks to our parents, wives, children and families for their patience and encouragement during our study in Sweden.

We gratefully thank all faculty members in the Informatics Department with a sincere gratitude to our supervisor Lars Fernebro for his friendly cooperation and valuable advice.

We are also grateful to our beloved Oman and those who gave us full scholarships as collaborations between the European Commission - Erasmus Mundus, Sultan Qaboos University and University of Nizwa.

We extend our thanks to all participants in this research.

Contents

List of figures

List of tables

List of Acronyms

CIS	: Centre Information Security, Oman
DOI	: Diffusion of Innovation Theory
E-commerce	: Electronic commerce
E-government	: Electronic government
E-Oman	: Electronic Oman
E-services	: Electronic services
G2B	: Government-to-Business
G2C	: Government-to-Citizen
G2E	: Government-to-Employee
G2G	: Government-to-Government
ICT	: Information and Communications Technology
IDA	: Info-communications Development Authority
IS	: Information System
ITA	: Information Technology Authority, Oman
MM	: Muscat Municipality, Oman
MoE	: Ministry of Education, Oman
MoHE	: Ministry of Higher Education, Oman
MoM	: Ministry of Manpower, Oman
OECD	: Origination for Economic Co-operation and Development
OeGF	: Oman e-Governance Framework
TAM	: Technology Acceptance Model
TB	: Tender Board, Oman
TRA	: Telecommunications Regulatory Authority, Oman
UNDESA	: United Nations Department of Economic and Social Affairs

1. Introduction

Global era changes make the Internet available everywhere, to everyone and it is very useful to provide different online services. Within the past dozen or so years, it was mainly used for educational, information provision and sharing purposes (Schneider & Perry, 2000). However, today the Internet applications facilitate many essential daily activities and the community has become more interested in the services provided electronically. Electronic government (e-government) is an important application of the Internet and is used by establishments to encourage broad use of computers and to help communication and interactions with its ministries, citizens and businesses (Evans & Yen, 2006; Gil & Martinez, 2007; Reddick, 2006; Sprecher, 2000). The main aim for such electronic initiative is to proceed towards better access to information and improved electronic services (e-services). There is a significant acceleration of many government agencies which try to use different Information and Communications Technologies (ICT) like wide area networks, the Internet, and mobile computing to adopt the e-services (The World Bank Group, 2012).

The revolution of modern ICT leads many government authorities to spend a lot of money and resources for delivering their services to citizens electronically despite the difficulties and obstacles of this adoption (Chen *et al.*, 2006). In 2012 about 190 out of 193 United Nations members reported that they developed strategies to adopt the e-government services compared to 2008 when they were 179 countries, which is a result of the increasing power of ICT. This has given governments the flexibility of providing services and information to citizens through multi channels (United Nations, 2008; United Nations, 2012). This rise in e-government adoption leads to the need of understanding the factors which may affect such a process to enhance it and avoid the loss of resources.

Regardless of how advanced countries are in terms of ICT infrastructure and deployment, many technical and non-technical factors can affect the adoption of e-government. For example, in the United States spending on e-government projects is expected to increase 6.9% yearly (Pulliam, 2005), but still many citizens may be reluctant to adopt e-government services due to a lack of trust in the security of online transactions and concerns regarding the use of information submitted electronically, they are still more likely to use traditional ways like in-person visit or phone calls than the Web to interact with the online services (David *et al.*, 2004; David & Pierre, 2008). The technical problems of managing e-service do not just have an impact on the services' performance but also in the users trust (McClure, 2000). For example, downtime and access problems which may interrupt e-service transactions and cause serious delays in any project of e-government also, may lead to the public's loss of confidence and to be frustrated about such services (United Nations, 2012). McClure (2000) noticed that technical problems are very common in the challenges facing the adoption of e-government and these kinds of factors can cause e-services failure due to discontinued use by citizens.

As shown above, countries like the United States which are considered advanced in technology are still suffering in their implementation of e-government due to technical factors which may impact the whole process of such adoption. Unfortunately, the developing countries are more likely to suffer from the technical factors more than the developed countries on which they have less impact. There has been a lack of specific research studying the technical factors affecting the adoption of e-government in Sultanate of Oman. Therefore,

this research aims to identify and describe the technical factors affecting the adoption of e-government in different e-government agencies in Oman.

In this chapter we will provide a general description of the problem statements, study purposes and objectives and then address the key questions. At the end will present the structure of the thesis.

1.1. Research scope

A few decades ago, many governments executed their transactions traditionally by using paper and files with less sufficiency and effectiveness (Mehrtens *et al*., 2001). As e-government represents a high frequency of information systems issues such as rapid changes in ICT, and since the governments play a critical role at the centre of driving the development of any country – either developed or developing – all governments start recognizing the huge benefits and usefulness of changing e-government and attempting to develop their countries through deploying such important online services.

Unfortunately, there are a number of barriers that are likely to obstruct e-government adoption or at least hold back the development of the current e-government projects (Ebrahim & Irani 2005; Schwester, 2009). At a time that developed countries are successfully overcoming most of the challenges facing e-government adoption, in contrast it can be found from research that developing countries are still struggling in order to make a step forward in this regard (Ndou, 2004). The barriers of adopting e-government in developing countries occur to disperse their initiatives, which lead to enormous failure of most e-government projects (Ndou, 2004). And as it is declared by Commonwealth Telecommunications Organization, (2008) about 35% of e-government projects in developing/transitional countries had totally failed and 50% had partially failed and only 15% succeeded. Therefore in order to overcome these barriers, they should be explored at the level of the adoption they are in. Each individual developing country has its own stage of development. The stage of developing would affect a particular position in e-government adoption stages. Most developing countries are in the different stages with only some interactive services to their citizens (Wagner *et al*., 2003; Mutula, 2005). Once returning back to the barriers and benefits of e-government adoption, it can be figured out that they represent some factors of e-government adoption. It can be seen that there are some common factors influencing adoption of e-government among some developing countries since they are at a similar stage and in similar circumstances (Kanaan, 2009).

The e-government is not a new discourse; however, the success of government initiatives to adopt such system depends on a number of factors. The e-government issue is a wide area to conduct the research on, and many aspects of such an issue need to be researched separately to have a better share of elaboration which leads to precise and valuable contributions in this field. To attain a good practice of e-government, the most important issue to shed light on is the factors that affect e-government adoption. Actually we started collecting numerous factors from many publications based on their categories either technical or non-technical - e.g., social, organizational, political, and cultural - that are associated with the stages (static, interaction, transaction, and integration) where the adoption process of e-government, in what stage (Shareef *et al.*, 2010). Based on the Rogers' Innovation Diffusion Theory and other literature and surveying on e-government, we see a significant positive relationship between

the elements of diffusion and e-government adoption from a technical prospective in a way that perceived benefits through effective and secure IT infrastructure, such as services access, service integration, platform, network, and data centre (Tung & Rieck, 2005). Also from the Delone and Mclean model of information system success, in order to achieve the success of any IS project, technological or technical issues at least – that is system quality - must be considered which is accordingly influencing the user's satisfaction directly, which in turn affect the adoption of any IS project, e-government (Lai & Pires, 2010). Therefore, we decided to choose technical factors that are affecting e-government adoption as our research focus in order to have contribution of common meaning to the countries which face the same problem of technical factors and how to manage them so that we are narrowing down the extensive topic as well.

1.2. Problem Area

Since organizational adoption has two scopes, non-technical and technical factors, the starting up of e-government is associated with the deployment of these scopes' resources. In this research we will identify technical factors affecting the adoption of e-government and investigate other factors that influence adoption of e-government services, particularly in the Sultanate of Oman, by handling six e-government establishments which are Information Technology Authority (ITA), Ministry of Education (MoE), Ministry of Higher Education (MoHE), Muscat Municipality (MM), Ministry of Manpower (MoM) and Oman Government Tender Board (TB). Furthermore, based on the report that has been issued by the United Nations, (2012) concerning e-government survey report, it stated that the Sultanate of Oman has advanced from a rank of 82 out of 193 in 2010 to a rank of 64 in the 2012, and that it attained 92% in the first stage (emerging), 64% in the second stage (enhanced), 48% in the third stage (transactional), and 57% in the fourth stage (connected). In contrast we found from the United Nations, (2012) concerning e-government survey report that some countries did achieve higher rank than Oman and other developing countries as well, which shows us the problem of why Oman did not achieve higher level/rank than what it did achieve currently.

Thus we will go in-depth in the main government department that is managing the e-government in Oman and its services (e-Oman), which is Information Technology Authority (ITA) in Oman, to investigate the technical factor affecting the adoption of e-government either of a new factor or an already existing one, considered feasible to achieve that position, and which one needs to be focused on more in order to cover the remaining percentage of 43% on stage four and other stages. Moreover, we will see what external pressures influence the management plan of those factors. This surely this will help the government to improve its current adoption process and will enhance the e-services of those projects.

1.3. Research questions

To leverage the full potential of e-government adoption, it is essential to identify the technical factors affecting the e-government adoption. To achieve the aforementioned purpose of this research we addressed the following question and sub-questions that should be answered clearly:

- What are the technical factors affecting the e-government adoption in Oman?
    - How important is a certain factor?
    - How could a factor be managed?
    - Is the management of a factor affected by external pressures? If any, what are they?

Our main question is concerned the technical factors affecting the adoption of e-government in Oman. The existing models and theories will lend a hand to extract some of these factors. Moreover, this question is also going to take in consideration Oman as an example for this identification of those factors and because the research problem is to improve the e-government rank in Oman, we decided to add sub-questions to increase our benefit from this research and to have more elaboration about how a certain factor is important and how it could be managed. Moreover, the management process of those factors may influence not just by internal pressures or limitations but can be affected by external limitations. Therefore, it is very important to know those external pressures in order to learn how to manage a certain technical factor with the emergence of those limitations. Moreover, those external pressures may affect the decision making and also the process of adoption.

The e-government as an electronic system can be influenced either by technical or non-technical factors as explained before (Aladwani, 2003; Pulliam, 2005; Swartz, 2003). Our study will address the *technical factors* as we consider them elements which appear because of using the technology. And they appear as a result of technology limitations or people technology skills (Andersen, 2009).

1.4. The study purpose and objectives

As a major step to develop countries they try to implement e-government and encourage the public to use e-services instead of traditional ways. It is obvious that adoption of e-government has increased in many countries over the world, but the rate of adoption varies from country to country, and also the factors which affect the adoption of e-government differ from developing countries to developed countries.

Unfortunately, the developing countries are more likely to suffer from the technical factors rather than the developed countries on which they have less impact. There has been a lack of specific research studying the technical factors affecting the adoption of e-government in the Sultanate of Oman. As a practical objective to implement our findings, we aim to identify and describe the technical factors affecting the adoption of e-government in six different e-government agencies and the management plan for those factors, in turn, to enhance the e-services of those agencies and to improve the development process of e-government adoption in Oman by illustrating the level of importance for technical factors in the current e-government stages. Moreover, this study might be helpful for other governments which are at the similar level of e-government stage and similar circumstances with Oman.

Sharing experiences and learning lessons from other governments is very important in e-government initiatives. Our study would like to share Oman government experience with other governments about the technical factors affecting the adoption of its e-government initiative.

In addition to the practical benefits of discussing this topic, this study also has academic relevance because most of the previous literature has discussed non-technical factors affecting adoption of e-government, for example, but not limited to: Chan *et al*. (2003), Davison *et al*. (2005), Gefen *et al*. (2002), Lee, Braynov and Rao (2005), Warkentin *et al*. (2002), Gupta and Jana (2003), Robey and Sahay (1996). However, it appears obvious that this research would cover the lack of studies particularly on technical factors, their management, and external pressure influencing management of these factors as whole, which is affecting the adoption of e-government in developing countries. Since the existing studies concern the technical factors just addressed have been viewed individually from different perspectives as illustrated in table (2.1), so our research will add the comprehensive insight and address these factors together.

Furthermore, our study will contribute knowledge to the information system community by discussing a real e-government adoption case of Oman as a developing country. Therefore, the target group for this research study can be researchers from the academic world who are interested in e-government and its adoption process within developing countries.

1.5. Delimitation

This research is discussing the technical factors affecting the adoption of e-government from the prospective of information system management of online services. It does not discuss the technical issues from the system engineering or programming development prospective. The main aim is to cover those factors by focusing on the information technology architecture level without going into the technical low level or by analyzing the development process.

In addition, this research focuses on the organizational adoption of e-government and does not discuss the users' (citizens) opinion of those factors, so there is no need to involve citizens as a resource of data because those factors' affects are well known by people who are in charge of the dealing process.

2. Related literature review and theoretical foundation

This chapter includes comprehensive ideas that are needed to understand the research and its contents. It contains information related to issues of problem statement and research questions. It starts by explaining the definition of e-government and selecting the most suitable definition for our study. Then, it presents the e-government services, e-government stages, adoption process, and adoption level, since all of these topics highly correlate to our research as well as to build our understanding of these concepts, and also to make us more careful while using those concepts. Moreover, the technical factors affecting the adoption of e-government have been collected from different previous studies and theories. Also, the management of the technical factors was discussed as one of our interest in the research questions. Moreover, the managerial external pressures have been covered and included in our research framework at the end of the chapter.

2.1. Definition of e-government

There is no standard definition of e-government and each researcher in this field tries to have his concept depend upon his study purpose and objectives (Seifert & Petersen, 2002). The definitions are mainly covering business, citizen, government, technology, process, or an economic viewpoint (Seifert & Petersen, 2002; Irani *et al*., 2006; Weerakkody & Dhillon, 2008). According to the technical perspective, we selected four definitions. First of all, The World Bank (2012) defines e-government as "The use of information technologies by government agencies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other branches of government." This definition explains e-government as well as describing the variety of e-government tools and uses.

Secondly, e-government is "the use of ICT to transform government by making it more accessible, effective and accountable" (InfoDev, 2002). This definition describes e-government as a service available through the ICT.

Thirdly, e-government is "the use of information technology in general and electronic commerce (e-commerce) in particular, to provide citizens and organizations with more convenient access to government information and services …" (Turban et al., 2002). This definition clearly explains that there is a relationship between e-commerce and e-government.

Another definition by the OECD (2003) defines e-government as "the use of information and communication technologies, and particularly the Internet, as a tool to achieve better government". This definition explains that e-government is not a new technology but a use of both information and communication technologies like the Internet as a tool to provide e-government services to the public.

From these definitions we conclude that e-government is a technique of using existing tools and technologies to provide different online government services in order to give the citizen and business another option which is online government services in a form of digital services available on the Internet instead of traditional paper and physical visit.

2.2. E-government services

The government establishments aim to provide different types of e-services like health, education, tendering, taxation and employment system, and those services vary depending on the needs of the end-users. The management of e-government projects may aim to offer services for citizens, employees, business or other government establishments (Siau & Long, 2005; Fagan, 2006; Gonzalez *et al.,* 2007; Ray *et al.,* 2011). Therefore, this research is dealing with e-government projects which provide four main types of e-government services: Government-to-Citizen (G2C), Government-to-Business (G2B), Government-to-Government (G2G), and Government-to-Employee (G2E). These services can be categories as follows:

- Government-to-Citizen (G2C)
  G2C is the e-government endeavour in creating communication between the government and their citizens (Chun *et al*., 2012). G2C is the most important and valuable part of e-government, since it is serving the entire citizen population in a specific country. This type of service is offered by the government as an interaction between both the government and the citizens. Portal with different government e-services to citizens is an example of G2C. By using this portal, citizens are able to access different types of services offered by the government such as education, employment, health and family. Many governments give a high priority to this category, since it is serving the majority of government services to citizens by giving them another online services option.

- Government-to-Government (G2G)
  Any kind of government electronic services such as data, information and system sharing that interact between different government departments are considered to be G2G (Behzadi *et al.,* 2012).

- Government-to-Business (G2B)
  Any type of services offered by e-government between the government and the business community is under this category (Beynon-Davies, 2007). Examples of G2B can be registering businesses, government tender and payment of taxes.

- Government-to-Employee (G2E)
  Government and government employees (Hussein *et al.,* 2011), that is basically any type of online services by the government to their employees is considered to be G2E. Examples of G2E can be the payroll and tax information.

2.3. E-government stages

As the increasing attention of e-government adoption is going on, the needs to determine the stages in e-government have to be clarified in order to specify the requirements of the e-government adoption in each stage to attain the success. Also it helps to avoid the complexity in comparing and understanding the different studies' outcomes. Different stage models for e-government have been suggested, not only by individual researchers but also by institutions, some of them are similar stages, but they are named differently (Tan *et al.,* 2007). For example, ANAO model (1999), SAFAD model (2000), and Layne & Lee model (2001) have

four stages; Hiller & Belanger's model (2001), Siau & Long model (2005), and UNPAN's model (2003) have five stages; Deloitte's model (2001) has six stages.

Also the United Nations Department of Economic and Social Affairs (UNDESA) came up with the stages concerning e-government services. It pointed out the four stages to develop the online services which are emerging, enhanced, transactional, and connected (United Nations, 2012). In 2012, the United Nations report integrated 193 countries over the world, including Oman (United Nations, 2012).

These stages would be affected by the technical factors within organizational adoption of e-government. Moreover, the role of the factors affecting the e-government adoption is different from e-government stage to another stage, and that can be clearly identified between developed countries which are in the early stage and developing countries which are still in growth (Alghamdi *et al.*, 2011; Siau & Yuan, 2009; United Nations, 2012; Yimbo & Ouko, 2011). Research studies considered the factors affecting the adoption of e-government which in turn needs to take account of e-government stages, especially if it involves a case study (Tung & Rieck, 2005; Yimbo & Ouko, 2011; Alshehry, 2008). Therefore, this study is using the UNDESA report 2012 to describe the Oman case study in order to obtain benefits for other countries which were mentioned in that report as being at the same stages as Oman e-government or below (United Nations, 2012).

2.4. E-government adoption

Listed here are several approaches to the adoption process, first described by Bourne (1959) as the diffusion of innovation more than fifty years old. Adoption in IT refers to the organizational decision to make use of IT systems to support the organization's functions, decision-making, and management of the business (Thong & Yap, 1995). It is considered as one of the six stages of IT system implementation: initiation, adoption, adaptation, acceptance, use, and incorporation (Kwon & Zmud, 1987). Furthermore, Al-Turki and Tang (1998) argue that the implementation as a process can be separated into two main stages; the adoption as a first stage and then the assimilation as the second stage. Spence (1994) suggests five sequential steps of the adoption process that are illustrated in figure (2.1).

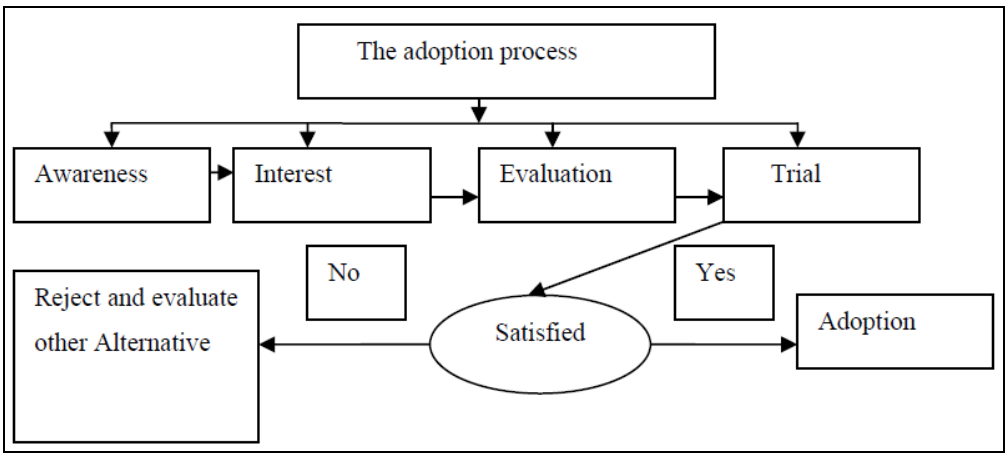

Figure 2.1: The adoption process (Source: Spence, 1994)

In addition, in this study we are going to use Ebrahim *at el* (2003) and Tung & Rieck (2005) to define the adoption process as the sequential government planned steps that aim to utilize

e-services to share data between various government agencies and provide services to stakeholders, as a best practice of ICT.

The factors affecting the adoption of e-government can be divided into two parts: individual and organizational (Bwalya & Healy, 2010). Titah and Barki (2006) have proposed that apart from organizational factors, individual adoption has a significant influence on the adoption of e-government services. With strong reference to Davis' Technology Acceptance Model (TAM) from 1989, it is known that individual adoption has been considered as the dominant characteristic that affects the intention to adopt or use the technology (Warkentin *et al*. 2002). On the other hand, organizational adoption has two scopes non-technical and technical factors, we selected the organizational adoption of e-government because it concerns the projects that we tackled in order to demonstrate the technical factors affecting the organizational adoption of e-government.

2.5. Technical factors affecting the adoption of e-government

Adoption of e-government requires several factors, whether technical or non-technical, to be successfully implemented (Alshehry, 2008). In this section, we shall identify the technical factors that affect the adoption of e-government as reviewed in previous research studies.

2.5.1. ICT Infrastructure

ICT infrastructure is one of the significant factors which make changes in the Information System (IS) issues. As it is mentioned above, from the definition of e-government in section 2.1, ICT represents a critical key for the adoption. Consequently, ICT is found to enhance and speed up the adoption of e-government, in the sense of utilizing technology to save time and effort through collaborating, cooperating and contributing with government agencies because the ICT lies behind the success of e-government adoption. Also, ICT infrastructure should be the main concern for e-government (Misnikov, 2003; alshehry, 2008; United Nations, 2012). Based on the IBM (2001), it can be noticed that the ICT infrastructure for an e-government involves technologies - with network readiness at the beginning - including application servers, hardware resources, software, operating systems, Internet, websites and data centre (IBM, 2001; Ebrahim & Irani , 2005; Macasio, 2009) .

This ICT infrastructure holds up the performance, data transformation, and storage which are necessary in the e-government services. Hence, ICT infrastructure should be prepared before e-government services can be available consistently and effectively (IBM, 2001; Ebrahim & Irani, 2005). For example, the computer network covering a particular area, as a component of ICT infrastructure, is extremely important to support attaining e-government adoption, in the sense of making interconnecting varieties of devices available and providing information exchange among devices (Stallings, 2000; Kurose & Ross, 2003). Also the Internet allows accessing government information and services from anywhere and anytime (Walczuch *et al.*, 2000; Stallings, 2000; Singh M, 2002). Moreover, the server plays a significant role in e-government which requires a powerful and high specification computer that can execute and host applications that enable connection to serve request through sending the response. These servers enhance communication across government network and information transmission by providing high speed access to government data and services within and between organizations as online transactions and procurement services (Stallings, 2000; IBM, 2001; Kurose & Ross, 2003; Ebrahim & Irani, 2005).

Furthermore, based on the Kumar *et al.,* (2007) Conceptual Model of e-government adoption, e-government adoption is affected by website design that provides perceived ease of use and perceived usefulness, by user characteristics and by users fulfilments with its services quality (Kumar et al., 2007).

Therefore, ICT must be considered practically as the first step to be prepared for the e-government adoption. ICT infrastructure provides the foundation for establishing the services in e-government adoption. ICT developments make possible the adoption of e-government and heighten the quality and the delivery of efficient services as well (Lank & Traunmüller, 2001; Pascual, 2003; Bwalya & Healy, 2010; Bwalya. *et al.,* 2011). Thus, this in turn, provides comprehensive readiness to e-government adoption. As Bwalya & Heale (2010) stated that appropriate ICT infrastructure affects confidently on usability and correspondingly on Perceived Ease of Use (PEU) and it will have a good influence on the overall intent to use and adopt e-government (Bwalya & Healy, 2010).

2.5.2. IT Security

Security is treated as the most important concern in the online world (Nikkhahan *et al*., 2009). Since e-government services are offered online to the public, IT security is extremely important. The importance of IT security is constantly growing (Sharma et al., 2005).

IT security is considered to be one of the most significant divisions of information security (Euting & Weimert, 2009). The main purposes of the information security are protecting the information and guarantee to obtain ability, privacy and honesty of information (Aljifri & Navarro, 2003; Elmarie & Elme, 2000; National Institute of Standards and Technology, 2000; Pfhleeger, 1997; Von Solms, 1999).

The e-government services are frequently dealing with enormous amounts of private data (Hermann *et al*., 2009; Zweers & Planque', 2001), which makes the IT security in e-government one of the most important technical factors that affect the adoption of e-government, and without it, the e-government project will be a failure. IT security is one of the main issues concerning the use of system, network, data…etc. IT security must be treated with great importance in e-government to ensure the security of e-government services provided to the public. The IT security is important from different perspectives such as from the e-government services as well as the public. There are many concerns related to IT security, such as: identify users accessing the system with appropriate grant of access to specific e-government services, protection of data/information against any type of computer scam, and system policy. To improve the security and minimize the threat against the e-government services in general, the government needs to build Internet trust and to have a national security standard.

In order to have a successful e-government project, the organization needs to be aware of all security issues which are needed to avoid any kind of failures of the e-government project (Hermann *et al*., 2009). Security is a crucial component in the development of citizens' assurance and their implementation of e-government (Nikkhahan *et al*., 2009).

2.5.3. IT Standards

IT is developing fast, and the need to have the same technology type and criteria is an essential indicator that makes the work compatible, which is referred to as ICT standards (Borras, 2004). Since different government agencies have different IT elements that may confront problems to function, integrate and interoperate with each other; this might result in to e-government adoption complexity. E-government is anticipated to make available access to all users from one single integrated gateway. Furthermore, it necessitates the involvement of government agencies to contribute their data to meet users' needs of e-government services (Layne & Lee, 2001; Vishanth *et al*., 2011). Hence, IT standards are required to avoid any ICT obstacles that would hold back the adoption of e-government systems. Standards have been described as conformity of system elements that would help software and hardware within the system to build up new services differently from each other. However, they should be appropriate and well-matched in with each other (Keen, 1991; Vishanth *et al.*, 2011). In addition, ICT standards have been defined by Freeman as "specification for hardware and software that are either widely used and accepted or sanctioned by a standard organization" (Freeman, 2006). So in this case, to attain the adoption of e-government successfully, it is required to standardize the ICT to facilitate the interaction between government agencies e.g. using the same database and other software and hardware to ensure the compatibility and avoid information redundancy. It has been argued that the IT standards guide for IT acquirement, management, and utilization, and it takes action as interlink between the use of physical and intellectual IT assets (Nyrhinen, 2006; Vishanth et al., 2011).

There are some advantages of technical interoperability, such as it has minimal intellectual property restrictions, or should be royalty-free on a logical and fair-minded basis. Also the standards allow technical interoperability between different products, and enable multiple competing implementations so that users are able to choose whatever product they want whereas the products work in interoperability properly (DeNardis, 2009). Moreover, it helps to improve government's efficiency, building the knowledge economy (Borras, 2004). So IT standards would be considered as a technical factor of e-government adoption.

2.5.4. Technical expertise

IT expertise is the technological ability needed to adopt e-government (OECD, 2003). Therefore, it is considered to be one of the essential requirements needed for the adoption of e-government. This technical expertise is considered to be a very important factor. There must be such a technical expertise in order to move toward e-government services and to raise the level of e-government services provided from the e-government to the public.

Authorities must move towards recognizing and certifying the expertise required for successful e-government (OECD, 2003). To achieve a successful e-government project, various government agencies need to hire a qualified IT expert in order to achieve the desired goal of e-government services. The existence of such expertise in different e-government services would have a positive effect in enriching the services provided to the public. Maintaining IT expertise inside the organization is important (OECD, 2003). Providing the necessary IT expertise to the government agencies to carry out the functions of e-government is a very urgent need, especially if the goal of these experiences will raise the

productivity of e-government services as well as the management and maintenance with the required knowledge and skills.

Ebrahim and Irani (2005) indicate that IT experts are increasingly leaving their jobs in the government to work in the private sector, due to the better offers they are getting. The government should consider offers for their IT expertise to avoid this issue, which is basically affecting their e-government services.

The field of information technology is changing very fast, which makes urgent the need to train the IT experts to keep pace with the ongoing evolution in technology. Ebrahim and Irani (2005) and Moon (2002) argue that to improve the efficiency of e-government services, governmental departments need to move forward in their development of highly trained IT expertise. As a result the IT experts are up to date with the new practices and technologies related to the e-government, which will help them to accomplish their work with high performance. The existence of such technical expertise will be reflected positively on the adoption of e-government.

2.5.5. Sources of technical factors

Table 2.1 shows our sources for those four technical factors, from previous studies which have used different theories, models, approaches and trusted literatures to investigate the technical factors affecting the adoption of e-government:

Table 2.1: The sources of the technical factors

Technical factors	Sources
ICT infrastructure	Alshehry, 2008; Bwalya & Healy, 2010; Bwalya. *et al*., 2011;Ebrahim & Irani , 2005; Lenk & Traunmüller, 2001; Misnikov, 2003; Pascual, 2003; Wagner *et al*.,2003; Zmud & Mitchell,1999
IT Security	Aljifri & Navarro, 2003; Dridi *et al*.,2001; Hermann *et al*., 2009; Joshi *et al*., 2001; Sharma *et al*., 2005; Zweers & Planque', 2001
IT Standard	Borras, 2004; Castellano *et al*., 2004; Kayworth & Sambarnurthy, 1997; Keen, 1991; Park, 2005; Scholl, 2005; Vishanth *et al*., 2011; Wangler *et al*., 2001
Technical expertise	Ebrahim and Irani, 2005; OECD, 2003; Scatolini & Cordella, 2005; Siau & Long, 2005; Ventura, 1995

2.6. Management of the technical factors

As countries implement e-government successfully, it is confirmed that they have been placed in strategic initiatives and plans in order to attain the goals of e-government which are supporting citizen services and government agencies communications (Gil-García & Pardo, 2005; Sharifi & Manian, 2010; Bwalya *et al.*, 2011). As Holliday and Kwok (2004) stated there is a need for unit to coordinator and speed up the adoption by enhancing and putting in place a proper ICT infrastructure and providing steady technical infrastructure. Coordinator as a centralized initiative can support e-government adoption by ensuring citizen-centric

orientation, ensuring the best ICT infrastructure with its optimal utilization and the inter-operability of different e-government departments' applications in order to well-control and monitor the e-government adoption (Gupta & Sridev, 2007; Sethi & Sethi, 2008) including supervision of establishing a unified government networks, ensuring security, and providing Internet connectivity through contracting with ICT industries .

Besides, decentralized implementation of e-government could lead to faster adoption of e-government according to each one of the government's departments, and its readiness and speediness of the e-government adoption as there is a difference in the technical competence of government's departments (Sethi & Sethi, 2008). Thus, centralized initiative and decentralized implementation would be a critical strategy to manage the e-government issues

In addition, it is important to setup a framework as a set of standards, best practices and process management systems to lessen risks and deliver better IT initiatives for starting e-government adoption (Holliday & Kwok, 2004). Designing a framework is a good way to check ICT readiness and provide precise considerations about e-government adoption as a project which would help in preventing the diversion of limited resources to unsuccessful directions. Further, the framework can be a guideline for similar issues to learn the factors that end up in the success or a failure of certain projects concerning e-government (Gupta & Sridev, 2007). Therefore building a framework for e-government ICT and security readiness will reduce troubles related to unsuccessful e-government adoption (Alghamdi *et al.*, 2011). It serves as a common abstraction of an e-government strategy as long as it contains technical factors as key enabler of e-government (Rabiah & Vandijck, 2009).

In addition, it would assist fostering the adoption of e-government through distribution of incubators as common services centres everywhere (Aita, 2006) easily go to and provide the services to the public, since the adoption of e-government's success or failure depends on the degree of acceptance and usage of ICTs and IT diffusion (Shareef et al., 2010).

Furthermore, to use of holistic approach to plan and get benefit from others' experiences (Holliday & Kwok, 2004) can drive to shorten the adoption e-government in a manner of starting from a point where others reached so that basically the hurdles can be avoided, rather than starting from scratch.

2.7. External pressures

The organization management can be affected by external pressures are considered as outdoor elements (limitations) that influence business objectives and they can be derived from governmental policies, legislation, trade agreements, industry associations, competitors, local communities and the media (Hosni & Khalil, 2004; Sharma, 2000). Accordingly, the external pressures in this study are external limitations which are affecting the management of the technical factors from outside the ministry which could be caused by citizens, other ministries or non-government organizations.

2.8. Summary of the chapter: Research framework

Figure 2.2 shows our research framework which has builds the literature review of this chapter, related to research study questions and objectives. First, starting from the definition

of e-government (see 2.1), which highlights those components by proposing the research definition. Second, at the top of the diagram, external pressures, as one of our research interests, considered as elements affecting the management of the technical factors as well as the e-government organizational adoption (see 2.7) therefore the external pressures as shown in the figure are outside the ministry and affecting those components (management of the technical factors, the technical factors and the organizational adoption of e-government). Third, the management of technical factors (see 2.6) and the four studying technical factors (see 2.5) are surely affecting the organizational adoption (see 2.4) as discussed about the adoption process it considered as the sequential government planed steps (inside the ministries) that aim to utilize e-services to share database and confirmed by the effect of the technical factors in the adoption process which take the direction from the technical factors and its management to the organizational adoption of e-government (alshehry, 2008; Shareef *et al.*, 2010). Finally regarding our research framework, it is very important to state that this research framework also includes the technical factors level of impotence which will be determined by the interviewees.

This framework has been used in this research for different purposes for example in the design of the data collection method and empirical data analysis and discussions, as it is in line with our research questions and purposes by including the main conceptual framework of our research. It supports our seeking for information which is related to technical factors and the organizational management of those factors, the level of importance, and the external pressures.

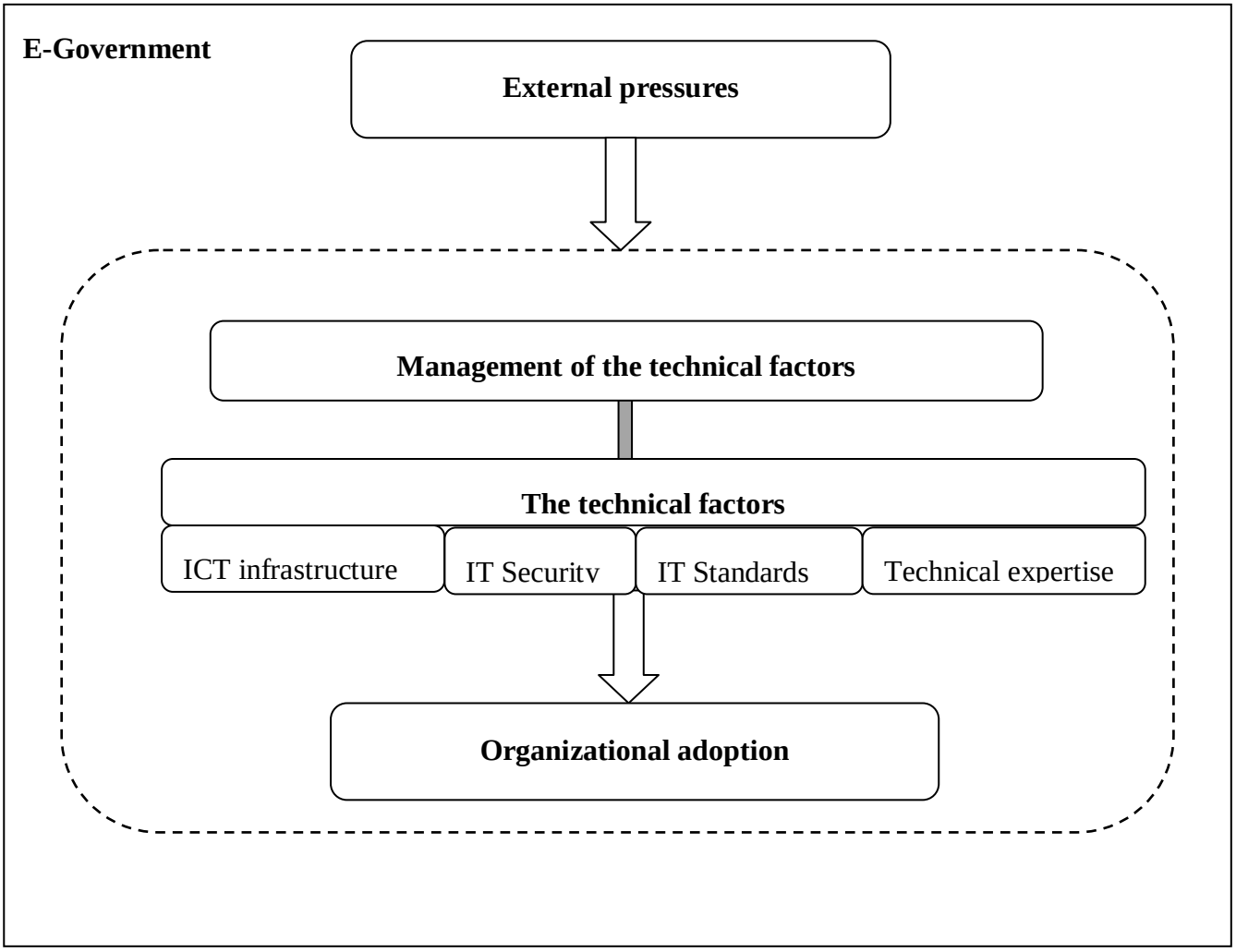

Figure 2.2: Research framework

3. Research Methods

This study focuses more on information collection rather than discover peoples' values and opinions about its main purposes. This study aims to identify and describe the technical factors affecting the adoption of e-government. Therefore, the purpose of the study is mostly in line with a descriptive study (Key, 1997; Sekaran, 1992).

A deductive approach has been used in this study since it started by examining what was written about the field in general and continued to develop a theoretical framework which we used throughout the thesis. This can be seen as a deductive approach as the existing theories were used as a foundation for the empirical study.

3.1. Qualitative study

The qualitative researcher tries to state events, actions, norms and values from the perspective of the studied objects in order to create a thorough understanding of experience (Denzin & Lincoln, 2005; Mack *et al*., 2005). The information that is collected in a qualitative study is often described as more methodical than information in a quantitative study which is collecting data from a large number of people in order to generalise it for a larger population within that field (Bryman, 1997). In this study, we intended to obtain understanding of the objects that are studied. Our intention was to focus on a few objects rather than trying to generalise the findings to a large field. It is clearly that the research questions and the purposes of the study are more in line with the qualitative approach.

3.2. Cases studies

The use of cases studies in this research is very important to clarify the e-government environment which can be influenced by specific technical factors by dealing with a real practice of managing such phenomena. That will give us, as researchers, more understanding of those factors, and our findings will be more useful for decision makers and other research seekers as well.

In addition, a case study is preferred when the study is intended to answer questions like what and how (Yin, 2003). The investigator has little or no control of the events because the study is contemporary (Yin, 2003). In this research we are primarily focusing on this type of studies which depend on descriptive manner and need clear evidence from researchers about its context by using a real case (Blumberg *et al.*, 2005). Our study focuses on a contemporary context where the investigator intends to have no control over behaviours during the data collection (Yin, 2003). Therefore, according to Yin's (2003) and Blumberg *et al*., (2005) arguments a case study is preferable for such study.

We selected six e-government agencies in Oman which implement different e-government services and those agencies were of high-quality and match the international standards in the sense of completion and applying the conditions of the different e-government services (UNPAN, 2011; The Gulf Secretariat General, 2012; ITAMC-Oman, 201; Ministry of Manpower-Oman, 2011; Muscat Daily-Oman, 2011), in order to ensure that our results are more reliable and valid. That also will help to show different viewpoints of those managers in dealing with such problem Area. Moreover, it gives us the chance to learn how those

establishments could be affected under different variables like e-government service types, number of users and management plans.

3.3. Research design

The research design is illustrated in the next figure 3.1. It shows that the literature reviews started from the beginning while we were scoping and choosing our problem and continues until the end. The explanation of technical factors which are affecting the adoption of e-government and other topics in chapter 2 of this thesis were supported by different literature. Furthermore, some findings from Oman case study were discussed and analysed from what has been written in that part. Also, we followed the same procedure for the results that were collected after the findings in order to explain them in our discussion and conclusions.

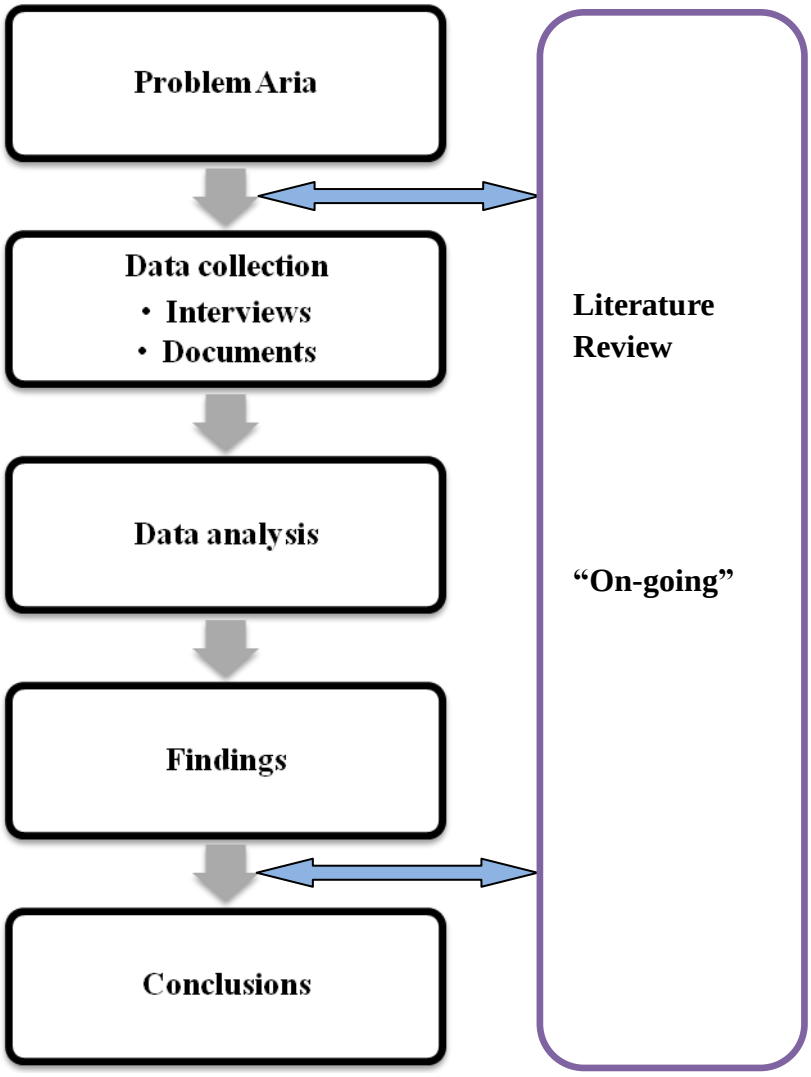

Figure 3.1: Research design

3.4. Data collection

Data collection is described as a set of interrelated activities (Creswell, 2007). The main purpose of these activities is to collect information which could be useful to find out the answers to research questions. In this research, we applied a set of research methods to fulfil the main purposes of the study. The adopted methodologies include firstly, literature review which was done previously to collect the data needed to support the main issues of our study research questions. Secondly, multiple-experience studies through qualitative interviews by conducting a case analysis in Oman of multi- projects. Thirdly, supported documents provided by ministries that implement those projects.

3.5. Documentation

Documentation that supported data resources in this research was used in chapter 4 (Oman case study) and chapter 5 (Findings and discussions). In chapter 4, it has been used to provide background information about the e-government case in Oman and to describe the research involve ministries and their adoption of e-government. In chapter 5, it has been used to fulfill the empirical data which needed to discuss the factors affecting the adoption of e-government in Oman. Documents provided useful information that is required to complete and supplement information that has been founded by other resources (Yin, 2003). Documents in study research could involve reports, newspapers and online documents (Patton & Patton, 1990; Yin, 2003). As Merriam (1988) indicates, the use of this tool helped a great deal in revealing meanings, developing understanding and discovering the facts. However, researchers must be careful when using such instruments and not use them from unknown authors (Marshall & Rossman, 2006; Yin, 2003). For this reason, documents used have been collected from the government of Oman which are from a reliable source and reachable online from well known organizations websites. Table 3.1 shows brief information about resource of documentation in this study (all of those resources were reachable in 30/04/2012):

Table 3.1: Resource of documentation

Organization Name	Number of resource	Organization Website
Information Technology Authority – Oman	4	www.ita.gov.om
United Nations Public Administration Network (UNPAN)	3	www.unpan.org
Ministry of Manpower - Oman	1	www.manpower.gov.om
Ministry of National Economy – Oman	1	www.mone.gov.om
Tender Board – Oman	1	https://etendering.tenderboard.gov.om
Oman Educational Portal – Oman	1	www.moe.gov.om
The Gulf Secretariat General	1	www.gcc-sg.org

3.6. Qualitative interviews

As mentioned earlier, this study used interviews to conduct this research in order to investigate technical factors which affected the adoption process of the e-government from a management point of view. For that reason, the best way to contact that group is the face to face interview (Creswell, 2007), because, such detailed interviews can provide a close perspective on the real-life factors and how to manage and control them. Moreover, in order to describe the functionality of each establishment, we need to use the interview tool as the most supportive tool for this type of study.

Using interviews helped to learn about the practical experience of implementing the e-government system in each of the projects. The research topic required knowledge from individuals who have been involved in information system management of the e-services by a having a conversation, face to face, in order to gain experience and more details in some aspects which are related to their working position. To conduct such interviews on such a limited number of people, the good method is the Semi-Structured interview as a data collection method (Kvale & Brinkmann, 2009). There is an advantage to use this type of interviews, as semi-structured interviews are helpful for comparison and involve less in the way of interviewing skills (Kumar, 1996; Preece *et al*., 2002). This technique gives us and interviewees more flexibility in asking and answering questions, and the order of questions can be changed or additional questions can be asked to get details during the conversation, for example, if a candidate brings up any interesting ideas that we had not prepared questions for (Oates 2006). Thus, we chose semi-structured interviews to conduct the interviews.

3.7. Interviewees selection

The selection of respondents in a qualitative study is often depending on the purpose (Bryman, 1997). In the planning process of the interviews, a selection has to be made among people, environments, events and social processes (Kvale, 1996). One way to conduct the selection is to choose persons, environments or objects that meet specific descriptions (Miles & Huberman, 1994). Interviewees were chosen from government establishments mainly depend on their position and working experience and that was done through their organizations.

As a further step, to make sure that we were going to meet the right person who would give us the most valuable information, and to get a chance to interview somebody from those e-government agencies, we decided to create a request letter that had a background about us as researchers and about Lund University and after clearly explaining our study at the end of that letter we asked them to choose the appropriate person who had the suitable experience for this research (See appendix A). Then, each one of us visited one of the targeted organizations to give them our request letter and explain in detail, in case they asked us. By using that letter, the speed of conducting interviewees was enhanced, and we felt it gave them a solid foundation about our study. Also, it was helpful to conduct an interview with the most suitable person who had experience in the field of research. As a result we interviewed top managers in those projects. The number of interviewees from each government agency and their position are illustrated in table 3.2.

Table 3.2: About Interviewees

Government agency	Interviewees No.	Position
Ministry of Manpower	2	Director Manager Middle Manager
Ministry of Higher Education	1	Director Manager
Ministry of Education	1	Director Manager
Muscat Municipality	2	Director Manager Middle Manager
Information Technology Authority	1	Director Manager
Tender Council	1	Project Manager

3.8. Interview guideline

In this research study we would like to obtain knowledge about the technical factors that are affecting the adoption of e-government in general and particularly in Oman, as a case study. Moreover, we would like to know the role of each factor and how those factors can be managed and if the management process of a certain factor was influenced by external pressures or limitations, to increase the overall adoption speed of e-services. Therefore, we opted for using the interview method to discover and describe those main objectives as the best qualitative method for this research. We chose Kvale (1996) interview approach as a guideline to perform research interviews. Kvale's (1996) approach contains seven methodological stages which are thematizing, designing interviews, transcribing, analyzing, verifying and reporting.

The qualitative research interview is a process of creating knowledge and that take place by the interaction between the interviewer and the interviewee; therefore the project should be planned with the whole process in mind (Kvale & Brinkmann, 2009). Figure (3.2) is showing our management process of building interviews:-

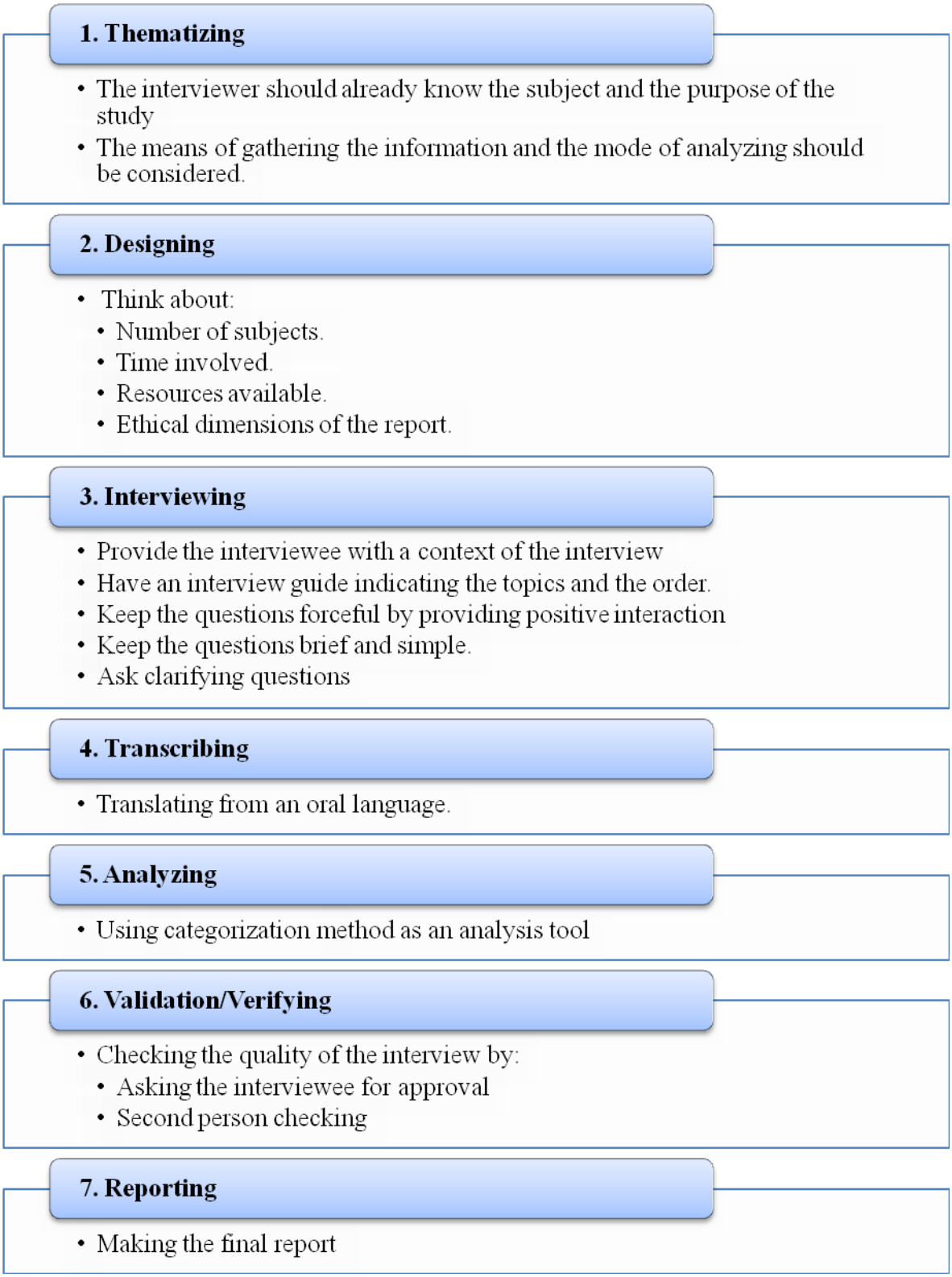

Figure 3. 2: Management process of building interviews (The source of seven stages: Kvale, 1996)

Those stages are linked to each other and each one is completing the next one as shown in the figure. This approach aims to make the analyzing process and the drawing of conclusions easy. Furthermore, that will impact on the overall quality of the interviews (Seale, 1999; Kvale & Brinkmann, 2009).

At the thematizing stage, as a foundation step of knowledge creation, we clarify the subject and the purpose of our study to clearly know what we are about to discover and to make sure that our questions are totally linked to the main goals of our study. Questions must be designed in the interview depending on the number of the subjects which are going to be studied and having too few will make the study unreliable and having too many will make it unwieldy (Kvale, 1996).

As a result, at the designing stage, we decided to use three main topics as info-structure and guideline of our interview questions which were totally linked not only to our research questions (see 1.3), but also to the research framework (see Figure 2.2). The first group of questions is related to e-government adoption and aims to give us background information about the e-government project in a specific organization to describe it later on at the beginning of the project discussion. The second topic of our interview guideline is technical factors affecting the adoption of e-government that contains questions related to the first research question and its first sub-question (technical factors affecting the e-government adoption and how a certain factor is important). In this part, we asked the participant about the technical factors which were discovered from literature review as well as if he/she would like to add any new technical factor to our list because that is one of our research interest. The third main part of our design, but not the last, is about the management of a factor. It includes the last two sub-questions of our research because both of them are discussing the management and the external pressures of each factor including the new factor if we discover any from the interviewee discussion progress. In our design we also took in consideration the time involved for each interview, and we mostly limit that to be less than 45 minutes, as we designed questions directly targeting a needed point with low generalization of meaning (Interview guideline, see appendices B).

Three additional sections have been added to our interview design template (Introduction, opening and closing). As the researcher needs to describe the study, the purpose of it to the respondents, also describe how the interview process will take place, as well as give an overview of what ideas will be discussed at the launch of the interview to avoid losing time later on (Kvale, 1996). Also, to ensure reliability, validity and ethical aspects, we decided to add the opening and closing sections (Seale, 1999). We explained the need for those sections in the research quality of this chapter (See 3.11). In total, we ended up with six sections which are organized and depending not just in our interest of research, but also to support our final expectations of the findings and other coming stages of conducting the qualitative interview. After we had a strong design, we continued to conduct the interviews as the third step of our framework (Interview guideline, see appendices B).

3.9. Conducting interviews

As a preparation step before conducting the interviews, we decided to improve our knowledge and to have all the interview equipment ready. Awareness of what information to search for increases the quality of the interview (Kvale, 1996). In order to gain knowledge within the field of e-government in general, and about the main topics of our research in particular, we read articles and studied theories before the interviews were conducted. As far as was possible, we also tried to gain information about the candidates and their organizations and working position that could be relevant for the interviews. As preparation, and to avoid any problems that can occur as a result of interview recording, we used to test our recorder in

advance and we had at least two recorders as a backup. Also, we divided the job among us so one would conduct the interview and pay more attention to the interviewees, and the second would write the transcript to prevent losing information as a result of record damage or interviewees' interaction. Semi-structured, face to face interview, were conducted during the month of April 2012, in the Sultanate of Oman, using the interview guideline (Appendix B), which was developed for this research.

3.10. Data transcription and analyses

Researcher analysis process of the interview mostly depends on the transcription stage (Kvale, 1996). Transcribing involves building a verbatim text of each interview by writing out each question and its response using the audio recording. The interviewer's side notes should also be included in the transcription, and properly labelled in a separate column.

Actually, after the interviews had been conducted within two weeks, immediately the transcriptions were completed in nine days by those who had done them, using the same procedures, so that they could remember whatever was said in the interviews, in case anything was not be clear from the recording tapes. It took an average of 4 to10 hours to transcribe 15 to 75 minutes of interview, since the transcribers had different typing skills, which resulted in 5-11 single-spaced pages. Next, we sent the transcription to the interviewee to ensure reliability and any information that they might have missed during the interview. After that, we coded the transcription, based on our questions theme, in order to analyze the data. The table 3.3 below shows the themes of coding were designed from our questions, in how we applied thematized transcriptions. By doing so it assisted us to collect rapidly the needed information which had been answered from the questions. Table3.3 shows the coding themes we used:

Table 3.3: Coding areas

Code	Area	Explanation
P.I	Project Information	Giving some background about the e-government project in the organization and since when the ministry adopt the e-government.
A.S	Adoption speed	E-government adoption overall speed in the Sultanate of Oman and particularly in the organization
O.F	Ordering Factors	How the factors can be ordered based on the importance concerning e-government adoption
N.F	New factors	Is there any new factor that might be added that affects the adoption?
M.Infr	Managing ICT Infrastructure	How ICT Infrastructure could be managed and what is the management plan for that.
M.Sec	Managing Security	How Security can be managed, what is the management plan for that.
M.Sta	Managing IT Standard	How IT Standard can be managed and what is the management plan for that.
M.Exp	Managing Technical Expertise	How Technical Expertise can be managed and what is the management plan for that.
E.P.Infr	External Pressure affect ICT Infrastructure	What external pressures affect the managing of ICT infrastructure?
E.P.Sec	External Pressure affect security	What external pressures affect the managing of security?
E.P.Sta	External Pressure affect IT standards	What external pressures affect the managing of IT standards?
E.P.Exp	External Pressure affect	What external pressures affect the managing of Technical Expertise?

We kept the code of the ministry's projects in a way that indicate its name. Also, we added the interviewees' names, since there was no confidentially issue to consider, and after asking for their permission, Furthermore, we designed our own indexing scheme, so that it would be clear to ourselves as well as others who read this thesis, to come across with the empirical and the analyzed data. The coding combines the ministry's project code, the interviewee, and the paragraph number of the interviewee's answer.

Table 3.4: Ministry's project code

Ministry's Project	Code
Ministry of Manpower	MoM
Ministry of Higher Education	MoHE
Ministry of Education	MoE
Muscat Municipality	MM
Information Technology Authority	ITA
Tender Board	TB

Example of index coding of interview:
MoM-1-(3):
MoM = Ministry of Manpower interview,
1= the first interviewee,
(3) = paragraph number of interviewee's response.

Table 3.5 shows an example of interview transcript from the first interviewee Tender Board, showing quotes of paragraph three and four:

Table 3.5: Example of interview transcript

Index	Theme	Transcript
TB-1-1	P.I	**We:** "...First of all we would like you to give us a background about this project, and tell us when the initial start of it took place".
		MR. DEEPAK: "This project is part of an e-governance initiative by the Sultanate and was initiated in 2006 by a tender board, after an international tender, and it was finalized in 2008, on September 15th , so after that the project started on11th November 2008".
TB-1-5	O.F	**We: "**If we talk about the four technical factors we have in this interview, we have infrastructure which consists of Internet, network and data-centre. Another technical factor is IT security. A third one is IT standards and the final one is Technical expertise. Now if we ask to order this, which one would you give the first priority, or say is the most important technical factor?".
		MR. DEEPAK: "The first thing I will be giving you is infrastructure, because without infrastructure we cannot do anything. Second, is technical expertise, third is IT security and fourth are the IT standards….".

As a descriptive research, we think it is better to follow the categorizing method to create a conclusion and farther actions from the analysis results. Through connecting the theoretical and empirical findings, the respondents' points of view have been analyzed in a way based on the theoretical framework (figure 2.2) and concepts developed in the literature review. We started describing their responses based on the structure that we did design in the theoretical framework; covering the importance of the factors, the management of these factors, and the external pressures that affect the management of factors; we put them in the tables so that it shows all of their responses clearly and as a guide to our analysis. Then we discussed their responses, whether they connect to the literature reviews with some interpretations. Finally, we end up with a conclusion which answers our questions and accomplishes our research purpose as well.

At the beginning, the concept of e-government definition, e-government services and e-government stages are interlinked to the chapter four, which is the Oman Case – to give a preliminary picture to empirical data followed this chapter to assist in understanding the situation in Oman concerning e-government adoption. Then e-government adoption processes were reviewed in the literature to clarify the continuity of the adoption in the e-government

and to guide us to the e-government adoption levels – organizational and individual adoption – which in turn reflect our selection of the projects related to the ministries or agencies. At the end, we connected the importance of the technical factors affecting the adoption of e-government, the management of these factors, and the external pressures that influence the technical factors managements in the literatures review along with the empirical data and consequentially reached the finding which has been discussed and analyzed in chapter five. After that, we reached our conclusion which represents our answers to the research questions.

3.11. Research quality

The quality of the study during the data collection and the data analysis is very important and must be reflected in any type of study (Miles & Huberman, 1994, Seale, 1999). The most common ways to ensure the quality of scientific study is by reliability, validity and ethical aspects and avoid research bias (Seale, 1999). In the next context we are going to write about those three main points.

3.11.1.Reliability

Reliability is an important aspect that needs to be considered in a study. As Seale (1999): illustrated in his book, if the study is repeated with the same method, but with another researcher, and it shows the same outcomes, then the reliability in the study is high. There is a risk that the individual knowledge basis and preconceived ideas of a researcher can influence the study and its findings (Yin, 2003). People interpret the world using their earlier experiences, knowledge and preconceived ideas. Therefore, to ensure about the quality researchers must ensure that these interpretations are real and must implement some solutions (Gilovich, 1991, Seale, 1999). As researchers we must be aware of this type of risk, especially at the creation process of the interview questions, because the respondents' answers will impact the final findings. Secondly, the internments and the respondents' can influence the researcher too. Before starting data collection and the data analysis process we have to keep in mind those risks.

In order to ensure the reliability of interview transcription, it is recommended to let two persons, independent of each other, print the material and note differences. Also, we sent their transcription to the interviewee to check if the real facts has been recorded. In this research, in order to avoid any mistakes we use both of those ways (another person checking and the respondent checking). As shown in our final design of interview, we added a special section at the end asking the interviewee for his checking of our transcript (Appendix B). Moreover, as explained before, we made interviews in pairs to compare the final work of two persons.

3.11.2.Validity

Validity means that a method studies what it assumes to study (Miles & Huberman, 1994; Seale, 1999). One of the difficulties of the qualitative interviews is to ensure that the interviewer has understood the respondents correctly. Preconceived ideas in combination with personal, political and cultural values could interpret the interviews (Kvale, 1996). Kvale (1996) proposed the approval of the transcriptions by the respondents as a solution to improve the validity of the interviews. Thus, if the respondents consider the transcriptions or the summary is not in line with their opinions, a new collection of data must be done, followed by a repetition of the controlling procedure (Yin, 2003). As can be seen in our interview

guideline (Appendix B), at the end of the interviews we collected the interviewees' e-mail addresses to send them our transcriptions. As a result of that process, we have not found any clashes between our transcripts and the interviewees' opinions.

Therefore, to ensure about the validity in this study, we gave respondents the objectives of this study and the main purpose of it with a detailed description of the work flow at the beginning of the interview and that is the purpose of the introduction part in our interview design, and the letter which was sent to ministries before conducting interviews (See appendix A).

Moreover, also as a strategy, the findings were examined by what has been found in the literature reviews. This study also used theoretical literature by drawing on more than one theoretical perspective from many authors; especially when we cover important data which are related to the main purpose of our study.

3.11.3.Ethical aspects

The consideration of ethical aspects also must be taken into account to ensure about the quality of the study (Seale, 1999; Kvale & Brinkmann, 2009). According to Israel and Hay (2006), no study can be perfect if it is conducted in a way that contradicts ethical values standards. It is necessary to reflect on what actions are right and wrong and how the study can have an influence on people. Actually we considered ethical aspects before, during and after the study. As Miles & Huberman (1994) recommended, we explained to the respondents about the advantages and disadvantages when they participate in the study. Interviews allow participants to consider the subject and questions could give them a wide reflection about those challenges. This study is going to be very useful, as we hope, not just for the respondents, but also for other people who would like to get advantages from understanding such research.

Before the interviews start off, an approval of participation should be taken (Kvale, 1996; Miles & Huberman, 1994). Therefore, we did describe the study, purpose of it for the respondents; also we described how the interview process will be going and give an overview of what ideas will be discussed. At the end we asked the respondents for approval of using their names in the study. Luckily, we got approval from all interviewees to use their names in our study.

3.11.4.Bias

Bias in research are "systematic error that are deriving from a conscious or unconscious tendency on the part of a researcher to produce data, and/or to interpret them, in a way that inclines towards erroneous conclusions which are in line with his or her commitments" (Hammersley & Gomm 1997). Bias can be caused by different recourses like the sampling of time, places, events, people, issues, availability and reliability of sources, and researchers' preferences (Norris, 1997). In this research, the literature reviews that are used come from different sources in order to remove opinions that come from only one author (Hammersley & Gomm 1997; Norris, 1997). For the sampling of participants, we interviewed people that we did not know before. They were selected from their organization as a best person for our research objectives after visiting them on site, as a first step before conducting the interviews and after giving them a letter about the main purpose of this study. Moreover, this research

was reviewed by us and a language checker in order to remove some biases that we did not notice.

3.11.5.Generalizability

It is very complex to come up with a generalized study for the technical factors affecting the e-government which can be useful for all situations of e-government adoption, because that depends on IT infrastructures as well as the features of e-government adoption in the country.

This is believed to assist Oman and other countries that have similar characteristics across key variables in the uptake and strategic planning for e-government. This study is using the UNDESA report 2012 to describe Oman e-government in order to obtain benefits for other countries which have been mentioned in that report. It must be emphasized, however, that this is not a comparative study which can generalize for all of the e-government adoptions.

Accordingly, those factors have been discussed with a limited number of information system managers who have a technical experience in each of the chosen e- government projects without interviewing all the technical staff in different levels, and that is also regardless of the limitation on the research time. To insure about the quality of the research, the key IT managers have been interviewed (see table 3.2).

4. Oman case study

This chapter starts by introducing general information about Oman because it is very important to know about the geographic and statistical information of the population and the total size of Oman IT market, this description is very useful to understand later discussion about the technical factors in the next chapter. Moreover, it contains information about e-government adoption in Oman and its current stage to make this research more useful for other governments who would like to gain experience from such case study. Furthermore, this chapter introduces the government agencies which is involved in the study, starting from the Information Technology Authority (ITA), which is the main government unit taking care of the e-government in Oman, followed by another five government establishments, Ministry of Education (MoE), Ministry of Higher Education (MoHE), Muscat Municipality (MM), Ministry of Manpower (MoM) and Oman Government Tender Board (TB).

4.1. About the Sultanate of Oman

The Sultanate of Oman is located in Southwest Asia, in the southeast part of the Arabian Peninsula, near the United Arab Emirates (UAE), Saudi Arabia and Yemen, with the third largest land area in the Arabian Peninsula, about 309.5 thousand square kms, and a coastline of 1700 kms. It is bounded in the northeast by the Gulf of Oman and in the southeast by the Arabian Sea. According to the Ministry of National Economy, in 2011, Oman had a population of 2.773 million people (Ministry of National Economy - Oman, 2011). According to the ―Oman Information Technology Report (2011), the total size of Oman IT market in 2011 was forecasted by BMI to be about US$339mn, raised from US$314mn in 2010 (PRLog, 2011). BMI expects there to be a Compound Annual Growth Rate (CAGR) of 7% for 2011- 2015 in the Sultanate of Oman (ibid).

4.2. E-government adoption progress

Oman, like many developing countries, adopted e-government every late in the early twentieth century, i.e. only nine years ago and mainly it influenced by the rapid development in ICT felid (AlEsmaeli, 2002; AlShihi, 2006; Ernst & Young, 2002; ESCWA, 2011). The United Nations Economic and Social Commission for Western Asia (ESCWA, 2011) described Oman's ICT policies and strategies as having clear ICT plans and objectives which has assigned a specific national entity to achieve its goals. Further, ESCWA commented that since 2003, the Omani government adopts a national digital strategy, known as e-Oman. The e-Oman initiatives contain a wide range of initiatives and services designed to electronically transform the government and pave the way for a knowledge-based economy. Today, this strategy is supervised and implemented by an independent government unit called Information Technology Authority (ITA), which was established in May 2006 to complement Oman's economic vision 2020 (Information Technology Authority – Oman, 2010; ITA-2).

ITA, as part of its objective, is to improve the efficiency of government services, enhance the activities of businesses, enrich individuals with competence and direct Oman towards becoming a sustainable knowledge-based economy. A number of infrastructure projects have been implemented to serve the purpose of e-Oman as launching of the official e-government

services portal and National Data Centre, establishing e-payment gateway, and connecting schools Via Very Small Aperture Terminal (ESCWA, 2011; Information Technology Authority – Oman, 2010).

As an evaluation for the adoption of e-government for the country ESCWA (2011) noticed Oman's government has allocated financial resources to ICT projects and exhibited good political leadership in producing a clear ICT strategy, a clear ICT operational plan and strategies for both ICT technology incubators and research facilities. In addition, the United Nations body in its last three reports illustrated there were opportunities for improvement in Oman's ICT infrastructure, including further development of research facilities, telecommunications, and the technology incubator initiative (ESCWA, 2007; ESCWA, 2009; ESCWA, 2011). ESCWA qualified Oman for maturity level 3 in 2011 out of four levels as one of ESCWA member country which looks like Egypt, Jordan, Kuwait, and Saudi Arabia.

Regarding the speed of e-government adoption process in Oman an official from Information Technology Authority indicated "The speed of e-government adoption process is something in between the slow and medium and that is mostly influenced by citizens' awareness and interest" (ITA-12). Moreover, that was supported by other interviewees from two ministries, Oman Government Tender Board and Muscat Municipality (TB-4; MM-1-5). Therefore, as explained by Spence (1994), the adoption process contains five sequential steps starting with awareness and interest, thus the adoption process in Oman is struggling at those two steps.

4.3. Current e-government stages

Oman's rapid progress in the use of ICT is confirmed by the United Nations biannual e-government survey (United Nations, 2012) that shows Oman is ranked 16th in the world on the UN e-participation index (e-participation index is indicative on how governments create an environment in which citizens can be more active and supportive of their governments). An official from ITA illustrated "[...] there is also good improvement in terms of online citizen and business services index, this accomplishment indicates ITA strategic plans are yielding results [...]" (ITA-30). The ranking for e-services in 2012 is at 35 compared to its position of 55 in the 2010 report (United Nations, 2010; United Nations, 2012). In the same way, Oman has improved its overall ranking on the UN e-government development index, moving from its last position 82nd to 64th out of 193 countries, a move ahead of 18 positions from 2010 (ibid).

Oman e-government components in that report have been evaluated from the points of e-services, e-participation, telecom infrastructure, and human capital (United Nations, 2012; ITA-30). Comprising the e-services index, four sections correspond to the four stages of e-government development (emerging, enhanced, transactional, and connected). Table 4.1 shows the rank of Oman e-government in those four stages as well as some of the countries which are near to Oman stages. The Sultanate of Oman attained 92% in the emerging stage, 64% in the enhanced stage, 48% in the transactional stage, and 57% in the connected stage (United Nations, 2012). The United Nations e-government survey(2012) considered Oman e-government at 57% on stage four, labelled connected, which represents the most sophisticated level in the online e-government initiatives (United Nations, 2012).

Table 4.1: Oman e-government stages in 2012 (Source: United Nations, 2012).

Country	Online Service Index Value	Stage I %	Stage II %	Stage III %	Stage IV %	Total %
Qatar	0.7386	83%	64%	62%	64%	65%
Mexico	0.0732	100%	69%	62%	57%	64%
Lithuania	0.6993	83%	67%	54%	59%	62%
Luxembourg	0.06993	100%	69%	62%	49%	61%
Hungary	0.6863	100%	69%	54%	52%	60%
Brazil	0.6732	100%	64%	48%	57%	59%
El Salvador	0.6732	100%	71%	38%	59%	59%
Switzerland	0.6732	100%	88%	46%	43%	59%
Oman	0.6667	92%	64%	48%	57%	58%
Slovenia	0.6667	100%	71%	56%	45%	58%
Russian Federation	0.6601	100%	67%	35%	62%	58%
Portugal	0.6536	100%	74%	42%	51%	57%
Belgium	0.6471	100%	64%	65%	38%	57%
Croatia	0.6405	100%	76%	44%	45%	56%
Malta	0.6144	100%	62%	48%	45%	54%
Egypt	0.6013	100%	64%	27%	57%	53%
Georgia	0.6013	100%	55%	58%	39%	53%

4.4. Government agencies involved in the study

In this research study, six e-government establishments were involved. ITA as a supervision e-government unit in Oman and another five ministries which implement the most sensitive e-government projects in Oman. In the following lines we will discuss the background of each of those agencies, its role in the government, e-government project and the adoption process speed.

4.4.1. Information Technology Authority (ITA)

ITA is responsible for implementing national IT infrastructure projects and supervising all projects related to Digital Oman Strategy implementation (e-Oman), while providing professional and technical leadership to a range of the Sultanate's e-government initiatives (Information Technology Authority – Oman, 2007). In general, the adopted approach of the strategy is that it includes e-government as well as Oman digital society issues. An interviewee from ITA said "[…] we aim to create an effective government-community-citizen infrastructure that provides better public services to Omani people [...]" (ITA-2). The ITA vision outlines the main goals as it continues to move towards realizing the strategy. It can be summarized in the following (Information Technology Authority – Oman, 2007):

1. Citizens have the knowledge, means and tools to interact digitally, access the Internet and use e-Services efficiently and safely anywhere and anytime in Oman. In addition, they are made aware of offered e-government services and prefer to interact with government services electronically rather than manually.

2. The Omani IT industry is supplied with the resources and tools to transform IT business ideas into products and services that address market needs of the government to modernize and enhance infrastructure, applications and services.
3. Government services will be made more efficient, automated and offered online to citizens, businesses, employees and other Government agencies. E-services shall be integrated end-to-end across agencies and offered online with high level of availability, usability and security.
4. Government infrastructure and applications will be modernized and made more compliant to common government standards published by ITA and will be geared towards achieving efficiency, service automation and the desired level of business continuity.
5. Government IT staff will be highly trained and able to operate increasingly complex infrastructures by training and skills development programs associated with the utilized technology and architecture standards.

4.4.2. Oman Government Tender Board (TB)

The TB was established in 1972 to manage and implement all tenders in various state government agencies. Since that time, all government tenders printed in Omani newspapers are to notify the business community in the Sultanate of Oman (Tender Board - Oman, 2012).

The Sultanate of Oman's government launched a new e-government project called Oman TB (e-tendering), it was started in 2006 as part of e-Oman initiative to have all government tenders and bidders online (TB-1). The main purpose of e-tendering is to systematize and simplify the process of the government authorities' tendering less than one centralized system by the TB (Information Technology Authority – Oman, 2012; TB-1).

The adoption speed of the e-government is slow (TB-4), the reason behind that is the practice of several years ago of tendering in TB, which needs more time, effort and slows the adoption speed of such e-government project which, step by step, tries to reach the needed level of the adoption (TB-4).

The reasons why we selected this project, is that we believe it to be a national project. A professional from the TB stressed that by saying "This is a national project and I think definitely this is going to change the way we do tendering right now" (TB-1). Another reason is that one of the best e-government services which has G2G and G2B services, offers the government authorities to do the tendering as well as offering the private sector to do bidders. A third reason, TB won the 1st prize in 2011 as G2G project among 85 projects at the Gulf Cooperation Council (GCC) e-government awards in November 13th, 2011 (Tender Board - Oman, 2012), GCC countries are: Kuwait, United Arab Emirates, Kingdom of Saudi Arabia, Qatar, Bahrain and Oman (The Gulf Secretariat General,2012).

4.4.3. Ministry of Manpower (MoM)

The Ministry of Manpower holds the responsibility of the technical education and vocational training sectors and labour sectors in the matter of issuing the executive rules and regulations, protect and support national manpower, and supply all elements required to build up its talents and capabilities. As initial steps to speed up the improvement of its services through digital technology, the ministry started to deploy several projects such as IT-enabled service centres ('SANAD' offices is on the area of IT Enabled Services. They are using the ministry's labour card smart form system to provide expatriates a rapid way to renew and receive their labour cards) and National Manpower Registration which exemplifies e-readiness, e-Economy, and e-Service (G2G). Moreover, complementarily, 'SANAD' offices are intended to be linked with other e-services and government systems to facilitate one platform of services to e-services which are related to other ministries. These projects have been awarded for excellence in e-government services for 2010 (Muscat Daily-Oman, 2011). Since then, the Ministry's adoption of e-government is between fast and very fast as official staff stated:

"…Fast… I would say…it's good fast" (MoM-1-37). Another one said "Sure I give it very fast ... We are in the adoption ... Any governmental request, or need to link with data from the ministry we are collaborating along with other government agencies. We have linked with approximately 13 or more than 10 government agencies." (MoM-2-12).

Therefore, we picked it as a project to be tackled for getting the technical factors that influence the adoption of e-government.

4.4.4. Ministry of Higher Education (MoHE)

Ministry of Higher Education (MoHE) in Oman has a large centre, namely, Higher Education Admission Centre (HEAC). The HEAC is an e-government initiative that was developed and implemented by MOHE in Oman, as one of the official staff declared "…the centre was established in 2005, and the initial stage started in 2006…" (MoHE-1). The main aim of this initiative is to transform the way applications to Higher Education Institutes (HEIs) are submitted and processed. Its central admission system that is coordinating the enrolment of Omani students who graduated from high or equivalent schools inside and outside of Oman, can easily finalize the processes of enrolment in the higher education institutions, like scientific specializations at colleges, universities and scholarships. The MoHE has invested a lot of time, knowledge and resources into encouraging HEAC to switch from a manual to an electronic system (HEAC, 2009). Traditionally, applications forms were submitted on paper. With the new HEAC, the procedures of submitting and processing the applications online at 'one-stop shop' would be fast, would take less time and effort, as well as will be regarded as relatively more transparent**.** Furthermore, through this system, precise and efficient exchange of data between the HEAC and HEIs will be achieved. This system was one of the projects that won the award of Gulf Cooperation Council (GCC) and it was declared the initiative with the highest standard of quality and efficiency (ITAMC-Oman, 2011). In addition, Dr. Elsa Estevez – academic program officer at the United Nations University, International Institute for Software Technology (UNU-IIST) – appreciated HEAC system as e-government projects (UNPAN,2011). Consequently, we selected this project to go through it closely, in order to understand the factors that are influencing the adoption of e-government. The speed of MoHE adoption of e-government as a project is medium speed, because it was started while the ICT infrastructure was still not as it is today (MoHE-4).

4.4.5. Ministry of Education (MoE)

MoE is a government authority in charge of anything related to education from 1st to 12th grade and a supervision of Kindergarten, private and international schools in Oman (Oman Educational Portal – Oman, 2012). Schools data are available as offline system; MoE and schools used to have offline systems that need to send/receive data by using the traditional way of a secondary storage such as CDs (MoE-3). In 2006, this system changed from offline to online system and named Educational Portal (MoE-3).

MoE added many new features and services to the Educational Portal and announced it officially in 2007 (MoE-3). This e-government project can be accessed online by MoE, schools, teachers, students and parents which changed the MoE physical services to online services (MoE-3, MoE-41).

We selected this project because it is a national project which was also confirmed by a professional from MoE who stressed that "[...] it is a national project [...]" (MoE-21). Another reason is that it serves a large segment of users dealing with the educational system in Oman, such as teachers, students and parents, as well as the MoE and schools management.

4.4.6. Muscat Municipality (MM)

Muscat Municipality is a governmental department which is responsible for providing such services like: building permits, rent contracts, and municipality permits to citizens and residents. As a pioneer department in e-government, Muscat Municipality designed a central information portal, as part of e-government initiative, to transform the services to be e-services.

"[…] comparing with other ministries, Muscat Municipality is the first governmental department that adopted e-government, which is a rare idea all over Oman […]" (MM-1-4).

It launched the Mobile-Rial (m-Rial) application in 2003, while conducting an e-government conference, and that application helps the users to interact with municipality and perform payments on-line without visiting the municipality (Information Technology Authority-Oman, 2007). And it is going further to implement other services electronically:

"Then it deployed Customer Relationship Management (CRM) and gathered all the services that are related to the customer to be under one umbrella…" (MM-1-1).

Times of Oman-newspaper (2008) stated that in view of the fact that Muscat Municipality implemented the e-services management system (CRM) successfully, consequently it became the first government service department in the Middle East to apply this system. Oracle also reported this on its website (MENAFN - Times of Oman, 2008). In addition , Muscat Municipality won a number of prizes, such as the Oman Digital Awards under the best e-service category for parking reservation and payment fees by using SMS 2009; it also won two awards within Sultan Qaboos Award for Excellence in e-government for Muscat Municipality Portal (e-Content Award) and G2B (e-Building Permit) (Muscat Municipality-Oman, 2011; MM-2-2). Therefore, we selected this department's project to represent one of the e-government adoption projects as a case study. We interviewed two official staff members from the Muscat Municipality – Internet department directors – and they stated that the adoption of e-government within the Muscat Municipality is between medium to fast (MM-1-5; MM-2-2), and those prizes are inherently an indication of adoption speed.

5. Empirical Results & Discussion about the technical factors

This chapter contains our analysis and discussion of the findings related to six e-government establishments in Oman, ITA as a government unit responsible for implementing e-government in Oman and another five e-government projects which has been introduced in the last chapter. The technical factors affecting the adoption of e-government in Oman were presented factor by factor, as well as their level of importance, management plan and external pressures for each one. At the end of this chapter, we will present and analyze our findings about additional technical factors to our research framework.

5.1. ICT infrastructure

From our interviews with officials' managers from ITA (a leader unit of e-government in Oman), MoM, MoHE, MoE, MM and TB (Government agencies used e-government projects) we can illustrate the following table 5.1 which contains the participants' opinion about the ICT infrastructure impact in Oman e-government project out of four levels of other factors (ICT infrastructure, IT Security, IT standards and Technical expertise):

Table 5.1: Participants' opinion about the ICT infrastructure importance

Agency	ICT infrastructure importance	Level
ITA	"[...] the level one factor is ICT infrastructure [...]" (ITA-13) "[...] It is a problem which is related to the network architecture and the financial support for each government agency. In each ministry we need to support this factor with tools like data centres."(ITA-14)	First
MoM	" [...] Sure ICT infrastructure is level one [...]" (MoM-2-16, MoM-1-3)	First
MoE	"[...] Always the most important ICT infrastructure [...] in level one" (MoE-10)	First
MM	" the first factor is ICT infrastructure" (MM-1-7)	First
TB	"[...] level one is ICT infrastructure" (TB-5)	First
MoHE	" [...] the second level is ICT infrastructure [...]" (MoHE-7)	Second

As can be seen from table 5.1 that six of the participants selected the ICT infrastructure as a level one factor that is affecting the adoption of e-government in their organizations, and only one has selected it as level two. They indicated that the most important factor when dealing with e-government projects is the ICT infrastructure and it must be well planned because it contains both data centers and network, the basis of e-government projects being successful (ITA-14; MoE-10; MM-1-7). In addition, Oman government at this stage needs firstly to improve the ICT infrastructure which will enhance the government e-service quality dramatically and to reach the largest number of users (TB-6). However, an official from the Ministry of Higher Education gave this factor a level two because the ministry has lost a lot of technical experts who built the project. Therefore, those employees are affecting his management more than the ICT infrastructure itself (MoHE-8; MoHE-9).

Discussion: Misnikov (2003) and alshehry (2008) emphasized that the ICT infrastructure should be the main concern for the e-government and based on the IBM (2001), the ICT infrastructure for an e-government involves technologies - with network readiness at the

beginning - including application servers, hardware resources, software, operating systems, Internet, websites and data centre (ITA-14; MoE-10; MM-1-7). Moreover, this factor works to enhance communication across government network and information transmission by providing high speed access to government data and services within and between organizations as online transactions and procurement services (Stallings, 2000; IBM, 2001; Kurose & Ross, 2003; Ebrahim & Irani, 2005; TB-6).

5.1.1. Management of ICT infrastructure

Table 5.2: Participants' opinion about the management of ICT infrastructure

Agency	ICT infrastructure management
ITA	"[...] E-payment Gateway, National Data Center, e-government Services Portal [...]" (ITA-7)
MoM	"[…] MPLS which is supported by ITA team […]" (MoM-2-28)
MoE	"[...] ITA is managing our ICT infrastructure" (MoE-22)
MM	" We are linked to government network MPLS and e-government Services Portal which managed by the authority " (MM-1-16, MM-1-15, MM-2-7, MM-2-25)
TB	"[...] The National Data Center is hosting all the servers […]" (TB-7) " […] ITA E-payment Gateway process done in the e-tendering system […]" (TB-1)
MoHE	" [...] The National Data Center managed everything [...]" (MoHE-19; MoHE-20)

Generally, from their explanations in table 5.2, the ITA, as a central government unit, is responsible for the management of ICT infrastructure for those projects. ITA framework at ICT Infrastructure is aimed to improving the basic overall IT needed within Oman through a number of projects. Those projects are included as a government data centre, an e-payment gateway to enable people to make payments online, Unified Government Network (UGN) to isolate traffic of different ministries across the government network through Multi-Protocol Label Switching (MPLS) and a Call Centre to assist users of e-government services (ITA-7, MM-1-16). Those projects can be described briefly as follows:

- **Official e-government Services Portal (www.oman.om)**
  It is the main electronic outlet to access government information and e-services from the web (ITA-7). It has several supporting features and factors to deliver the e-services more flexibly and comprehensively between G2G, G2C, G2E and G2B. For example, the electronic forms which enable users to download, fill out, and submit requests for all e-government services (ITA-7, MM-2-7). Moreover, the portal is accessible through mobile and interactive phones and also made accessible to the handicapped.

- **Central Call Center (80077777)**
  The Call Center was launched to assist portal visitors and users of e-government services, 24 hours a day, by calling the free number or sending email queries (ITA-7). Also, support includes responding to queries about the National Data Center, Unified Government Network and the Center for Information Security (ITA-7).

- **The National Data Center (NDC)**
  The National Data Center is available to host government agencies and institutions' database and electronic systems (TB-7, MoHE-19). At present, the National Data Center is hosting more than 20 government agencies and institutions, including ITA infrastructure projects and systems (ITA-46). Since its operations, the NDC hosted data, whether it was pertaining to basic operation or disaster recovery, such as the Official e-government portal, Center for Information Security, e-tendering project, Disaster Recovery Site for the Ministry of Oil and Gas, Ministry of Commerce and Industry (TB-7; ITA-7; MoHE-20).

- **Unified Government Network (UGN)**
  As illustrated in ITA report (2010) the Unified Government Network (UGN) is a nation-wide telecommunication infrastructure interconnecting government agencies within Oman. It aims to support other e-government applications and to improve public service. It is considered a national communication infrastructure linking all government establishments, not any other business, in order to support e-government projects on course to developing public services and enhancing e-services offered by these establishments (ITA-5).

  The implementation and management of the UGN has been outsourced to the Oman Telecommunication Company (Omantel), which is the leading telecommunication infrastructure in Oman (Information Technology Authority – Oman, 2007). Omantel has developed a Multi-Protocol Label Switching (MPLS) which can be used to provide Virtual Private Networks (VPNs) to isolate traffic of different ministries across the government network (ITA-5, ITA-7, MoM-2-28, MM-1-15). MPLS-based VPNs are also very flexible as the addition of new sites to a certain Ministry VPN or reconfiguration can be achieved with relatively minimal effort (MM-1-4, Information Technology Authority – Oman, 2010).

- **E-payment gateway**
  The e-payment gateway was launched in August 2008 as a complete and integrated set of programs and rules that were provided by the ITA to assist secure e-payment processes for payment transactions (TB-1, Information Technology Authority – Oman, 2008). It works under an umbrella of rules and laws that ensure the security and protection of purchase procedures and service delivery through the Internet anywhere and anytime, without the need to physically go to the establishments (TB-1). The gateway provides both individuals and the business sector the option of e-payment of service fees through secure and effective channels (TB-1). It entails payment through Omani ID cards, mobile phones and transfers of funds between bank accounts (Information Technology Authority – Oman, 2010).

- **Consultancy services of e-government projects**
  The ITA also offered a number of consultancy services to government agencies and institutions as a part of providing the technical architecture to support the ICT infrastructure for e-services (Information Technology Authority – Oman, 2010). They varied between evaluating investments proposals, studying and analyzing functional needs, evaluating offers and preparing proposals for more than 50 ministries (ITA-7).

Discussion: After identifying the importance of the factors, the next step is to manage these factors in a manner that can assist to accelerate the adoption of e-government and provide sufficient e-services to the citizens. So, as it can be seen from the literature in section 1.7 that Holliday and Kwok (2004) stated about the necessity of unit existence to coordinate the speed of e-government adoption by building up and supporting the development of ICT infrastructure. We found from the empirical data that one of the respondents explicitly mentioned that ITA is taking care of ICT infrastructure managements, and that it was really helpful for their projects in order to overcome the problem which any agency might face (MoE-22). Also, this is followed by other respondents when they obviously declared the role of ITA in such e-government services project, some of them commending the efforts of ITA as coordinator unit to prepare the ICT infrastructure for their projects, especially when it comes to establish the unified government network which is called MPLS (MM-1-15; MM-2-7; MoM-2-28), national data Center to keep some of their servers there (ITA-7; MoHE-19; TB-7), e-government services portal (ITA-7; MM-1-16; MM-2-25), and e-payment gateway (ITA-7; TB-1). Thus, throughout all of the aforementioned facilities, it reflects the centralized initiatives of ITA which can inspire other ministries to start their projects as Gupta & Sridev (2007) and Sethi & Sethi (2008) illustrated that would lead to accelerate the adoption of e-government. Also, Sethi & Sethi continued noticing that it shows the way to decentralize the implementation of the project concerning e-government for each agency individually, as management steps.

Furthermore, Gupta & Sridev (2007) posed the extent to which the framework is important so that it may help to manage the ICT infrastructure to come out with a successful adoption of e-government. Besides that, Alghamdi *et al*. (2011) commented that building a framework for e-government ICT will eliminate problems' emergence related to failure of e-government adoption. This was further supported by ESCWA (2011) when it is clarified that ITA has produced a clear ICT strategy and operational plan to improve the basic overall IT needs within Oman through ICT Infrastructure framework.

5.1.2. External pressures of ICT infrastructure management

Table 5.3 is briefly shows our findings about the external pressures of ICT infrastructure management

Table 5.3: Participants' opinion about the external pressures of ICT infrastructure management

Agency	External pressures of ICT infrastructure management
ITA	"[...] The management of ICT infrastructure is influenced by the Internet facility and price rate of telecommunication companies [...]" (ITA-21)
MoM	"[...] Internet connection within Oman rugged mountainous is great difficult […]" (MoM-2-14)
MoE	"[...] The network traffic in our service has normally reached 200,000 requests and the Internet is very slow […]" (MoE-25)
MM	"[...] External pressures is the Internet facility […]" (MM-1-17, MM-2-8)
TB	"[...] The Internet connection […]" (TB-10)
MoHE	" [...] The government financial legislations [...] and the Internet [...]" MoHE-21

The first pressure, as an official from ITA said:

> "*The management of ICT infrastructure in our country is influenced by the Internet facility and price rate of telecommunication companies, which is partly out of ITA control because we could not enforce those companies to provide low price for the low demand, or to cover the wide area of Oman by 3G or the highest speed available in the market. We have a limited control for those companies, but still there are certain rules and regulations implemented by the Telecommunications Regulatory Authority (TRA)*" (ITA-21)

The Internet facility as an external limitation, which was mentioned also in the ITA report; most of the population is living in Oman's capital city (Muscat), about 45% of the total population, and they have easy access to Internet, but connecting the rest of the population to a network of optical fibre is quite a challenge (Information Technology Authority – Oman, 2010). The Telecommunications Regulatory Authority (TRA) and the telecommunication companies faced great difficulty in creating sustainable telecommunication infrastructure due to the country rugged, mountainous, craggy and unrelenting terrain (MoM-2-14). Nevertheless, the TRA and the telecommunications companies continued to find sustainable solutions to provide connectivity to all citizens in every region (MoM-2-14, Information Technology Authority – Oman, 2010).

At the same time, five participants from those agencies have mentioned the same external pressure which has a big impact on their management plan of this factor (TC-10; MoHE-21; MoE-25; MM-1-17; MM-2-8; MoM-2-14). For example, Ministry of Education e-service providing depends on the data transfer speed and the Internet capacity, so providing a better speed of accessing the Internet by the telecommunication, will indeed satisfy the needs of citizens in using e-government services (MoE-25). The education project of the ministry has the largest demand as an educational e-service which is serving more than half the population, mostly in the same time and with a large data transfer rate, but that project is suffering from the Internet service in the country, as well as the end users (MoE-25). It has been noticed that IT managers in those projects could manage the data caterers which are inside their ministries to deal with such traffic. However, the problem is the Internet speed and capacity which is out of their control and controlled by telecommunication companies (MoE-25; TB-10; ITA-21).

The second pressure of ICT infrastructure management, an official from the Ministry of Higher Education adds another external pressure to the Internet limitations, the government financial legislations which followed the purchasing of ICT infrastructure tools make things very complicated and delayed for a long time until it is accepted by the Ministry of Finance (MoHE-21). He also indicates the acceptation procedure sometimes takes six months, and at that time the IT manager may have another request, also it could be rejected after a long wait because of financial legislation issues (MoHE-21).

Discussion: external pressures could be government legislations and media that impact the management of institutions from outdoor organization (Hosni & Khalil, 2004; Sharma, 2000). The e-government management of ICT infrastructure is mostly impacted by information transfer rate between the government agencies and the target groups which depend on the Internet service in the country (IBM, 2001; Ebrahim & Irani , 2005; Macasio, 2009; TC-10;

MoHE-21; MoE-25; MM-1-17; MM-2-8; MoM-2-14). The management of the ICT infrastructure as a technical factor also could be affected by the government legislations of funding this type of architecture (MoHE-21).

5.2. IT security

After interviewing senior managers from six different Oman government institutions, we can state their opinions about the level of IT security which is important as a technical factor out of four levels (ICT infrastructure, IT security, IT standards and technical expertise) in table 5.4:

Table 5.4: Participants' opinion about the IT security

Agency	IT security importance	Level
ITA	"[...]IT security is the fourth factor [...]" (ITA-4) " [...] ICT infrastructure, IT standards and IT expertise are more likely to influence ITA management of e-government [...]"(ITA-27) "We have secured data channels and security expertise teams […] we do not need to worry about the security […]" (ITA-27)	Fourth
MoM	" [...] The IT security is the third one [...]" (MoM-2-16, MoM-1-3)	Third
MoE	"[...] IT security is the third [...]" (MoE-15)	Third
MM	"[…] The security is the second" MM-1-9 " [...] we deal with both G2C and G2B, IT security could impact our whole business [...]" (MM-1-24, MM-2-9)	Second
TB	"[...] Third point is the IT security […]" (TB-5) "[...] First infrastructure then technical people in the project, then security part […]" (TB-6)	Third
MoHE	" [...] The last thing is the IT security [...]" (MoHE-10) "[...] at the end when I would like to open the service for the public I will think then about the security [...]" (MoHE-10)	Fourth

As can be seen from our findings, three of the agencies were saying the IT security is level three of importance in their management of technical factors (TB-5; MoE-15; MoM-2-16; MoM-1-3). Two of the agencies linked the IT security importance level with the process of offering the e-service, therefore it comes before opening the service to the public (TB-6; MoHE-10). Establishments like ITA and the MoHE consider the security as a low level of importance because the security in those organizations represents less challenge than other technical factors (ITA-4; MoHE-10). For example, ITA has implemented a number of protected security solutions and hired specialized security experts that give this factor level four in the importance sequence (ITA-27). However, in Muscat Municipality they thought more about the security as a second level of importance as they deal with both G2C and G2B which may influence their whole business (MM-1-24, MM-2-9).

Discussion: IT security is considered to be one of the most significant divisions of information security (Euting & Weimert, 2009; Sharma *et al.*, 2005). Therefore, the e-government authorities have implemented protected solutions to prevent unauthorized access to the data (Nikkhahan *et al.*, 2009; Hermann *et al.*, 2009; ITA-27). IT Security is treated as an important factor in the implementation of online services (Nikkhahan *et al.*, 2009; TB-5;

MoE-15; MoM-2-16; MoM-1-3; ITA-4). The information security is protecting the information and guarantees to obtain ability, privacy and honesty of information which could influence the whole business (Aljifri & Navarro, 2003; Elmarie & Elme, 2000; Pfhleeger, 1997; Von Solms, 1999; MM-1-24, MM-2-9). Citizens may be reluctant to adopt e-government services due to a lack of trust in the security of online transactions and concerns regarding the use of information submitted electronically (David *et al.*, 2004; David & Pierre, 2008; MM-1-24)

5.2.3. Management of IT security

Table 5.5 shows our findings in the management of IT security.

Table 5.5: Participants' opinion about the management of IT security findings

Agency	IT security management
ITA	" […] for the e-government security issues we have Center for Information Security (CIS) and National Computer Emergency Response Team (CERT) which offered its service for both public and private sectors […]" (ITA-7) "[…] CIS provides security services to governmental agencies according to best practices to guarantee information confidentiality, integrity, and access […]" (ITA-7) "[…] Internet Connection Security System enables employees from all government agencies to access the Internet and benefit from all resources available on government websites without using the government network […]" (ITA-7)
MoM	" [...] the employees' security awareness is very important to manage the security in providing government e-service […]" (MoM-1-3)
MoE	" [...] we have especially well trained people who joined has join many courses from ITA like information security management systems, Preparing Information Security Auditors course and post disaster recovery […]" (MoE-28) "[…] ITA gives our project application for a firewall and data center security system. Moreover, it is very important to have efficient security team who has the latest knowledge in the technology […]" (MoE-28) " [...] We mainly connected to the ITA [...]" (MoE-29)
MM	"[…] we would like to say great thanks for CIS group for their workshops and courses in the IT security to our employees in the ministry […]" (MM-2-9) " […] The CIS detects incidents; evaluate its impacts; mitigate the resulting damages impacting work and continuously develop information security procedures which call as Cyber […]"(MM-2-9) " […] Cyber protections like : Anti-virus, Web Application Firewalls, Security Loopholes Management, Security Training and Awareness […]"(MM-2-9) " […] ITA conducted several activities like seminars, courses and workshops on themes such as information security management systems […]" (MM-2-9)
TB	"[…] in the National Data Center, the transactions are completely encrypted [...] It is highly secured […]" (TB-15)

	"[…] our datacenter is totally hosted, in the National Data Center, the transactions are completely encrypted. Even the online payments, that is done by the ITA E-payment portal, that's a common portal and whenever they submit their tenders or offers we do a client side encryption and data comes and stored in the database. So, even if the Internet Service Provider wishes to see the data, it cannot see the data. Only after the tender is open […]" (TB-15)
MoHE	"[…] The firewall security give us protection from any hacking that came from outside of our organization […]"(MoHE-26) "[…] CERT is considered one of the most important e-government Initiative projects, it announces to us about any hacking before it happens to protect our data […]" (MoHE-28)

From those findings we can see that the management of IT security in Oman e-government is mainly managed by a central unit which is ITA (ITA-7; MoE-29; MM-2-9; TB-15; MoHE-28). ITA has developed two solutions to manage the IT security Center for Information Security (CIS) and Computer Emergency Response Team (CERT) (ITA-7; MoHE-28; TB-15; MM-2-9; MoE-28). Both of those initiatives are considered the main ITA keys for addressing the security risks from technical and strategic dimensions (Information Technology Authority – Oman, 2010; ITA-7). CIS aims to address security risks and build information security awareness within Oman for public and private sectors through providing a wide range of information security related services (MM-2-9). In addition to CIS, CERT aims to analyze and treat information security incidents on the Internet, also to enhance information security awareness and culture among different social levels, individuals or institutions (MoHE-28; ITA-7).

A. Center for Information Security (CIS)

The ITA is represented by the CIS to provide security services to governmental agencies according to best practices to guarantee information confidentiality, integrity, and access (ITA-7; Information Technology Authority – Oman, 2010). The CIS creates a safe, secure and regulated working environment by protecting information and databases and restrict internal and external security breaches. As an official from ITA indicates: "This action would create confidence among employees and citizens in commercial transactions" (ITA-7). The Center detects incidents; evaluate their impacts; mitigate the resulting damages impacting work and continuously develop information security procedures, and that can be illustrated by the following security protections accesses which are called Cyber protections (Information Technology Authority – Oman, 2011; MM-2-9):

- **Anti-virus protection**
  The CIS provided anti-virus protection alongside licensing and software support in government agencies (MM-2-9). Moreover, it provides protecting software and support for servers, clients, mail exchange against viruses, spyware and breach (Information Technology Authority – Oman, 2011).

- **Web Application Firewalls**
  The CIS also protected the government websites by preventing attacks and attempts of sabotage and breach by using Web Application Firewalls (MoE-28; MoHE-26). As an

official from the Ministry of Higher Education explained "the firewall security give us protection from any hacking came from outside of our organization" (MoHE-26)

- **Internet Connection Security System**
  Internet Connection Security System enables employees from all government agencies to access the Internet and benefit from all resources available on government websites without using the government network (ITA-7; MM-2-9).
  This service also allows flexibility of control and monitoring of employees' access and browsing through a central unit (ITA-7). Moreover, it ensures keeping viruses outside the domain of the network and to insure the transactions in the National Data Center are completely encrypted (TB-7; TB-15).

- **Security Loopholes Management**
  This service entails taking stock of all equipments and components of the internal network of government establishments or institutions, services provided by systems and applications and all security policies (ITA-27). It works to study and analyze the potential threat, evaluation of discovered loopholes risks, and provision of advice and opinion on dealing with the discovered security errors and loopholes (ITA-27).

- **Security Training and Awareness**
  Definitely, the employees' security awareness is very important to manage the security in providing government e-service (MoM-1-3). Therefore, to spread awareness on information security among government agencies, the ITA conducted several activities, including seminars, courses and workshops on themes such as information security management systems, business continuity management, risk management, Preparing Information Security Auditors course and post disaster recovery (TB-7; MM-2-9; MoE-28).

B. National Computer Emergency Response Team (CERT)

As an official from the Ministry of Higher Education said "CERT is considered one of the most important e-government Initiative projects that warns us about any hacking before it happens to protect our data" (MoHE-28). It was established in May 2009 to serve a wide group of ICT users, particularly the national infrastructure institutions and major industries, in addition to the public (Information Technology Authority – Oman, 2011). It provides a diverse set of information security related services and it aims to build confidence in the use of e-government services on the Internet, as well as to build competent Omani cadres qualified to respond to security incidents and detect them. CERT has carried out the following (ibid);

- **Responded to a number of cyber crimes and incidents** and followed them up in coordination with the concerned authorities, through:

  a. Receiving security incidents, classifying and analyzing them.
  b. Investigating the incidents through records analysis and tracking sources of breach.

c. Offering the required support for response to incidents through assisting the victims and directing them to overcome impacts of incidents.
d. Work on coordinating among impacted parties to respond to incidents.

- **Information Security Risks Detection in Cyber Space**
  The CERT is provided with the latest capabilities to detect new risks in cyber space (Information Technology Authority – Oman, 2011). The team monitors threats and analyses records collected through specialized software, in order to determine the means and route through which hackers managed to break into the system and, at the same time, discover system defects (MoHE-28).

Discussion: IT security is a crucial component in the e-government adoption, and since IT security is a factor that is affecting the adoption, it should be managed in order to accomplish successful adoption of e-government. We found, from the empirical data, that ITA has managed the IT security as central unit (ITA-7; MoE-29; MM-2-9; TB-15; MoHE-28) to speed up the adoption as Holliday and Kwok (2004) stated. ITA, in turn, started through establishing CIS and CERT (ITA-7; MoHE-28; TB-15; MM-2-9; MoE-28), to manage and address the security risk issues and setting up the awareness of the public and private sectors(MoHE-28; ITA-7). Therefore, the services are provided based on the best practices to ensure the confidentiality, integrity and access (ITA-7). The responsibilities of CIS such as providing services like Anti-virus protection, Web Application Firewalls, Internet Connection Security System, Security Training and Awareness, and Security Loopholes Management; and CERT's responsibilities like responding to a number of cyber crimes and Information Security Risks Detection in Cyber; would create a safe, secure and regulated working environment by protecting information and databases and restrict internal and external security breaches. Then, it would be more stable and reliable, so that it can lead to successful adoption by controlling IT security issues.

Also Holliday and Kwok (2004) commented that planning to get advantage of other experience can bridge to e-government adoption easily and fast. And what ITA is that it conducted so many courses and workshops to transfer the knowledge and the experience to other agencies as one official from MM said " […] ITA conducted several activities like seminars, courses and workshops on themes such as information security management systems […]" (MM-2-9). Consequentially, it makes us derive - as initial steps - toward decentralization of e-government implementation (Gupta & Sridev, 2007; Sethi & Sethi, 2008).

5.2.4. External pressures of IT security management

Table 5.6 shows our findings about the external pressures which impact the management of IT security in those establishments:

Table 5.6: Participants' opinion about the external pressures of IT security

Agency	External pressures of IT security management
ITA	"Our management of this factor .... I mean the management of IT security does not impact by external pressures because we do not share it with others" (ITA-28)
MoM	"The external pressure in the sense, for example: policies as I told you cyber-law security, we have to comply with it, ITA has developed amended cyber security and pattern-rights and all these policies must be followed as it is[…]" (MoM-1-12) "External pressure maybe like lack of awareness people might not be aware of what they are doing….that is the main things. Maybe the awareness could be the most important." (MoM-1-13)
MoE	---
MM	" We do not have any pressures" (MM-2-10)
TB	" No, there is no pressure […]" (TB-16)
MoHE	" I do not think there are any external limitations" (MoHE-27)

Regarding the external pressures which may influence the management of IT security, an official from the Ministry of Manpower has specified two pressures. The first one is cyber-law security from ITA which must be followed as security policies without having some flexibility for the IT managers in e-government projects (MoM-1-12). The second pressure that he added is about citizens' security awareness, which may influence the project security, like passwords sharing with others (MoM-1-13). Other participants did not suggest any external pressures or limitations for their management of this factor (TB-16; MoHE-27; ITA-28; MM-2-10; MoM-2-22; MM-1-26). An official from ITA explained "Our management of this factor .... I mean the management of IT security has no impact from external pressures because we do not share it with others" (ITA-28).

Discussions: The external pressures are considered as the limitations from outside the ministry which can be caused by government rules from other government agencies and citizens' impact in the management of technical factors (Hosni & Khalil, 2004; Sharma, 2000). Therefore, the management of IT security in Oman e-government projects is affected by two external pressures, cyber-law security policies and citizens' awareness about security issues (MoM-1-12; MoM-1-13).

5.3. Technical Expertise

In our interviews we discussed the technical expertise with the interviewees, IT expertise as a technical factor and what level of importance it has in each e-government agency. In table 5.7 we present our findings from the interviews conducted with six e-government authorities regarding the importance of the factor:

Table 5.7: Participants' opinion about the importance of the technical expertise

Agency	Technical Expertise importance	Level
ITA	"…IT expertise will be the second…" (ITA-13)	Second
MoM	"The second one could be the technical expertise…" (MoM-1-5)	Second
MoE	"…IT expertise I give it the second high priority" (MoE-12)	Second
MM	" … I leave the IT expertise to the last" (MM-1-8)	Fourth
TB	"Second is technical expertise…" (TB-5)	Second
MoHE	"To me, the most important is the right IT expertise; it is the most important…" (MoHE-10)	First

We noticed that the professionals in the four e-government projects gave it a second priority after ICT infrastructure. A professional from TB explained that by saying:

"…I think that should be the second point, because after having infrastructure I don't have people to work, and what is the point in investing in that one, so I rate the IT expertise as second point." (TB-6)

It is common sense to us why the majority selected the technical expertise as the second important factor, after having the ICT infrastructure, the need of IT expertise is a must in order to deal with all kinds of issues related to the e-government projects services, such as developing, maintaining, controlling and protecting different aspects of the e-services.
On the other hand, a professional from MoHE gave it the first priority, because by getting IT expertise it will lead to build an excellent infrastructure, security and standards (MoHE-9), his point of view is to start first with technical expertise, the technical expertise will plan the best suitable ICT infrastructure, security and standard needed for the e-government project (MoHE-10).

A third point of view is from the Ministry of Municipality, the interviewee gives this factor the last priority because they rely on outsourcing in their e-government projects which he explained by saying:

"...to be explicit with you, we rely on outsourcing for designing and developing most of our online services ..." (MM-1-27).

Due to reliance on outsourcing, this factor is considered to be the last priority to the ministry.

Discussion: We notice from the findings that the majority gave technical expertise the second important factor, which obviously is needed in e-government adoption (ITA-13; MoM-1-5; MoE-12; TB-5). Technical expertise is needed as a technical capability in adopting e-government (OECD, 2003). Because technical expertise is needed for the e-government project, different government authorities need to hire a qualified IT expert (Ebrahim & Irani, 2005; Moon, 2002; TB-6; MoHE-10). By understanding the importance of having the needed IT expertise, it will lead to have a successful e-government project (OBCD, 2003; MoHE-10).

5.3.5. Management of technical expertise

In table 5.8 we show our findings of the management of technical expertise that has been discussed in the interviews we conducted. The informants' responses were as followed:

Table 5.8: Participants' opinion about the management of the technical expertise

	Technical expertise management
ITA	" [...] when you entered the ITA I am sure you saw most of the people are Omanis', we select the best in IT[...] there is a training management for the IT expertise, there is a plan and we conduct specialized IT training [...]" (ITA-22)
MoM	"[…] training development plan for the each individual in the other department, we identify what is the strength and weaknesses and what is the opportunity and threats for them… we do a kind of SWAT analysis and we ensure that each individuals is performing as the aspect level[…] also ITA conduct more workshop and other stuffs for example seminars and also they invite us and we nominate people who love in that and want people who want and can to be expert so this is how we make the individual performance, so individual performance will help us to satisfy our management objectives and goal" (MoM-1-14)
MoE	"... we have internal and external training... attending e-government conferences outside Oman to get the latest e-government technologies...." (MoE-38) As I already mentioned that we have expertise from contracted company for certain time…also we gain experiences through visiting other organizations outside Oman which have more experience, regarding how they implement, what kind of barriers they faced and how to manage them…(MoE-39)
MM	"[...] we don't use any new system unless our people get courses and training and be ready to deal with the new system [...] actually we rely on the outsourcing […]" (MM-1-27) "We resort to consultant offices that ITA provided, to get recommendations how to develop the work and having gap analysis between current status and the standards, then give you recommendation how to reach the standards…..conducting knowledge transfer seminars and workshops experiences" (MM-2-14). We have internal development concerning staff training, at the same time we attract experts through consultancy offices or through consultancy company in order to get more experience (MM-2-15).
TB	"...continually we have in-house training…" (TB-11)
MoHE	"...first of all IT expertise must be available to you before the infrastructure as a plan stage, as a result they will guide you in getting the best and the latest technologies needed..." (MoHE-9). "...It is much easier to handle the work when you have more IT expertise…" (MoHE-8).

As it can be seen from table 5.8, all of the officials we interviewed agreed on the importance of training for their IT expertise who are in-charge of dealing with the e-government projects, as a main issue of managing the factor IT expertise (ITA-22; MoM-1-14; MoE-38; MM-1-27; TB-11; MoHE-9). Training the IT expert is needed as part of their management of the IT expertise factor and there is a plan for it (ITA-22).

Training also will help management to understand the strengths and weaknesses of their IT expertise (MoM-1-14). This will guide the management on how to deal with the IT experts, what work they can do, and what improvement can be done.

The training can be internal and external, as well as attending conferences related to e-government (MoE-38). We think this is a best solution to keep the IT expertise updated with the latest technology in the e-government, by offering the IT experts internal and external training as well as attending e-government conferences.

An expert from MoHE argued that if you have more IT expertise in e-government project, it will be much easier to handle the work (MoHE-8). Furthermore, he added that IT expertise are needed in the early plan stage before starting the e-government project, because the IT expertise will be the guide to the plan stage of the e-government project (MoHE-9).

Discussion: It can be found from the findings we collected from the interviews, that it is compulsory to train technical expertise in order to update them with the latest technology in the e-government field (ITA-22; MoM-1-14; MM-2-15; TB-11). So that it can be able to execute the work with a high level of performance. Consequentially giving the needed training will enhance the e-government services and improve the effectiveness of the government e-services and help it then in attaining the adoption (Ebrahim and Irani, 2005; Moon, 2002).

Since the ITA is coordinator unit for e-government initiative, it conducts seminars, workshops, and conferences to guide all initiatives towards e-government adoption (ITA-22; MoM-1-14; MM-1-27; MoE-38). And that gives verification to what Holliday and Kwok (2004) noted, and this can be applied to technical expertise as well, so ITA assists other agencies to develop their staffs to cope with the adoption easily and rapidly. Also, we can say that ITA is a centralized initiative of e-government adoption in managing technical expertise, as far as we can understand, but it is not directly guided since each agency has its own internal training or in-house training (MoM-1-14; MoE-38). As a result, it gives an indication of centralized initiatives and decentralized implementation as Gupta and Sridev (2007) and Sethi and Sethi (2008) mentioned, but here it goes even further for ITA to conduct and train the staffs, as an implementation to double the efforts, so that the adoption will be faster.

Additionally, as Aita (2006) stated, regarding the role of incubators in accelerating the adoption, an official interviewee from MM confirmed that consultancy offices like incubators can get assistance and more experience to handle e-government projects and overcome the barriers that might be confronted. Also, through these consultancy offices, the agencies can attract the technical expertise and have outsourcing as well, as there is sufficient place where the experience can be exchanged. Besides, from Holliday and Kwok (2004), the experience from others can help to shorten the way to adopt e-government through technical expertise, and an official interviewee from MoE clarified that through visiting other agencies abroad which have more experience and is a pioneer in this field. The agencies can gain more experience regarding how to implement, how to overcome the obstacles, and how to manage them successfully, by allowing their staff to draw on the experience from the experts. As a

result, continuous training of the technical experts through different ways is the main management concern of this factor.

5.3.6. External pressures of technical expertise management

Table 5.9 shows the external pressures of the technical expertise management:

Table 5.9: Participants' opinion about the external pressures of the technical expertise

Agency	External pressures of technical expertise management
ITA	"...retain and sustain ... private sector are able to pay more... because we are a government department, we have a salary limit according to their degree and not their expertise... so definitely they will leave..." (ITA-23)
MoM	"... people now they start to compare financial things, they might get a good benefit from the government but they look at in the money so they, they go to the private sector..." (MoM-1-15)
MoE	"The training is important, the continues training to the IT expertise, evolving technology is not in days but in hours… there must be a enough budget for continues training, which mean rehabilitation and update information and knowledge to keep pace with what is found in the world and keep up with the level of progress"(MoE-18).
MM	"... first of all is the financial difficulties, because we use outsourcing we paid twice the salary of our programmer in MM ..." (MM-1-29) "... second, sometimes we have new ideas to implement, but because of our technical expertise level of experience in MM we keep it as a plan or give to another company as a tender to developed it and help us in making this new idea ..." (MM-1-30) "...since we deal with many kind of systems, our technical expertise after 5 or 6 years they leave MM because they are getting better offers ... in one year we lost more than 6 of our main technical expertise ..." (MM-1-32)
TB	"For technical expertise, first I have a challenge is to train my team, we have taking youngsters from Oman, continually we have in-house training, they have to be sure to give support to others. So that was a challenge to us, because it is a planned project, we had giving them various cases, what experience, and what are their comments which we carry to others, we chat with them, made them to understand what will be the likely case could occur and what are the challenges that could be face and how to handle it" (TB-11).
MoHE	"…all the staffs who start this project left their job because they got better offers, the only person left is the manager, he got offer to leave put the top management refused him to resign…" (MoHE-16). "…I don't care about the certificate degree of the IT expertise but I care more about their professional expert in their field, on the other side we are forced by Ministry of Civil Service that the certificate degree is the measure to determine the salary. Therefore the IT expertise target is the private sector." (MoHE-17)

The main external pressure faced in the governmental departments dealing with e-government projects is the retaining of the IT expertise because of the private sector offers to the IT expertise (MoHE-8). The private sector is paying more than the government (ITA-23), the private sector is paying salaries according to the expertise, and not according to the degree (ITA-23).

Another external pressure is from the government side, it is from the Ministry of Civil Service, because of the rules and regulation of hiring IT expertise in setting degrees and salary range of the IT experts which all government authority must follow, which will result to lose the IT experts because of the better offers from the private sector (MoHE-17; MM-1-32). We

think this is the main reason why IT expertise goes toward the private sector, because of the government rules and regulations of the salary range based on degree, not based on the professional work done by the IT expert (ITA-23; MoHE-17; MoHE-8).

Discussion: The external pressures could be government rules or industry associations that influence the business objectives (Hosni & Khalil, 2004; Sharma, 2000). As we saw from our findings, the two external pressures affecting technical expertise are the government rules of hiring employees and the private sector offers to the IT experts (MoHE-16; MoHE-17). Technical experts are continually leaving the government organizations to work for the private sector (Ebrahim & Irani, 2005; MoHE-16; MM-1-32). This way, the government needs to think of changing their rules and regulations of hiring and giving better offers to their technical experts in order to solve this financial issue which will stop or limit the affect of this factor (MoHE-17; MoM-1-15).

5.4. IT standards

We are presenting in the table 5.10 below the responses of the interviewees concerning the importance of IT standards as technical factor affecting the adoption of e-government.

Table 5.10: Participants' opinion about the importance of IT standards

Agency	Importance of IT Standards	Level
ITA	"…IT would come the third one…" (ITA-13)	Third
MoM	"…and the forth one could be IT standard" (MoM-1-6)	Forth
MoHE	"after all…then you can think about IT standard" (MoHE-10)	Third
MoE	"…IT standards will be the forth one" (MoE-16)	Forth
MM	" the third one is IT standards" (MM-2-4)	Third
TB	"…so I find that it will be the last priority." (TB-6)	Forth

From the table 5.10, the respondents are divided into two groups regarding the ranking of the IT standards' level of importance. Three respondents (ITA, MoHE, and MM) commented that IT standards would be the third factor that should be considered in their projects, and the remaining three (MoM, MoE, and TB) stated that this IT standard can be taken as the fourth factor in their projects.

Discussion: As can be seen from section 2.6.3, in the literature review, e-government adoption requires IT standards since it affects the adoption. On the matter of its hardware and software, if the systems currently used are not compatible with each other, particularly with other agencies, they might not be functioning together properly, and this might lead to failure of e-government adoption, or at least to dissatisfaction.

It can be shown from table 5.10 that three out of six respondents agree to consider the importance of IT standards to be a third technical factor affecting the adoption of e-government in their projects, based on an official from ITA and MM (ITA-13; MM-2-4),

because of the need to start with ICT infrastructures and security to make the base ready before they might think about the IT standards to ensure the compatibility and interoperability between the systems and other e-services, based on Borras (2004). Since the needs to integrate the whole system is concerned with the involvement of different government agencies to contribute their data with others, as complementary in the later phase of the adoption, most e-services project's managers postpone it and consider it a subsequent priority, as Layne and Lee, (2001) and Vishanth et al, (2011) mentioned.

On the other hand, the remaining respondents argued that the importance of IT standards would be rated the fourth factor affecting the adoption of e-government in their projects. As one official from TB clarified, IT standards are changeable according to the requirements which are needed and due to the International organization for standardization (ISO), since it keeps changing the standards within a certain period of time along with IT developments. So, it is found that IT standards will be the last priority (TB-6). In addition, others support the opinion of TB that the importance of IT standards is the last technical factor affecting e-government adoption in their projects, by pointing out that after all they can think about IT standards (MoHE-10; MoM-1-6; MoE-16; TC-6). Moreover, as two officials from MoHE and MM supported their responses by reasoning that they rely on outsourcing with regards to the technical issues, so it does not matter to them that they put it in the third or fourth in their rating (MoHE-22; MM-1-41). However, it does not mean that IT standards is the least important factor, or that there is no need to consider it, instead, it means that it looks like when say, buying a new vehicle, for example, the last thing that might be considered is the standard model which can be suited with the place where you drive, after having the vehicle, driver, and security (TB-22). Then, you can acquire a vehicle that complies with the standard specifications for the Gulf countries, for instance, so that it can function well. DeNardis, 2009, stated that IT standards' importance is embodied in having interoperability to make everything go well.

5.4.7. Management of IT Standards

As can be seen from section (2.6.3) in the literature review, e-government adoption requires IT standards since it affects the adoption. On the matter of its hardware and software, if the systems currently used are not compatible with each other, particularly with other agencies, and might therefore not function together properly, then this might lead to failure of e-government adoption, or at least dissatisfaction. The table 5.11 shows the respondents' answers of how the IT standards would be managed:

Table 5.11: Participants' opinion about the management of IT standards

Agency	Management of IT Standards
ITA	"…while we are planning for a particular IT standards, we called many people from government and private sectors such as Telecommunication companies, Banking, and other ministries, who have enough experience in the field of IT… We sit together to define and design standards…. With consultants, of course… study the standards…has been reviewed…and then we end up and publish the current framework concerning the standards" […] so it is exist, then next step is how to be implemented" (ITA-24)
MoM	"…we are following best practices around here so we get certified for ISO 27000" (MoM-1-22) "…we are using ISO that we have…" (MoM-2-23)
MoHE	" regarding IT standards…we assigned company as an outsourcing to draw strategic management for IT standards concerning the expansion that we required" (MoHE-22)
MoE	"…yes….we follow a particular framework…called… Oman e-government framework from ITA…" (MoE-33)
MM	"… as strategic plan, we do not have… openly we have got a recommendation from ITA to follow particular IT standards, but it needs a time" (MM-1-19) "…we do not have a particular standard, in reality, or framework… we are planning to get IT standards…we aimed to have ISO certificate…" (MM-2-11)
TB	"…You should not try to adopt or imitate what standards that is in the global or something as a case; this will be good to see […] but standard should be established once the usage should be the first priority. …." (TB-17)

As presented in table 5.11, an official from ITA stated that most of the public and private sectors participate to define, design and study IT standards with the presence of consultants to end up with a framework (ITA-24). Another official from MoE stressed that they are following a particular framework, which is Oman e-government framework, published by ITA (MoE-33). The ITA just recommended the use of their framework to other agencies, but still, some of them need time to follow, as they are currently following ISO standards (MoM-1-22). In contrast, MoHE used to assign a company as outsource to design IT standards for them (MoHE-22). While MM is trying to get ISO certificate, they do not have the intention to follow the ITA's standards, although they already have been recommended for that (MM-2-11; MM-1-19). However, an official from TB stated that it is not necessary to follow the standards as much as to ensure the ability to be used (TB-17).

Discussion: The government moves towards standardizations in its technical architecture, and ITA signed a contract with the Info-communications Development Authority (IDA), Singapore, and with the presence of other public and private sectors to study, review, and then to publish common government standards, namely Oman e-Governance Framework (OeGF) (ameinfo, 2009; ITA-24). That has been supported by TB which commented that other parties should be involved in developing the framework to avoid the gaps between IT standards, which would be fixed, and the technical expertise (TB-17). This is not just because they are international standards that they should be deployed, but because one has to take into consideration who will cooperate to activate these IT standards to attain the adoption.

This framework is a set of best practices and process management systems improving e-government services and is to shift toward accomplishing automated services through e-services integration. This framework also implies the regulation and actions that keep the government projects sustained, provide IT value assurance, provide framework for reducing and controlling of IT risks, and design better IT standards (ITA, 2011). So the purpose of this architecture is to direct the selection as principles; use and operation of technologies as strategies that are needed to enhance business requirements and delivery of services (ameinfo, 2009). One of OeGF components is Technical Reference Model (TRM) which defines IT and their relevant technical standards to facilitate sufficient system integration, effective management as well as interoperability between all government agencies (ITA, 2011). TRM contains information and standards concerning Data Center, Network, Platform (Hardware & Software), service integration, and service access. Then, the next step is the role of ministries and other agencies to comply with the standards (ITA-24).

An official from MoE mentioned that they are following particular IT standards called Oman e-government Infrastructure Framework from ITA (MoE-33). Also, officials from MM articulated that they are trying to adopt the ITA's IT standards to follow the framework, but till now they do not have any practical steps to manage the IT standards (MM-1-19; MM-2-11).

On the other hand, some respondents stated that they do not have to care about that as they are outsourcing the whole processes (MoHE-22). The reason regarding the managing of IT standard by outsourcing as an initial start is to get more experience and best practice from others. Then the management of IT standards will be controlled by the organization itself. Also, manage it according to their own requirements, so that they achieve the benefit of e-government adoption. Moreover, an official from MoM remarked that they are following ISO as international standards to manage the IT standards.

5.4.8. External pressure of IT standards management

Throughout all interviews, we found that some external pressures have been mentioned which the interviewees thought might be affecting the management of IT standard as a factor affecting the adoption of e-government, although it's not related to the IT standard technically, but at least these external pressures would influence the adoption. The table 5.12 shows the interviewees' responses, as follows:

Table 5.12: Participants' opinion about the External pressure of IT standards' management

Agency	External Pressure of IT Standards' Management
ITA	" the ministries can not communicate with us or between themselves in the integration without following our standards" (ITA-26)
MoM	"[…] So external forces nothing but pattern rights law […] which is forcing us to comply with IT standard […]" (MoM-1-23). "With all over the awareness …it would be an obstacle" (MoM-2-24).
MoHE	"…Nothing right now, but if we suppose, it would be financial issues" (MoHE-25)
MoE	"No so far, no there is no such force […]" (MoE-1-22).
MM	"[…] changing some of the regulations or more additional procedures…so it may affect the IT standards…we did not see any external but almost internal pressures […]" (MM-2-13).
TB	" […] Wither applications or hardware, anything related to that, they will have a time period, like a said, in 2010, what infrastructure, what software, in 2013 it might be outdated, you might have ordinary service, now you will talk about blade service, tomorrow we don't know what we will go to talk about […]" (TB-20).

As presented in table 5.12, interviewees' responses differ from each other concerning the external pressures that influence the management of IT standards as a factor. An official from ITA stated that in order for ministries to communicate with each other in the integration stage, they should follow the ITA standards (ITA-26). So, the ministries should take this into consideration before complying with standards other than ITA, otherwise it will cause a problem once they come to the integration stage to comply with ITA's standards. Based on an official from MoHE, external pressures are represented by financial issues to implement such standards in the organization (MoHE-25). Also, changing some rules and procedures in the government may affect standards that the agency is used to, somehow (MM-2-13). Moreover, an official from TB mentioned that changing technologies and IT development maybe one of the external pressures which influence the management of IT standards. However, as an official from MoE stated, nothing right now can be considered as pressure to manage IT standards.

Discussion: An official from ITA noticed that the external pressures of managing IT standards according to the agencies' project is that, once the agencies come to integrate the services and start communicating with each other, they should make their system interoperable with others'. In that case, they have to follow ITA standards to make it work properly (ITA-26). Also, based on Hosni and Khalil (2004); and Sharma (2000), the changing of regulations, procedures, and law are represented as external pressures (MoM-1-23; MM-2-13). Keeping pace with this issue, along with IT developments, would be a restriction for the agencies to easily manage IT standards within their projects for a long-term.

Alternatively, other official interviewees confirmed that there is no such external pressure on the IT standards based on their points of view, due to not facing any problem when they comply with particular IT standards. And that is supported by MM which clearly stated that

there is no such external pressures, but it could be internal (MM-2-13; MoHE-25; MoM-2-24).

5.5. New factors

Table 5.13 shows the results of discussing an additional factor to the previous four factors with research interviewees:

Table 5.13: Results of discussing an additional factor

Agency	Is there any technical factor that you would like to add to this list?
ITA	"No, those four factors only which I am sure about [...]" (ITA-14)
MoM	"[...] fifth one which you missed out is IT governance [...]" (MoM-1-6)
MoHE	"There is no author technical factors […]" (MoHE-12)
MoE	" […] citizens' awareness about how to use the technology […]" (MoE-20) " […] In sometimes they do not use our service because they do not know how to use it which impact our project in the Ministry of Education […]" (MoE-21) " […] there is must be long learning programs that educate citizens how to use our e-services […]" (MoE-21)
MM	" […] only regarding the technical skills of the citizens […]" (MM-1-10) "[…] you may create an application and because they do not have the right skills. Unfortunately, nobody will use it." (MM-1-10)
TB	------

After showing our list of technical factors prepared from the literature to the interviewees, we asked them to suggest a new additional factor. An official from the Ministry of Manpower thought that the IT governance was an important technical factor that must be the fifth factor in our list (MoM-1-7). Moreover, officials from the Ministry of Education and Muscat Municipality confirmed that they are suffering from lack of skills from citizens about how to use the technology, because both those projects are dealing with large numbers of citizens (MM-1-10; MM-1-10; MoE-20; MoE-21). Therefore, they talked about learning programs that train citizens about the ways of using government e-services to improve their technical skills (MM-1-10; MoE-21). On the other hand, an official from ITA was sure that those four factors were the only technical factors affecting the adoption of e-government (ITA-14).

Discussion: Our topic is obviously focusing on the technical factors which are affecting the adoption of e-government from an organizational perspective. But we found that one of the interviewees mentioned that the IT governance is one of those factors (MoM-1-7). Though, IT governance is considered to be as an IT strategy to achieve organization goals (Guldentops, 2003; ITGI, 2001; Peterson, 2003; Duffy, 2002). Governance is putting structure around how organizations align IT strategy with business strategy, ensuring that organizations stay on track to achieve their strategies and goals, and implementing good ways to measure IT performance (Guldentops, 2003; ITGI,2001). Moreover, two of the interviewees have mentioned citizens' awareness concerning how to use the technology (MoE-20; MoE-21;

MM-1-10). Therefore, even though, this is not related to our research scope which focuses on organizational management perspective of e-government projects, but we found that these two more factors which are non-technical (IT Governance and citizens' awareness) could work parallel with the four technical factors. In a matter that, through IT governance, risks can be introduced earlier in order to either avoid them or think for a proper solution to the problems or barriers that might appear within the technical issues. Moreover throughout learning programs which are provided to citizens, the citizens would be educated about the ways of using government e-services so that to improve their technical skills and heighten their awareness as well. So IT Governance and citizens' awareness need to be exist to assist functioning aforementioned four technical factors, which in turn affect the adoption of e-government.

6. Conclusion and Future Research

In our thesis we conclude that in order to have a successful e-government adoption in general, or a specific e-government project, the government must understand the importance of different factors affecting the e-government adoption in order to avoid the failure of e-government adoption in their current e-government projects or future projects. To know the major key factors will lead to a successful e-government adoption. Governments prefer to share their experience with different governments as well as getting different e-government experiences and practices to accelerate the e-government adoption. By sharing experiences, governments will learn from each other to hasten the development process.

Based on our research questions in section 1.3, in this chapter we aim to answer those questions as concluded from previous chapters:

❖ **What are the technical factors affecting the e-government adoption in Oman?**

Our study has identified four main technical factors affecting the adoption of e-government which are collected from different publications and validate them throughout the studied cases. Then two non-technical factors have been found from these cases as well which necessitate in order to function these four technical factors as it should be.

- Four Technical Factors:
  - IT Infrastructure
  - IT Security
  - IT Standards
  - Technical expertise
- Two Non-Technical Factors:
  - IT Governance.
  - Citizens' awareness.

Those factors have been studied in a real case to ascertain their role in the adoption process of e-government. The study has shown that those factors are affecting the current projects of e-government in Oman at its current e-government stages, all of the studied six establishments were influenced by those four technical factors, in addition to the two non-technical factors, but with a different impact order (See tables 5.1, 5.4, 5.7, 5.10).

♦ **How important is a certain factor?**

All the factors were important but each one has a different level of significance which depends on its impact on the offering of e-service and the need to solve the complexity of that factor. Therefore, we found different views for each of the government establishments. In general, IT infrastructure received the first level of significance in five e-government units out of six based on interviewees opinions in table 5.1, which means it is the most important factor that needs to be considered at this stage of e-government in order to improve its e-services. From our findings in table 5.7 also, we can say that IT Expertise is the second factor of

importance in managing e-government projects as five out of six managers said it is level two of importance, or higher. The third factor is IT security, which got level three in importance in four government projects as shown in table 5.4. However from interviewees opinions in table 5.10, we cannot say the fourth factor is IT Standards because it got equal balance between different projects, three of the managers said it was level three and three said it was level four, therefore this factor could be similar in importance as IT security, or less, so it is in level three or four.

- **How could a factor be managed?**

The success of the adoption of e-government is associated with the extent of good management of these technical factors within e-services projects, which in turn affect the adoption of e-government. Base on the literatures review of technical factors' management and the empirical data that we found along with the discussion, we reached to couple of ways as management of these technical factors. Firstly, and most importantly, one of these managements is the existence of a central coordinator agency with the authority to supervise - if not to control - the initiative of e-government adoption. Secondly, decentralized implementation of e-government services by the organizations, individually would be sufficient, since the importance of each factor differs among the agencies, or e-services projects. Thirdly, it is critical to have a reflection of the good ways and process management system as a framework to be used as guideline for all practices that focus on the technical factors affecting the adoption of e-government. Furthermore, some other management can be summed up for each factor separately from our finding and discussion of the empirical data.

As to be concluded that, in order to manage the ICT infrastructure factor, it requires having National Data Center with high readiness, Official e-government Services Portal, Call Canter to assist Portal visitors and users of e-government services, Consultancy services to governmental agencies for e-services projects, Unified Government Network to allow the interconnectivity between government agencies, and E-payment Gateway to assist secure e-payment processes for payment transactions. Also, by having centres which are responsible of all security issues from implementing proper instruments to diffuse the awareness of security, so that IT security can be handled and directed properly. Moreover, the designing of well-formed framework that goes along with interoperability of agencies' systems, in order to attain the IT Standards. As a last factor, technical expertise can be managed by continuous training and by gaining more experience through pioneers or consultancy offices.

- **Is the management of a factor affected by external pressures? If any, what are they?**

The ministries management can be affected by external pressures are considered as outdoor elements that can be derived from governmental policies, legislation, trade agreements, industry associations, competitors, local communities and the media (Hosni & Khalil, 2004; Sharma, 2000). Our general findings regarding the external pressures which may affect the organization management of those factors can be summarized as follows:

1. ICT Infrastructure
    - Government financial regulations

- Internet facility in the country

2. IT Security
    - Ggovernment IT security regulations
    - Citizens security awareness

3. IT Standards
    - Changing of regulation, procedures, and following pattern rights law
    - Keeping pace with IT developments.

4. Technical expertise
    - Government rules and regulation of employing IT expertise
    - Private sector offers to the IT experts

Generally speaking, government regulations could be influenced by the flexibility of e-government project management of all of those factors. Moreover, citizens' awareness about security issues could be a large external challenge for managing the security of online services. At the end, both telecommunications infrastructure, private sector offers to the IT expertise and IT developments also could be used as external pressures for such government initiatives.

Future Research:

This research could be an introduction to future research that may evaluate the effects of each factor on each e-government adoption stage, since each factor may have different impacts in each organizational adoption of e-government stages. Moreover, citizens based analysis in the adoption and dissemination of e-government is beyond the scope of this study. Some remarks gathered from interviews indicated there may well be potential effects of citizens' awareness about the use of technology in the adoption of e-government. Therefore, the future research of technical factors affecting the e-government adoption could include not only organizational adoption of e-government but also the individual adoption perspective.

Finally, this study involves only one country, which makes its generalizability appear limited, therefore the future research may involve other countries which are in different e-government stages than Oman to test the results of such impact of technical factors in the adoption of e-governments.

Appendixes:

Appendix A - Letters to the e-government projects authorities (English version)

Dear Mr. (Name of the person)

(Authority place)

Subject: Interview request

Date: ( )

We would like to ask you for a permission to conduct an interview regarding your successful e-government project (Name of the project). We need it for our qualitative research thesis as part of our Master Degree in Information Systems at Lund University.

The questions will be about the technical factors affecting the adoption of e-government, kindly recommends the right concerned person to discuss this topic; we need an IT expert who can answer our questions regarding the following:

- Background of your E-government project (Name of the project)
- E-government adoption speed
- Technical factors
- How to manage the technical factors
- Management plans for technical factors
- External pressures of the technical factor

Our qualitative research will be a beneficial work to all government authorities in Oman currently dealing or willing to deal with the e-government.

Kindly inform us about the right IT expert person to interview and when the suitable time to conduct the interview at (phone number).

Best regards,

Yaqoob Al-Rahbi (Nizwa University)

Sulieman Al-Harasi (Nizwa University)

Sami Al-Wahaibi (Sultan Qaboos University)

Appendix B – Interview guide (English version)

Interview method: Time/Date:

Opening questions:

1. Name:
2. Minister Name:
3. What is your working position? And since when you have been working in this ministry?
4. Do you want your answers to be treated confidentially?

E-government adoption:

5. Could you please give us a background about the e-government project in your organization and since when did the ministry adopt the e-government?
6. What is your opinion about the adoption speed of e-government in your organization and in Oman in general?

Technical factors affecting the adoption of e-government:

7. What is your opinion about the technical factors which affect the adoption of e-government projects?
8. What the degree which you will give those factors in your planning?
9. Which factor of the following technical factors has applied the most challenges to your organization? Could you explain why?

    - ICT Infrastructure (Internet, network, data center)
    - IT security
    - IT standards
    - Technical expertise

10. What about other factors do you think they are influence the adoption of such electronic system? Can you reorder them for us from the most to the least important or the one which does not related?
11. Is there any technical factor that you would like to add to this list? How this factor influences the adoption of the e-government and how do you plan to manage it?

The management of a factor:

12. What is your plan to manage the technical factor ICT infrastructure (Internet, network, data center?
    - Is the management of this factor affected by external pressures or limitations, e.g. public policies or the level of technical skills of the public; and so on? If yes, what are those external pressures?

13. What is your plan to manage the technical factor IT security?
    - Is the management of this factor affected by external pressures or limitations? What are they?

14. What is your plan to manage the technical factor IT standards?
    - Is the management of this factor affected by external pressures or limitations? What are they?

15. What is your plan to manage the technical factor technical expertise?
    - Is the management of this factor affected by external pressures or limitations? What are they?

16. What is your plan to manage the technical factor (additional factor if any)?
    - Is the management of this factor affected by external pressures or limitations? If yes, could you explain more?

Closing questions:

17. Would you like to add anything more?
18. Could we use your name in our thesis?
19. Could we send our interview transcription to your E-mail for checking?
20. Could we contact you for a follow-up questions and how we can contact you?

Appendix C – Interview protocols

Interview	TB
Government authority	Tender Board
e-government project	e-tendering
Interviewee position	Project Manager
Interviewee name:	Mr. Deepak Moka
Date:	2012/04/14
Time duration:	54:05

Area coding

Code	Area
P.I	Project Information
A.S	Adoption speed
O.F	Ordering Factors
N.F	New factors
M.Infr	Managing ICT Infrastructure
M.Sec	Managing Security
M.Sta	Managing IT Standard
M.Exp	Managing Technical Expertise
E.P.Infr	External Pressure affect ICT Infrastructure
E.P.Sec	External Pressure affect security
E.P.Sta	External Pressure affect IT standards
E.P.Exp	External Pressure affect

Index	Theme	Transcript
TB-1	P.I	We: Mr. Deepak, thank you so much for giving us this chance to conduct the interview with you, as you know we are students form Lund University, we are conducting interview for our master thesis and our topic is about the technical factors affecting the adoption of e-government. First of all we would like you to give us a background about this project, and tell us when the initial start of it took place". MR. DEEPAK: This project is part of an e-governance initiative by the Sultanate and was initiated in 2006 by a tender board, after an international tender, and it was finalized in 2008, on September 15th , so after that the project started on11th November 2008. This project is basically to meet the needs of all ministries including tender board, to streamline the processes, to implement the processes, maintain the flexibility given flexibility to ministry users on the usage of the system, so that everything is in an organized manner and any incrimination of policy procedures is incriminated in central way. Until now there is no central plate form governing or linking all ministries for this tendering purpose, so comment on that, it is the right time to initiate this process, where is we are this electronic tendering and electronic procurements under the e-government has been initiated in the other parts of the countries, in other countries around more than 10 years back, so what happen this project is having 3 faces, there are five ministries identify, big ministries like ministry of Health, Education, housing, ITA and Tender board. So these ministries are suppose to do a pilot study of these ministries to find the requirement and develop the application accordingly and get them used that one and then to be flowed by the 15 ministries and then follow the operation, maintains face so total the project is five years, two years is in the study and three years is for the operations. This is how the project starts. The scope of the project, coming to scope of project, start from tender creation, so when the tender document is ready after the internal approval and all, then the documents are created in the online web service and it is posted in the portal the companies go to their

		respective login, view there tender and make an online payment to purchase the tender document and then they processed for the bit submission electronically, there is no manually interaction or anything. If they want any quires or generation everything is done electronically to interfacing with the ministries and companies. So after the biding process completed, after the submission they need not come to ministry or tender board. Online tracking is there, they can see the opening of their bits and their completed as per the procedure and policies and they can followed with the ministry accordingly as a plan of provision, all this data exchange file management is handled electorally and system gives you a track where the files are, with whom, which user also it give the top management to review the files suppose it is stack with one person or to avoid the delays, they can relocate this file to someone else to speed enough this process. So like that it faster the system and complete monitoring, electronic monitoring at each point, each every day, each second, where it is, with whom it is, so what action been done and already track is there. So what comments are been raised, what is the clarification, if there is there in one snap shot, in the onMoE-click of button. That is the advantage and putty of this system. Another specific feature is like as a said earlier, they integrated with online payment, so there is cash less transactions, early they used, people used to come to the tender board or ministry to purchase the tender document, pay the money, so this is wasting in coming all the way and they have to bring the stationary, keep one resource engaged, so all this thing eliminated. Completed it is there from anywhere in the world, no need to come in person to submit and put the tenders in the tender box along queue waiting, the tension, there could be delay in the flight, all this things exclusive. So everything gives a total flexibility to both parties of the system, to the ministry users as well as to the companies, and one more thing is this frequent visits to the ministries, the company we see normally they come for one tender, they come for 10 times, the concern person might not be there. Again the keep on lot of wasting the time of the ministry resource as well as their valuable time. So when they post any clarification or anything, we have given interactive online communication tools. So that both the companies and the ministries can interact, to be, clarified their doubts for small things even if there is clarification or anything and one more thing for each an action whether the person involved or not for him if purchase sometime the document alerts, MoE-mail alerts will be triggered, so that he is aware that some changes have been done in the tender, so carried out, the companies are alerted on this changes. He cannot told that he is not aware of that, so that the system is automatically triggering that. There is also SMS integrations for this, SMS alerts will go to him, some changes, and modification triggering that. For this varius stage of the tender. Or the tender has been awarded. Actions or whatever action that are happing back to the companies, so this one. Another benefits about this, whether bidders do a profiling, until now there is no tender related or the work experience related, central system available, database available. This is not a plain system for registering like just give a contact details, it is not like that. This MoE-tendering system covers as a contracted database information system, CDBIS, so complete information of the vendor company from day one what is work experience, how many persons are there, what is the Omanization rate, everything is tracked in the database while registering in the system. There is two year validity, every two years he has to update his profile, or additional information, that is required. One more advantage of this, there is documents storage files, allocated for each company, each company has 20MB space for a regular documents, like when he wants to bid for a tender. Manually, have to take whole set of documents, make three copies manually and each time to the ministries. If you see realistically, the information which is provided by companies is so huge or expensive might be, which it is totally diverted from the core element which is required in assessing the companies eligibility. If I ask for a profit in last statement, they give you whole annual report, which is required for the ministry to do an assessment of the company, they need one single sheet which is signed, auditor sheet, which is show the profit and balance account. For that they send us 600 pages document and give it to the ministry, so like that, what we accept is, this system will stream line, what is the required information and what the buyer can provide against that, so it will reduce the evaluation time. Secondly, the evaluation, we have given a dynamic comparison tool, like suppose one company submitting one price, now manually, they have to open each price bids, have to make summary on that, they have to repair excel sheet on that one manually, whole time have to work on that one and then recheck wither the values are proper, then they

		have to submit to the higher management for decision. So suppose the higher management they want a specific report in a specific field, like suppose for example, one A item is there ABCD are the taxes, landed cost is the final value, they want only the landed cost, again the exercise run again, bid come back to us, manually again they have to prepare one more excel sheet or report, again they have only to prepare the landed cost and as per the requirements they have to prepare, all these things are eliminated. Completely there is a dynamic tools, where they can select the fields and parameters which they would like to generate a report for them apart from the graphical representations. Another putty of that report is the online tracking. Like the companies, suppose it is awarded toady, immediately the report is updated on run time, not in the end of the day. So suppose the company X is having more work, even that gives an opportunity for the decision comity or board to see whiter this tender could be awarded to them, they have the time or recourses to spare for this project and they can make a suitable decision if there is a time and commitment is there to awarded to other companies also, so those type of how much their success ratio, how much they participated, what tender they participated, everything is tracked completely. This is a integrated sysem, since all ministries which will be using for internal tenders and even the tender board, so there will be one stop shop for the tenders across sultanate. This is a national project and I think defiantly this going to changed the way how we do tendering right now, this is about the project. And coming to security and other things about this project, it is highly secured project, it is having a PK integrated and digital certificates complied applications, but since digital certificate are not there in Oman, right now they are establishing a setup for that it will be incorporated.
TB-2	A.S	We: Mr. Deepak, now what do you think about the adoption of this project, what scale you will give it? MR. DEEPAK: it is slow, but it is doing studly, because there is so much of work is there, the changed impact is much in this project, because first, technical everyone used to paper work, now mindset should be there, it is going electronic. You see less paper, less document everywhere, so you have to get people use electronic way of communicating, electronic way of doing business on their daily work, that is one big changed in the mindset. Second thing, is policy and procedures that have to be done properly, because this is all electronic transactions. Third thing is about the convenience, people have to get used to this, we have to educate lot of participants apart from ministry users, company also have to get adopted to this way of doing thing, because last 30 years we are doing the same manner. Now this is a changed management coming. When you are walking and giving a lexus car, you have to get familiar with you driving, you have to find where the gear is, where the accelerator, so it will take time for the common person to adjust to this thing, we expecting slow progress but we are expecting studly progress on this.
TB-3		We: what about e-government in Oman in general, what do you think of it MR. DEEPAK: e-government initiative focus is very much nowadays a lot of projects are there, the e-government initiative, hope that everything will be successful.
TB-4	A.S	We: what scale will you give it? MR. DEEPAK: it is slow
TB-5	O.F	We: If we talk about the four technical factors we have in this interview, we have infrastructure which consists of Internet, network and data-center. Another technical factor is IT security. A third one is IT standards and the final one is Technical expertise. Now if we ask to order this, which one would you give the first priority, or say is the most important technical factor? MR. DEEPAK: first thing I will be giving you is infrastructure, because without infrastructure we cannot do anything. Second is technical expertise, third is IT security and fourth is the IT standards
TB-6	O.F	We: now if we ask why you chose ICT infrastructure as the most important one. MR. DEEPAK: we have resources or we can outsource resources, now we now that in Oman we can get or expatriate or domain experts from other countries and we can do that, but to do the work we should have a proper infrastructure at least for them to get it done. If not internal, through externally to make it done, we have to have infrastructure setup to start off. That we be the first preference for me, without infrastructure even if you have resource whiter it is internal or external, it doesn't mater to us, it doesn't add value to us. Secondly, having infrastructure it give the sense of accountability and commitment to go forwarded, so we have invested capital, no automatically that will trigger the

		continues process of identifying the resource, improving the resources and other related activates on that one. That I feel strongly the first preference should be the infrastructure. Even if you have qualified people here, resource or from outside, they are not able to work if proper infrastructure is not there. Second thing is IT expertise, like we have now in Oman lot of youngsters are there who are IT professional and other professionals, when I go to ITA seeing a lot youngsters, not only youngsters, there is a changed coming to all the persons, I found in tender board one person, senior around 45 years old, he is going to computer class to learn, that set the curiosity, what is this, ages no bar, this expertise, this technical thing is not a big thing we are demanding they should now simple operation of a system and web applications. That I think we are achieving, we are doing the progress as far as Oman channels are concern and I think that should be the second point, because after having infrastructure I don't have people to work, and what is the point in investing in that one, so I rate the It expertise as second point. Third point is the IT security. After these two thing are established, next come the concern, I do a transaction, like a common basic common man, when I do electronic transactions like a payment, I am really worried whither my transaction is securely done, I don't now whether my bids are secured, whether my offered are secured, so I rate this as a third thing, because first functionally application should work, then we whether we want to lock the door with 2 keys, 5 locks, 10 locks. Then the security handle come. First infrastructure then people in that, then security part. Then coming to the IT standards, standards are iterative. One day, today we have ISO-9000, tomorrow we have ISO-12000, ISO- 27000 it keeps on, there is no upper limit for the standards as such. In 2001 we have one standards which may be void in 2005. In 2005 what the establishment has a standards will be sub standards when we move on to 2010. So theses are iterated annually or yearly or a period of time, these are benchmarks fixed by man for a quality iteration, so I find that it will be the last priority.
TB-7	M.Infr	We: we will move to management of each technical factor, if we talk about the most important one which is the ICT infrastructure, how you manage it and also what external pressures and difficulties? MR. DEEPAK: as far as infrastructure is concern, we don't have right now any major issues or technical issues as such. Because we are maintaining our things in the national datacenter, so that the national datacenter is hosting all the servers and MoE-governance projects, it is under the governance of ITA and it is managed in a third party location. So that way it is not a problem, I don't find any major problem in the infrastructure, that is one part it, establishing the project hardware, when it is coming to users, like end-user of the application, we need basically Internet and a computer. So I think that in Oman it is not a difficult thing, I think it is an affordable price are there and this is basic equipment. Because in school curriculum also, I think this computer is included. And every house hold, is having one computer and Internet, I am not leaving apart the mobile Internet and other things also available very free, only the cost is slightly expensive, that will come down as per usage cross. That's the global trend happing, so I find that infrastructure wise, we are ready, Oman is ready.
TB-8	M.Infr	We: so is that like strategic plan to manage this technical factor, the infrastructure? MR. DEEPAK: for my project, everything is handled proper plan, hardware it is already it has finalized, taking into account the next 5 years, how many users, the growth and other things, factoring all these point, everything is design and planed in that manner.
TB-9	M.Infr	We: so for the infrastructure, it is rely on the government, like the ITA MR. DEEPAK: no, infrastructure, actually this project belongs to the Tender Board, the contract itself, infrastructure is one part, hardware is one part, software is the other part. Hardware already discussed with technical members from all the participants, their forcing plan and executed in proper manner, what equipments should be there. Only it is hosted in the National Datacenter because of the Internet connectivity and continuity of the service, it has to be put in a datacenter, which is available there in the National Datacenter.
TB-10		We: do you face any external pressures in the management of this factor? MR. DEEPAK: small issues are there, small issues in the sense like sometimes

	E.P.Infr	the planning, multiple participant there, now there are giving for management of that data to one party, Omantel is handling the Internet connection, so every start up or every change we have this miner issues not major issues, by time it will be a better planning.
TB-11	M.Exp	We: if we move to the second one, which you chose the technical expertise, how you mange it, and what is the external pressures or difficulties MR. DEEPAK: for technical expertise, first I have a challenge is to train my team, we have taking youngsters from Oman, continually we have in-house training, they have to be sure to give support to others. So that was a challenge to us, because it is a planned project, we had giving them various cases, what experience, and what are their comments which we carry to others, we chat with them, made them to understand what will be the likely case could occur and what are the challenges that could be face and how to handle it. For example, I will give you one small example, like suppose one person calling from Salalah or some other inertial region, where he might have the Internet and a computer but he might not be aware of the application, either he come in person here or, so how we will give support to him. At least we can take them by the team viewer, using technicalities, like using the team viewer sessions we can guide them how to do this. Secondly, he can download, we have put the training kits in the form of screen, not a written text, so the end-user will relate to him in the process with graphical representations, what the next and so on. We adopted this strategy to overcome this thing, we have not put like just one document and you read it to interpret what words, steps, it is not like that. Every screen wise, what steps and what is the explanation they have to do, it is graphical representation, so make it easier, then we are using team viewer session to help them, guide them, suppose he cannot come in person. Apart from that, suppose the 4th grade or 3rd grade category, contractures are there, how are weaker, they don't have a huge business establishment like exalt or 1st grade, so for those type of people we ask them if they need our support, they will come in person. So make them, help them, we educate them, parallel we make them learn their work also. It is two, like hand holding, not specific linking each individual like you are coming with you documents, you guide them, register them, guide them how to do their work, make them set with us, so that we don't do their work. So we educated them together and this result will come later, we have to wait. Always as we say that the policies, need is the mother of invention. And until his tender is there, or unless you make it necessary, you will not get certificate unless you write this exam, you will write, otherwise you will not write. So same thing it is driving by that, so hopefully this change will come faster.
TB-12	E.P.Exp	We: Is there any external pressures in the management of this factor? MR. DEEPAK: when we go to ministries, there will be not be some infrastructure related like bandwidth is less, or Wi-Fi connection, but in Oman, the ministries wise coming faster. Lot of infrastructure has been provide, sufficient infrastructure is provide, funds are there, new technology is there and government is also helping the ministries in giving the training, providing them a products of windows or latest OS and other thing also.
TB-13		We: what about the IT people who suppose to take care of this project, do you have difficulties MR. DEEPAK: I don't find difficulties, I find everyone is corporative and very friendly, as I told you, ITA is a consultant for this project and the team or who is involved their they are very corporative and friendly
TB-14		We: we meat a view project, the successful e-government project in Oman, Tender Board is one of the successful project, they told us when they hiring IT expertise after sometime they will leave towered the private sector. MR. DEEPAK: here we don't have that issue, as I told, this project done by expertise in India, who is having 10 years experience. We won UNBS award, we won the second GCC award also. So what happen, the core management team, the top management team, the expertise is carried by this people. This is a small team, it is in a pyramid level, the base level, the help disk, second level, middle level totally managed by Omani, local people with local talent. So defiantly all the time what happens, iteration is the correct term, like people leaving after learning or something. Till now, this issue does not happen, and hopefully we retain that people.
TB-15	M.Sec	We: if we move to the third technical factor, IT security, how do you manage it? MR. DEEPAK: Yeah, as I told you, this project is already established project in full operation, where the people make an assessment of this and they have adopted

		it. So IT security, there is no compromise in this, Internet transaction security is main point. Like I have the Internet, I do the application and I have the application but what about how security, like when I do online payment or when I submit my transaction it should be secured. Otherwise the end-user will not be confident or will not use the system. It is a private thing. Even the datacenter is totally hosted, in the National Datacenter, the transactions are completely encrypted. Even the online payments, that is done by the ITA MoE-payment portal, that's a common portal and whenever they submit their tenders or offers we do a client side encryption and data comes and stored in the database. So even the service provider if he wishes to see the date, they cannot see the data. Only after the tender is open, bits are open then this data is decrypted by the person who is assigned to the decryption. This is the same car lock and key system. So we are further taking it to the next level with the introduction digital certificates, so the security as such is, we can say, we are on part with a global standard.
TB-16	E.P.Sec	We: so there is no external pressure to manage the IT security MR. DEEPAK: No, there is no pressures, when we have is audits will be there conduct periodic audit, that a government appointed the team, and this project is already by a third party, that everything has been tidying up, everything will be scrutinize well. Then we only open it for the public. Because of the customized solution periodic audit will keep on happening.
TB-17	M.Sta	We: we will move to the last technical factor which is the IT stands, what is your management plan to deal with the IT standards MR. DEEPAK: I kept the infrastructure ready, I kept the application ready, now resources are ready, now how do you benchmark this standards, first our goal and objective in Oman case scenario people should use the system. That should be the first target, if you keep the benchmark level high, and if you said this standards or that standards. The standards are established by the users. You should not try to adopt or imitate what standards that is in the global or something as a case; this will be good to see. I am not saying the standards should not be there, but standards should be established once the usage should be the first priority. Once people start using the system then it gives us the freedom to fix the standards, it should be done in a face manner. The mistake, what I feel now is happing in Oman is we fix the standards and the gap between the standards and technical expertise is very huge, it should be bridged. We are focusing on standards because of international standards, but first our users are new, and users are not text heavy, you cannot educate them across the table, it needs time for them to learn the experience and get that expert, it has to be acquired and acquiring takes time. When they are ready, then you benchmark him, okay, you fix 35 marks. 35% as a pass and let them achieve that, then you fix 50, then you fix 70. That should be the standards that should be how the standards is defined. It is like a baby, it has to grow. That evolution will has to decide the standards in a face manner. It should not be like I had benchmark this one and everything you comply with this, where they will go. For example, I will tell you a practical example, there are digital certificates, because it is like a token that is given, digital certificate stored there, if you straight day one you say you have to use digital certificate you have do to encryption, decryption , if you talk to a common man, he cannot relate that. Standard should be established in relation to the user, only then it will be successful. AC is not working but you are enforced to wear a tie, means you will suffer, so the standards that AC should be working properly, only then you are insist on wearing a tie, so this is my opinion, this my personal thing.
TB-18	M.Sta	We: what about the government side or the ITA MR. DEEPAK: government side, every standards is there, all the standards are there in books and they are trying to implement in some projects but what again I would like to tell each project is evolving one period of time with different requirements, now what they are trying to do is to bring them in one basket
TB-19		We: as an open IT standards MR. DEEPAK: yeah, they have some technical IT standards, everything is established, even ITA is new baby, only from last 4 year it is active thing, early we don't have anything, so the project, all the project which is out of their domain, they try to bring it under one thing, there are some conflicts, conflicts in established standards, because each system it is having it is own benchmarking standards established. If you bring it to the system, you have some five pre requirements then I will not come to the system, so these type of issues are there, which I think hopefully they will realize it and sort it out.
TB-		We: so basically the ITA, will not like enforce or required your project to use a

20	M.Sta	specific standards MR. DEEPAK: yeah, there has been some conflict like suppose there is one CIS portal, CIS, central information security some big project, they want very ambitious that all traffic between the ministries and every traffic should be encrypted, not to be a plain traffic, but that is a very big project which has to be done over time, but you cannot do it with a benchmark millstone within a time period, because there are a lot of issues on participants, a ministry portal should be ready with their equipment, infrastructure should be in their proper thing, because it is for different time period. In IT, this time period make lot of difference. Wither applications or hardware, anything related to that, they will have a time period, like a said, in 2010, what infrastructure, what software, in 2013 it might be outdated, you might have ordinary service, now you will talk about blade service, tomorrow we don't know what we will go to talk about. First have a common point, select a minimum, suppose there are 10 parameters that have to be required to full feel to complete it, let's start with one, two, then that strategy has to be evolved based on current practical situation, you should not imbues a strategy, you have to adopt a strategy, that's make a lot of difference. The way we approach to the problem, the strategy has to be adopted, what is best suiting for us, then only this will be a successful. You start to imbues a strategy which is fixed one, that will be rigged. This is how current approach or scenario is like, what I feel.
TB-21		We: since we have four stages in order to implement the e-government, so how we can distribute these factors among these stages, for example the first one is emerging or static and the second one is interaction, the third one is transactional, and the fourth one is integration, how we can distribute these factors among these stages, how much important I mean, the factor number 1 is it important just in stages 1 and 2 and once we go further in stages 3 and 4 we cannot consider it as a successful factor MR. DEEPAK: integration should be the last one, so first you have to group then to see how to integrate, because you will be with full flex systems, with a full flex system then we can see how it has be done. Suppose you are initiating something new it is better to have taking into account all these factors into mind. Like you should have a road map, first a road map, this systems are there are there you have to find which are the critical system, the critical path which are following in line with that, suppose anything coming or anything gap, that those thing should be lined or part with existing established project, not in its own. We have to have a total control or product line. I think the responsibility of ITA and other...
TB-22	M. Infr	We: in your point of view, is the infrastructure is more highly important in stage 1? MR. DEEPAK: see infrastructure, for example, first you should have a vehicle to drive, it is like a vehicle, basic common related to common life, first we need a vehicle to drive, without vehicle a driver cannot drive. So car is like infrastructure, first infrastructure should be there. If the infrastructure there, then it is a liability on us to trained the drivers. Then how to lock your car, because then comes the thought of whiter someone steeling you car will come, wither you want electronic lock you want a manual lock or how you want it or you want totally laser control, sensor, that you will decide, that it second, then comes the standards, like you want to go to which model.
TB-23		We: the last question we would like to ask you if you like to add anything else MR. DEEPAK: I wish you all the best to you guys and I think your research will should be useful you will contributing more to it since you are Omani I think you will understand other aspects of it. I think we are doing very good in Oman, the sultanate actually they initiatives and other thing which is undergoing which I have seen personally, as an expert, I am telling, we are coming from a place where already IT in full chrome, but still we can do much more here, the scope is always there, much advertising, and showing, lunching the e-government project, rather than non-clarity in implementing the project, implementation which is a need for technically we have to make that relate that to a common man. Suppose MoE-Oman is there for example, kiosks is there, other things are there, but how many people are using that, what steps making them to use that. I think more focus should be on how to get it reach to users. Pay utility is open center, in India, we have similar system we call it MoE-saver, MoE-saver mean electronic help, what they do, you can go there, it is a single stop for your electricity bills, like what we have here, we have OIFC, again it is incorporated entity sort of thing, separately the have given, it is a public interest, you can do anything there, you can book your tickets there, you can book your bus ticket, everything in centralized one kiosk, one hub, like a shop, all government utility are listed there, in distance

		places also, because people coming all the way to pay or something, first the role side, we have to take care of that, that type of establish center are there, you charge for it, one transaction you charge 100 Baisa, that is more than enough to operate this center independently. You have to give employment for 2 or 3 people, it creates employment for youngsters, capital has to invested by the government, it will be a fantastic thing, it will be under one thing, and people feel okay to go, now I can see that I can pay my all bills in single point and then you don't go to some other places like ROP, OIFC, Tender Board to pay the fee. Is should be one stop. I don't want run around 10 places, all the revenues of whole Oman going to MOF. We have now open 10-20 collections centers, all the money routed to government to Ministry of Finance, why we don't open this collection center with one stop. We should have something like that in Oman, whatever you do, you spend millions, you spend trillions, whatever you do, ultimately for whom you are spending, it is spending to the common person, that person should relate himself to this advancement of the technology, he should see the benefits, only then we will succeed. I think there are some void there.
TB-24		We: so what about it, do we need to create or build something in order to educate the users and go to this stage MR. DEEPAK: see here we have typical IT problem is, education doesn't come voluntary, or learning doesn't come voluntary, because, that's what I told you the missing link is the relationship, why I should learn, what is the purpose, objective, see for a company he will learn, suppose MoE-tendering, they will learn, because for them do a business, so defiantly even if he doesn't have a people or he doesn't have Internet or he doesn't have a computer, whatever might be, he will see to that he is equipped and has to do it to conduct business that's different, those project drive is there money is there with a contractor, because we are not dealing with individuals, we are delaying with companies, minimum companies able to spend 150 Riyal, he doesn't mind, because a tender board fees accept 200 Riyal, there are willing to spend that much of money, even if he is not having a computer or not having Internet, it doesn't mind, but for individual, why should I spent, why I should learn, there are learning programs, there are education program are there, it is not new in Oman, we are having it for the last 10,15 years we are having that one. There are giving merit, they are giving scholarships, so what is your benefit, you will ask this question as a common man, when I someone says, you please use this, portal, or go to this thing and you can, why I should I go, for this I should go there as well as I can pay here, these are mine block, because you don't find it related, you find it unwanted, this relationship once it is established, this training, everything make sense. Your foot is big, without salt you cannot taste it, the salt is this training, to top it up, to make you complete awareness about this. Training, if I give training after one day you will forget it, it is not like that, you should feel the need. The need should be created for each person and this project which are there, e-government project, should have a segment group, what they want, objective, whom the users, it is not like that public. It should not be a blank gutter to objective, it should be to whom the segment you are targeting, is it fulfilled the objective, these type of stuff they have to review and revaluate themselves and restructure the strategies accordingly, people want to explore this application, like that, give some innovativeness and target what you want to achieve, that's how you can make any project successful, without relating it will keep on going, it should not be that case.

Appendix D – Interview protocols

Interview	MoM-1
Government authority	Ministry of Manpower
e-government project	Manpower
Interviewee position	IT manager security consultant
Interviewee name:	Mr. Rajesh Ramomeni
Date:	2012/04/15
Time duration:	32:17

Area coding

Code	Area
P.I	Project Information
A.S	Adoption speed
O.F	Ordering Factors
N.F	New factors
M.Infr	Managing ICT Infrastructure
M.Sec	Managing Security
M.Sta	Managing IT Standard
M.Exp	Managing Technical Expertise
E.P.Infr	External Pressure affect ICT Infrastructure
E.P.Sec	External Pressure affect security
E.P.Sta	External Pressure affect IT standards
E.P.Exp	External Pressure affect

Index	Theme	Transcript
MoM-1-1		We: Mr. Rajesh we'd like to thank you for giving us this chance to conduct the interview with you, we are students from Lund university which is in Sweden, we are doing master degree, our thesis is about technical factors affecting the adoption of e-government, tell us about your name and your position here. Mr. Rajesh: My name is Rajesh Ramomeni, my work here from last two years and I work as IT manager security consultant
MoM-1-2	P.I	We: so we'd like to start with our first question… please tell us about e-government portal you have with the services and when it was the initial start….. Mr. Rajesh:I joined here actually 2 years before I guess it was started from 2002 they started with the small project identifying where the citizen getting more problem or they are coming crowded out of that, then they started pioneer of automated things. They are started as we are as using kiosk, where the people can go and clarify their doubt on their own and they have automated call log-in so if you have any clarification if you want to know through the agent or anyone you can call them they have the toll-freMoE-number, then they can go and get clarify on their own if they cannot take it, then they can come directly to the ministry and then they can get the clarification, so we are the pioneer of implementing that automated system in Oman, it's the first ministry and they started actually as I understand it from the needs of citizen as well as other agencies like other

		ministries, they might verify the manpower details or something so we provide some secured details for them and we collect our, getting feedback from them and they can use our data at the same time we also use their data for the mutual understanding between the agencies, government agencies, and also we do the services for the business people for example who have sponsors database here so if the taxation department or ministry of finance required data about the sponsor company we give them the details, so we are in the middle of helping the business as well as the citizens as well as other agencies.
MoM-1-3	O.F	We: Okay in our research we found four technical factors the first one is the infrastructure (part of it is Internet, network, datacenter) an other one is IT security the third one is IT standards and the fourth one is technical expertise so from your view of point from your opinion which one you think is the most important technical factor from the fourth. Mr. Rajesh: Of course the infrastructure will be the first, second will be the expertise, third will be the security, and finally is IT standards. Since I'm dealing with security, I will talk about it as one of the most important issues, so I IT security, because without break, (or horn) its harm and you neither can nor drive the car. With those you maybe have luxury vehicle but if you do not have break and horn (its harm) to use on immediate or urgent situation, because the awareness here, its now, we are generating awareness we have created more awareness session to people here and the idea is to helping us in term of secured awareness to the public
MoM-1-4	O.F	We: why do you think the IT security is important factor? Mr. Rajesh: Security is important because network and Internet gives flexibility to us but the flexibility people treated as they are accessing, if you want to connect to the Internet you are at the risk that you need to take an action
MoM-1-5	O.F	We: So which one you think is the second one. Mr. Rajesh: The second one could be the technical expertise, because I very well remember a full with the tool still a fool …. You might be having un-number of security devices and whatever you have but if you do not configure properly or well then you are under the determent.
MoM-1-6	O.F NF	We: the third one? Mr. Rajesh: The third one could be the security and the forth one could be IT standards…and fifth one which you missed out is IT governance
MoM-1-7	NF	We: IT governance…our purpose research is to search about technical factors. Could you explain more about it? Mr. Rajesh: Even technical factors come into IT governance…see…my top management is paying for what they want it…if you are not planning well and if you are not keeping enough data to without management then we are lacking something…they understand something and we are doing something so there is a big gap I see… this IT governance integrate (missed-word)
MoM-1-8		We: Any other factors that you want to add to this other than IT governance? Mr. Rajesh: For me I think that IT governance is missing as I said now.
MoM-1-9	M.Sec	We: Nice Sir we will more search about it, as a new technical factor … shell we discuss about your management of each factor one-by-one, if we talk about IT security, can you tell us more about it? Mr. Rajesh: Because of the external pressure coming on, for example now cyber-law has come and pattern-law has come and they are going to amend intellectual property right very soon and probably the protection or privacy might come in the future, so these are

		external pressures makes every government every entity to getting into IT security.
MoM-1-10	M.Sec	We: Do you think, how do you manage the IT security? Is there like a plan for it? Mr. Rajesh: Yeah, we have a plan, we have a strategic plan, how we are going to handle the e, it starts from user requests to fulfilling the returner, and we are, we are using some other mode like network and Internet for helping the users and our citizens in that way secured connection, secured authentication, secured data transfer and secured storage this all record as adjust tools.
MoM-1-11		We: Is there any difficulties to manage this technical factors as external pressures from outside of your organization? Mr. Rajesh: Can you give any example?
MoM-1-12	E.P.Sec	We: Like for example now you are managing IT security in the ministry, is there any external pressure from outside the ministry? Mr. Rajesh: The external pressure in the sense for example: policies as I told you cyber-law security, we have to complain with it, ITA has developed amended cyber security and pattern-rights and all these policies are amended by royal decree. We have to adhere to the polices and follow what they are saying, and if you not complained then we will be in the lost.
MoM-1-13	E.P.Sec	We: Is there any other difficulties as external…. Mr. Rajesh: External pressure maybe like lack of awareness people might not be aware of what they are doing….that is the main things. Maybe the awareness could be the most important.
MoM-1-14	M.Exp	We: If we move to the second factor: technical expertise, how do you manage it? Mr. Rajesh: Sure we have the strategic plan, they do individual development plan…training development plan for the each individual in the other department, we identify what is the strength and weaknesses and what is the opportunity and threats for them… we do a kind of SWAT analysis and we ensure that each individuals is performing as the aspect level.. If.. if… for example if one person does not possess experience in the programming or…thus he is doing a programming job but he might require more stuff more knowledge on the programming for that we send them for a course and we will see the improvement after coming back from the course we will assign him individual project or some kind of model to verify that he did understood the course well or anything required furthermore. So individual attention is happening also IT conduct more workshop and other stuffs for example seminars and also they invite us and we nominate people who love in that and want people who want and can to be expert so this is how we make the individual performance, so individual performance will help us to satisfy our management objectives and goal
MoM-1-15	E.P.Exp	We: second part of the question what are the external pressure or difficulties in managing IT expertise? Mr. Rajesh: Managing IT expertise is the salary in government they – off now the record – people now they start to compare financial things, they might get a good benefit from the government but they look at in the money so they , they go to the private sector, private concern also private company they are coming up now, whatever the expertise level what they are getting here and they use it for their personal, in the other way, it's good for Oman, people are serving for the country.
MoM-1-16		We: So what do you do to manage this situation, for example that you have the technical expertise working and suddenly they are leaving? Mr. Rajesh: Yes, we have auto of handover and takeover, the person we try to convince

	E.P.Exp	with clear of meeting if it does not apply and work out then we have the handover takeover, he has to handover all the responsibilities and whatever he has to transfer to the other person and then both of people should acknowledge it that whatever the transfer he got it and the person who getting the knowledge he has to accept, and he has to give concern to us. "Yes I have got all what I want".
MoM-1-17	M.Sta	We: The third technical factor that you did select is the infrastructure, how do you manage it , what is your plan to manage it? Mr. Rajesh: Yes, we are aiming to get ITA to complain to the datacenter standards, we are still trying to, so far physically and logically and everything is secured and still we are going to…for more strengthen security on the datacenter network and Internet. For the physical security I do not want to explain the way that you have seen the physical security for that… logical security, it's there.
MoM-1-18	E.P.Infr	We: Is there any external pressures and difficulties in managing that? Mr. Rajesh: External pressure for the keeping the datacenter up and right is, we are providing 24by7 service to the citizens and for the other entity also during the work hours so we have to keep our servers and network equipments up and running
MoM-1-19	E.P.Inf	We: any other difficulties from outside the organization? Mr. Rajesh: The manpower might face the electricity issues, we have alternative for it but sometime it goes beyond our expertise, the alternative that we have is to satisfying for some certain time, but the electricity, in Oman they only have one there is no alternative electricity supply provider…that is the issue.
MoM-1-20	M.Sta	We: The last technical factors that you selected is IT standards, how do you manage it? Mr. Rajesh: Yap… we have standards, the standards come from the best practices…. We also create our own standards on our mode, because we have a good best practice in the team follow and they also invent some other practices here and probably who knows whatever we follow can be given to some other ministries to follow. ITA has come recently they did a survey and they took some of the practices from us to suggest to other ministries
MoM-1-21		We: Is there any difficulties or external pressures for managing IT standards? Mr. Rajesh: There is no such pressure but if you start complain to the standards obviously the performance level will be increased and the management also getting satisfied.
MoM-1-22		We: So for example, from the government side or ITA, are they enforcing for example your ministry to use specific standards or? Mr. Rajesh: No so far, no there is no force from them but being…we are following best practices around here so we get certified for ISO 27000 for the information security management system, and we also get more awards from other well-known agencies
MoM-1-23	E.P.Sta	We: we know that, this is why we are selecting your project Mr. Rajesh: So external forces nothing but pattern rights law and cyber law which are forcing us to complain with IT standards and IT security standards….anything else???...
MoM-1-24		We: what do you think about these four factors, starting from IT infrastructure, security, and so on, how can you distribute these factors among the four stages concerning e-government adoption…for example: the first stage is concerning e-government is emergence, the second one is interaction, the third one is transaction and the forth one is integration… so how would you distribute these factors in such stages? So which one is important in stage number one

		Mr.Rajesh : can you list down the stages.. please
MoM-1-25		We: Integration, transaction, interaction and emergence (static, information for example the static website) Mr. Rajesh: So in that case the infrastructure could be the first one in that case to satisfy your question, the infrastructure would be the first one because then we need to interact and doing transactions and then to integrating with other ministries or integrating with their database or whatever, so the infrastructure is the most required…. For example: first we have to design a car as simple as parts and create the car and then after that the security come, we have to have a break and horn and the seat-belt and whatever for the security…… the third thing is you can name it as any one of the model of the car, you can name it the seat like this wheel size and the window size as well and everything that become as IT standards….. and just putting you to understand and finally the technical expertise. If some problem would occur in the car, you need to have somebody to help you on-time, they should not take the research and development, they should easily troubleshooting what is the exact problem. So the order is as you transfer your question is. … but if you ask me personally without getting the e-government things I will choose start from security….
MoM-1-26		We: What about open source, do you think that this open source will affect the use of It standards for example? Mr. Rajesh: Purely it depends on what you are looking it.. what kind of open source to use
MoM-1-27		We: For example the applications Mr. Rajesh: Still open source does not have intellectual property right, you can use it and you can fire it but nobody would do code review as part of it on that nobody is certifying it…this is authentic open source and you can use it, nobody can come forward to tell this, so according to me, for the ministry, for a good sack, I would not recommend for the open sources… probably for the private concern this is cost-factors involves… if I would like to purchase something the license have to be.. That matters, so private concern they can go for open sources and government to not go for according to me as a security person.. Because nobody does the code review and nobody does the validation part as well.
MoM-1-28		We: And this one fine if it goes with the organization Mr. Rajesh: Even within the organization when they connect the network automatically something goes and nobody authenticate and nobody says that this is a secured application… so that where we have a problem.. If you ask the programmers, they would say yes it's good for them because it is handy for them but if you ask the security person I would say that there is no security with it. I am looking from the security perspective and they looking to it from comfort perspective
MoM-1-29		We: Is your servers part of the national datacenter? Mr. Rajesh: Yes
MoM-1-30		We: So you handle your servers here or there… Mr. Rajesh: Here and there.
MoM-1-31		We: Both… why both? Mr. Rajesh: Here to we need to have some back up…
MoM-1-32		We: so the main server is here or Mr. Rajesh: No this is the primary and there is act as a secondary if something happen to the primary now and that would become the primary until we recover the normal status

MoM-1-33		We: Do you think that open standards will push the adoption of e-government foreword or it will eliminate it? Mr. Rajesh: Actually it depends on the government and the people who are going to use the application
MoM-1-34		We: So do we have to create a closed-standards to for example encourage the ministries to enhance the adoption of e-government or just make an open standards for application and hardware side Mr. Rajesh: Can you rephrase it…please?
MoM-1-35		We: We have here two type of standards, we have open-standards an open list for many policies for many types of software and we have here closed-standards, so which one is better in order to accelerate the e-government adoption? Mr. Rajesh: Purely it depends on the management and IT governance, I tell you why governance come into the picture close standards you must to follow but the open standards whatever you want you can take it and adopt, so that your system will be most, you may saying some open suggestion and you are saying strictly you have to do it…okay… I have to do what you say and also I give his suggestion and I will implement it here, so IT governance they will suggest, if you corporate IT governance probably whatever suggestion you are giving, everything will become complete and full-secured system we want, so answer to your question is both… purely it depends on, there is no compulsory thing in that case, here there is a compulsory
MoM-1-36		We: When we come to the last stage of e-government adoption which is integration some of the standards does not work compatibility with others so here, do we have to force start using the closed standards or make it as its Mr. Rajesh: Purely it depends on the usage and the businesses.. Again it's the senior management has to decide on what they want to and what are the organization objectives... if the standards is going to satisfy our objective probably we can go
MoM-1-37	A.S	We: Do you think the adoption of your organization if we give it a scale very slow, slow, medium, fast, or very fast…what scale you would give? Mr. Rajesh: Fast
MoM-1-38	A.S	We: What about Oman in general the adoption of e-government? Mr. Rajesh: I would say, its good fast.. recently do you here about 4111, Muscat municipality have also implemented they all take from us, we have toll-freMoE-number, IBMS system, and now they have started, its fully automated, it's kind of onMoE-to-one services, if you have powerful problem you can call 111 your call will be recorded and you will be given immediate attention on, so this is one example of improving e-government… if you want to get more information about ministry or any clarification please…call the toll-freMoE-number and you can find it in our website, you can call and then you can get the clarification for any doubt related to your problem
MoM-1-39		We: Is there anything you want to add for the interview regarding the factor affecting the adoption of e-government? Mr. Rajesh: Whatever we do in the ministry of manpower, we understand the need of these thick-wall and we understand the objective of the ministry of manpower whatever initiative and whatever new project we take is that aligned with the objectives, in that way we are a good in IT governance as well as e-government. This will help us in the strategic plan
MoM-		We: Anything else you want to add

1-40		
MoM-1-41		We: Thank you very much. And we appreciate your time Mr. Rajesh: Thank you.

Appendix E – Ministry of Higher Education Arabic interview summary

Interview	MoHE
Government authority	Ministry of Higher Education
e-government project	Higher Education portal
Interviewee position	Deputy Director
Interviewee name:	Mr. Tariq Al-Balushi
Date:	2012/04/15
Time duration:	23:54

We interviewed Mr. Tariq Al-Balushi, a deputy director from Ministry of Higher Education regarding the technical factors affecting the adoption of e-government. Firstly, he talked in brief about their e-government project which is Higher Education Portal and the adoption speed of e-government adoption in their project and in Oman. Secondly he ordered the four technical factors effecting the adoption of e-government as follows:

1. Technical expertise
2. ICT infrastructure
3. IT standard
4. IT security

Thirdly, Mr. Tariq explained in details the reasons behind the order selection he chosen. Fourthly, he explained the management as well as the external pressures of each factor. Finally, Mr. Tariq, did not add any new factors.

Note: the Arabic interview is available at http://www.omanisouq.com/mohe.doc or by e-mail infocenter@squ.edu.om

Appendix F – Ministry of Education Arabic interview summary

Interview	**MoE**
Government authority	**Ministry of Education**
e-government project	**Education portal**
Interviewee position	**System Supervisor**
Interviewee name:	**Mr. Mohammed Al-Abrawi**
Date:	**2012/04/12**
Time duration:	**46:09**

We interviewed Mr. Mohammed Al-Abrawi, a system supervisor from Ministry of Education regarding the technical factors affecting the adoption of e-government. Firstly, he talked in brief about their e-government project which is Education Portal and the adoption speed of e-government adoption in their project and in Oman. Secondly he ordered the four technical factors effecting the adoption of e-government as follows:

1. ICT infrastructure
2. Technical expertise
3. IT security
4. IT standard

Thirdly, Mr. Mohammed explained in details the reasons behind the order selection he chosen. Fourthly, he explained the management as well as the external pressures of each factor. Finally, Mr. Mohammed, did not add any new factors.

Note: the Arabic interview is available at http://www.omanisouq.com/moe.doc or by e-mail infocenter@squ.edu.om

Appendix G – Information Technology Authority Arabic interview summary

Interview	**ITA**
Government authority	**Information Technology Authority**
Interviewee position	**Application and e-services Manager**
Interviewee name:	**Mr. Dhahi Al-Mashifari**
Date:	**2012/04/14**
Time duration:	**70:32**

We interviewed Mr. Dhahi Al-Mashifari, application and e-services manger in the Information Technology Authority regarding the technical factors affecting the adoption of e-government. Firstly, he talked in brief about the Information Technology Authority, e-government in Oman, and the adoption speed of e-government adoption in Oman. Secondly he ordered the four technical factors effecting the adoption of e-government as follows:

1. ICT infrastructure
2. Technical expertise
3. IT standard
4. IT security

Thirdly, Mr. Dhahi explained in details the reasons behind the order selection he chosen. Fourthly, he explained the management as well as the external pressures of each factor. Finally, Mr. Dhahi, did not add any new factors.

Note: the Arabic interview is available at http://www.omanisouq.com/ita.doc or by e-mail infocenter@squ.edu.om

Appendix H – Muscat Municiplity-1 Arabic interview summary

Interview	**MM-1**
Government authority	**Muscat Municipality**
e-government project	**Muscat Municipality e-services**
Interviewee position	**HOD-Internet**
Interviewee name:	**Mr. Abdullah Al-Sawai**
Date:	**2012/04/16**
Time duration:	**55:00**

We interviewed Mr. Abdullah Al-Sawai, HOD-Internet in Muscat Municipality regarding the technical factors affecting the adoption of e-government. Firstly, he talked in brief about their e-government project which is Muscat Municipality e-services and the adoption speed of e-government adoption in their project and in Oman. Secondly he ordered the four technical factors effecting the adoption of e-government as follows:

1. ICT infrastructure
2. IT security
3. IT standard
4. Technical expertise

Thirdly, Mr. Abdullah explained in details the reasons behind the order selection he chosen. Fourthly, he explained the management as well as the external pressures of each factor. Finally, Mr. Abdullah did not add any new factors.

Note: the Arabic interview is available at http://www.omanisouq.com/mm1.doc or by e-mail infocenter@squ.edu.om

Appendix I – Muscat Municipality-2 Arabic interview summary

Interview	**MM-2**
Government authority	**Muscat Municipality**
e-government project	**Muscat Municipality e-services**
Interviewee position	**Project Senior Manager**
Interviewee name:	**Mr. Salem Al-Kalbani**
Date:	**2012/04/16**
Time duration:	**36:19**

We interviewed Mr. Salem Al-Kalbani, project senior manager in Muscat Municipality regarding the technical factors affecting the adoption of e-government. Firstly, he talked in brief about their e-government project which is Muscat Municipality e-services and the adoption speed of e-government adoption in their project and in Oman. Secondly he ordered the four technical factors effecting the adoption of e-government as follows:

1. ICT infrastructure
2. IT security
3. IT standard
4. Technical expertise

Thirdly, Mr. Salem explained in details the reasons behind the order selection he chosen. Fourthly, he explained the management as well as the external pressures of each factor. Finally, Mr. Salem adds awareness, e-government marketing and digital literacy as new factors.

Note: the Arabic interview is available at http://www.omanisouq.com/mm2.doc or by e-mail infocenter@squ.edu.om

Appendix J – Ministry of Manpower Arabic interview summary

Interview	**MoM-2**
Government authority	**Ministry of Manpower**
e-government project	**Ministry e-services**
Interviewee position	**HOD- Design and Development of internal systems**
Interviewee name:	**Ms. Skina Al-Shahi**
Date:	**2012/04/15**
Time duration:	**17:00**

We interviewed Ms. Skina Al-Shahi, HOD-Design and Development of internal systems in Ministry of Manpower regarding the technical factors affecting the adoption of e-government. Firstly, he talked in brief about their e-government project which is Ministry of Manpower e-services and the adoption speed of e-government adoption in their project and in Oman. Secondly she ordered the four technical factors effecting the adoption of e-government as follows:

1. ICT infrastructure
2. IT standard
3. IT security
4. Technical expertise

Thirdly, Ms. Skina explained in details the reasons behind the order selection he chosen. Fourthly, she explained the management as well as the external pressures of each factor. Finally, Ms. Skina did not add any new factors.

Note: the Arabic interview is available at http://www.omanisouq.com/mom.doc or by e-mail infocenter@squ.edu.om

Bibliography

AL-Turki, S.M and Tang, N.K.H., (1998). Information technology environment in Saudi Arabia: a review. Working report, *Leicester University Management Center*. UK.

Aladwani, A.M., (2003). Key Internet characteristics and e-commerce issues in Arab countries. *Information Technology and People*, Vol 16, pp 9-20.

AlEsmaeli, S., (2002). Oman e-government Strategy. In: Higher Leadership Symposium on e-government: Innovation and Challenges to the 21st Century Managers, Muscat, Oman.

Alghamdi *et al*., (2011). "e-government Readiness Assessment for Government Organizations in Developing Countries." *Computer and Information Science*, Vol. 4, No. 3.

Aljifri H, Navarro DS, (2003). International legal aspects of cryptography. *Computers & Security*; 22(3):196–203

Alshehry, M., (2008). "Transformation towards e-government in Kingdom of Saudi Arabia: Technological and Organisational Perspectives," Academic, the School of Comuting,CCSR, *De Montfort University*

AlShihi, H (2006). Critical Factors in the Adoption and Diffusion of e-government Initiatives in Oman. Victoria: *Victoria University*. p97 - 105.

Ameinfo – Oman. (2009). "Oman's EGovernment Architecture Framework to Be Developed by IDA International Singapore." AMEinfo.com, 15 Mar. 2009. Web. 01 May 2012. <http://www.ameinfo.com/188567.html>.

Andersen, R., (2009). The Diffusion of Content Management Technologies in Technical Communication Work Groups. Milwaukee: *The University of Wisconsin*.pp 70 -75

Anita's, (2006).Analyzing ICT Policies and Strategies in the ESCWA Region.[pdf].*Economic and Social Commission for Western Asia ESCWA*.URL:

Australian National Auditing Office, (1999), Electronic Service Delivery, including Internet use by Commonwealth Government Agencies, *ANAO*, Canberra

Behzadi, H., Isfandyari-Moghaddam, A., Sanji, M. (2012). e-government portals: a knowledge management study", *Electronic Library*, The, Vol. 30 Iss: 1, pp.89 – 102

Beynon-Davies, P. (2007). Models for e-government, *Transforming Government*: *People, Process and Policy*, Vol. 1 Iss: 1, pp.7 – 28

Blumberg, B., Cooper, D.R. and Schindler, P.S. (2005). *Business Research Methods*. McGraw-Hill, Berkshire. ISBN-10: 007710742X.

Borras, J. (2004) International Technical Standards for e-government, *Electronic Journal of e-government*, Vol. 2, Pp. 75-80.

Bourne, E. J., Hutson, D. H. & Weigel, H. (1959). Chem.& Ind. p. 1047.

Bryman, A. (1997) Quantity and Quality in Social Science Research. Studentlitteratur, Lund

Bwalya K. J. and Healy, M. (2010). Harnessing e-government Adoption in the SADC Region: a Conceptual Underpinning. *Electronic Journal of e-government* Volume 8 Issue 1.

Bwalya, K. J.; Plessis, T. D. & Rensleigh, C. (2011). Multi-Dimensional Factors Impacting on e-government Adoption in Botswana, Mozambique and Malawi, *IJEA* 3 (3) , 20-32 .

Castellano, M., N. Pastore, F. Arcieri, V. Summo and G. Bellone de Grecis (2005) "An egovernment Cooperative Framework for Government Agencies," Proceedings of the 38th Hawaii International Conference on System Sciences.

Chan, C.M.L. and S.L. Pan (2003) "Managing Stakeholder Relationships in an E-Government Project," *Ninth Americas Conference on Information Systems*, 783-791.

Chen, Y.N., Chen, H.M., Huang, W. and Ching, R.K.H., (2006). e-government strategies in developed and developing countries: an important framework and case study. *Journel of global information management*, 14(1).pp. 23-46.

Chun, S.A., Luna-Reyes, L.F., Sandoval-Almazán, R. (2012) "Collaborative e-government", *Transforming Government: People, Process and Policy*, Vol. 6 Iss: 1, pp.5 - 12

Commonwealth Telecommunications Organisation (2008) e-government for Development Information Exchange Project Website [Internet], Available from: <http://www.egov4dev.org> [Accessed March 20th 2003]

Creswell, J. W., (2007). *Qualitative inquiry and research design: choosing among five traditions*. 2nd ed. *SAGE* Publications, London.

Gilbert D., Balestrini P., Littleboy D., (2004). Barriers and benefits in the adoption of e-government, *International Journal of Public Sector Management*, Vol. 17 Iss: 4, pp.286 – 301

Gilbert D., Balestrini P., (2008). Trust and risk in e-government adoption . *Journal of Public Sector Management*, Volume 17 (Issue 2), pp. 165–176.

Davison, R.M., C. Wagner and L.C.K. Ma (2005) "From government to e-government: a transition model," *Information Technology & People*, 18(3), 280-299.

Dawes, S. (1996), "Interagency Information Sharing: Expected Benefits", Manageable Risks, *Journal of Policy Analysis and Management*, Vol. 15, No. 3, pp. 377-394

Deloitte and Touche. (2001). The citizen as customer. CMA Management, 74(10), 58.

DeNardis, Laura, "Open Standards and Global Politics", *International Journal of Communications Law &Policy*, Issue 13, Winter 2009.

Denzin, N.K., & Lincoln, Y.S., (2005). *The Sage handbook of qualitative research*. 3rd ed. Thousand Oaks, CA: Sage.

Dridi, F., Pernul, G. and Unger, V. (2001), Security for the electronic government, *Proceedings of the European Conference on e-government Trinity College*, Dublin, Ireland

Duffy, J. (2002). IT/Business alignment: is it an option or is it mandatory? IDC document 26831, *IDC*, Farmington, MA.

Ebrahim, Z. and Irani, Z. (2005), e-government adoption: architecture and barriers, *Business Process Management Journal*, Vol. 11 Iss: 5, pp.589 – 611

Elliman, T., Irani, Z., Jackson, P. (2007), Establishing a framework for eGovernment research: project VIEGO, *Transforming Government: People, Process and Policy*, Vol. 1 pp.364-76.

Elmarie K, Elme S, (2000). Information security management: An information security retrieval and awareness model for industry. *Computers & Security* 2008;27: 224-231

Ernst & Young, (2002), *E-Commerce Study: Executive Summary*, Gulf Cooperation Council, Ryadh.

ESCWA, (2007), *Regional Profile of the Information Society in Western Asia*, United Nations, New York.

ESCWA, (2009), *Regional Profile of the Information Society in Western Asia*, United Nations, New York.

ESCWA, (2011), *Regional Profile of the Information Society in Western Asia*, United Nations, New York.

EUTING, T. & WEIMERT, B., (2009). Information security, In: Bullinger, H.-J.: Technology guide: Principles, applications, trends, Berlin: Springer, 2009, S.498-503

Evans, D., & Yen, D. C., (2006). e-government: Evolving relationship of citizens and government, domestic, and international development. *Government Information Quarterly*, 23(2), 207−235.

Fagan, M. H., (2006), Exploring city, county and state e-government initiatives: an East Texas perspective, *Business Process Management Journal*, Vol. 12 Iss: 1, pp.101 – 112

Freeman, P. (2000). Elements of effective Computer Science. IEEE, Computer Surveys. Mar. 1995, pp. 27-29

Gefen, D, P.A. Pavlou, M. Warkentin and M.R. Gregory (2002) "Egovernment Adoption," Proceedings of the Eighth Americas Conference on Information Systems.

Gil-García, J. Ramón, and Theresa A. Pardo. (2005). E-government Success Factors: Mapping Practical Tools to Theoretical Foundations. Government Information Quarterly 22: 187-216.

Gil Garcia, G. J. R., & Martinez, M. I. J., (2007). Understanding the evolution of e-government: The influence of systems of rules on public sector dynamics. *Government Information Quarterly*, 24(2), 266−290.

Gilovich, T. (1991), *How we know what isn't so – The fallibility of human reason in everyday life*. The Free Press, New York

Gonzalez R., Gasco, J., Llopis, J. (2007) "e-government success: some principles from a Spanish case study", *Industrial Management & Data Systems*, Vol. 107 Iss: 6, pp.845 - 861

Guldentops, E. (2003). Maturity measurement- first the purpose, then the method. *Information Systems Control Journal*. Vol. 4. pp. 15-16.

Gupta, M.P. and Jana, D. (2003) "e-government evaluation: A framework and case study," *Government Information Quarterly*, 20, 365-387.

Gupta P. and A. Sridevi, (2007) "e-Governance Approach in India The National e-Governance Plan—NeGP", Compendium of e-Governance Initiatives: published by *The ICFAI Universities Press* (2007), Chapter-3, page 11.

Hammersley, M. & Gomm, R. (1997). Bias in Social Research, Sociological Research Online. [Online]. Available at: http://www.socresonline.org.uk/2/1/2.html [accessed 7 April 2012]

Heeks, R. (2004), e-Government as a Carrier of Context, I-Government Working Paper No. 15, Institute for Development Policy and Management, *University of Manchester, Manchester*, U-K

HERMANN, F., EHRIG, H. & ERMEL, C. (2009). Transformation of Type Graphs with Inheritance for Ensuring Security in e-government Networks Fundamental Approaches to Software Engineering. In: Checkik, M. & Wirsing, M. (eds.). Springer Berlin / Heidelberg.

Hiller, J. & Belanger, F. (2001). Privacy strategies for electronic government. The Pricewaterhousecoopers Endowment for the Business of Government. Retrieved February 28, 2007 from http://www.businessofgovernment.org/pdfs/HillerReport.pdf.

Holliday, I., & Kwok, R. C. W. (2004), Governance in the Information Age: Building e-government in Hong Kong. New Media and Society 6.4 (2004): 549-70.

Hosni Y.A., Khalil T.M. (2004). Management of Technology Internet Economy: Opportunities and Challenges for Developed and Developing Regions of the World. s.l.:Elsevier, Amesterdam .p 556.

Hussein, R., Mohamed, N., Ahlan, A.R., Mahmud, M. (2011) "e-government application: an integrated model on G2C adoption of online tax", *Transforming Government: People, Process and Policy*, Vol. 5 Iss: 3, pp.225 – 248

IBM. (2011). ICT Infrastructure [Online]. IBM. Available: www.ibm.com [Accessed 10 Feb. 2011].

InfoDev. (2002). The e-government Handbook for Developing Countries. A project of InfoDev and the Center for Democracy & Technology.

Information Technology Authority – Oman, (2007). "ANNUAL REPORT 2006-2007." *Information Technology Authority*. Web. 27 Apr. 2012. <http://www.ita.gov.om/ITAPortal/Data/DocLibrary/FID2008111291554982/ITAenglish.pdf>.

Information Technology Authority – Oman, (2010) "ANNUAL REPORT OF E.OMAN 2010." *ITA 4th Annual Report 2010*. Web. 11 Apr. 2012. http://www.ita.gov.om/ITAPortal/Data/DocLibrary/FID20123817213588/ita_annual_report_2011_english.pdf

Information Technology Authority – Oman, (2011). "Oman National CERT. " *Information Technology Authority*. N.p., 16 Apr 2011. Web. Last visit 30 Apr. 2012. Available at: <http://www.ita.gov.om/ITAPortal/Data/DocLibrary/FID201141685115353/OCERT%20Brochure%20English.pdf>.

Information Technology Authority – Oman, (2012) Oman's eGovernment progress recognised internationally (04 Mar 2012), Available: http://http://www.ita.gov.om/ITAPortal/MediaCenter/NewsDetail.aspx?NID=411

Irani, Z., Al-Sebie, M., and Elliman, T. (2006).Transaction Stage of e-government Systems: Identification of its Location & Importance, *Proceedings of the 39th Hawaii International Conference on System Science*, Hawaii.

Israel, M. & Hay, I., (2006), *Research Ethics for Social Scientists: Between Ethical Conduct and regulatory compliance*: *SAGE*, ISBN:1412903904.

ITGI, (2003). IT Governance Institute, Board briefing on IT governance, 2nd edition, retrieved on 18 August, 2008, from www.itgi.org

Janssen, M., Cresswell, A.M. (2005), An enterprise application integration methodology for e-government, *Management*, Vol. 18 pp.531-47.

Joshi, J., Ghafoor, A., Aref, W. and Spafford, R. (2001), Security and privacy challenges of a digital government, (Ch. 7, pp. 121-136), I n W.J. McIver and A. K. Elmagarmid (Eds). , *Advances in digital government Technology, human factors and policy*. Norwell, MA Kluwer Academic Publisher.

Kamal, M.M., Themistocleous, M., Morabito, V. (2009), Justifying the decisions for EAI adoption in LGAs: a validated proposition of factors, adoption lifecycle phases, mapping and prioritisation of factors, *Proceedings of the 42nd Hawaii International Conference on System Sciences, Big Island, HI, 5-8 January*, IEEE Computer Society, Piscataway, NJ, .

Kanaan, R. Kareem, (2009), "Making sense of e-government Implementation in Jordan: A qualitative Investigation", available at: https://www.dora.dmu.ac.uk/bitstream/handle/2086/2415/Thesis.pdf.

Kayworth, T. and Sambamurthy, V. (1997), "The Impact of Corporate Information Technology Infrastructure Standards on Enterprise and Business Unit It Use', Proceeding of the 18 th international conference on information systems, pp. 462463

Keen, P.G.W. (1991), *Shaping the Future: Business Design through Information Technology*, Harvard Business School Press, Cambridge, MA.

Key, J.P., (1997). Research Design in Occupational Education: Module R12 Descriptive Research. [Online] Available at http://www.okstate.edu/ag/agedcm4h/academic/aged5980a/5980/newpage110.htm [Accessed 23 March 2012]

Kumar, R. (1996), *Research Methodology: A Step-By-Step Guide For Beginners*, Longman, South Melbourne.

Kumar V, Mukerji B, Butt I and Persaud A (2007) "Factors for Successful e-government Adoption: a Conceptual Framework" *The Electronic Journal of e-government* Volume 5 No. 1, pp 63 – 76.

Kvale, S., (1996). *Interviews: An Introduction to Qualitative Research Interviewing*. California: *SAGE*.

Kvale, S. & Brinkmann, S., (2009). *Interviews: Learning the Craft of Qualitative Research Interviewing*, 2nd ed. *SAGE* Publications, London.

Kwon, T. H.; and Zmud, R. W, (1987). "Unifying the Fragmented Models of Information Systems Implementation." In J. R. Boland, and R. Hirshheim (eds.), *Critical Issues in Information Systems Research*, New York: John Wiley, pp. 227-251.

Lai, C, S, A, and Pires, G. (2010), Testing of a Model Evaluating e-government Portal Acceptance and Satisfaction, *The Electronic Journal Information Systems Evaluation* Volume 13 No. 1.

Layne, K., Lee, J. (2001), Developing fully functional e-government: a four-stage model, *Government Information Quarterly*, Vol. 18 pp.112-13.

Lee, J.K., S. Braynov and H.R. Rao (2005) Effects of a Public Emergency on Citizens' Usage Intention toward e-government: A Study in the Context of War in Iraq, *Proceedings of the Eleventh Americas Conference on Information Systems*, Omaha, NE, USA.

Lenk, K. & Traunmuller, R. (2001). Broadening the concept of electronic government. In Prins, J.E.J. (Ed), *Designing e-government. On the crossroads of technological innovation and institutional change* (pp. 63-73). The Hague: Kluwer Law International.

MACASIO, J. (2009). ICT Services Management Practitioner's Not E-enterprise Architecture [Online]. Onecitizen. Available: www.onecitizen.net [Accessed 23 Sep 2010].

Mack, N., Woodsong, C., MacQueen, K., Guest, G., & Namey, E. (2005). Qualitative Research Methods: A Data Collector's Field Guide. Online. http://www.fhi.org/en/RH/Pubs/booksReports/QRM_datacoll.htm

Marshall, C., & Rossman, G. B. (2006). *Designing Qualitative Research* (4th Edition). Thousand Oaks: Sage Publications.

McClure, Electronic government, (2000): federal initiatives are evolving rapidly but they face significant challenges, 2000 <http://www.gao.gov/new.items/a 2001791.pdf>, [accessed 14/03/2012

Mehrtens, J., Cragg, P.B., and Mills, A.M. (2001) A Model of Internet Adoption by SMEs, *Information and Management*, 39, 165-176

Merriam, S. B. (1988). *Case study research in education: A qualitative approach*. San Francisco, CA: Jossey-Bass.

Miles, M. B. & Huberman, A. M. (1994), *Qualitative data analysis: an expanded sourcebook*. Sage Publications, Inc., Thousands Oaks

Ministry of Manpower - Oman. (2011). "e-government Award Winners Honoured." *Ministry of Manpower - Oman*, 1 Jan. 2011. Web. 27 Apr. 2012. <http://www.manpower.gov.om/en/news_detail.asp?id=1008>.

Ministry of National Economy – Oman, (2011). "The Statistical Year Book 2011 ." *Ministry of National Economy*. N.p., 30 Nov. 2011. Web. 21 Apr. 2012. <http://www.mone.gov.om/book/SYB2011/2-population.pdf>.

Misnikov, Y. (2003) How ICTs Can Serve Good Governance, *UNDP*, [Online]. Available:http://lgi.osi.hu/publications/2003/217/english.pdf [21.3.2003] Date visited: 31 March 2012.

MOON, M. J., (2002). The Evolution of e-government among Municipalities: Rhetoric or Reality? Public Administration Review, 62, 424-433.

Mutula S M (2005) "Bridging the digital divide through e-governance: A proposal for Africa's libraries and information centers" *The Electronic Library* 23(5) pp 591-602

Myers, B. L., Kappelman, L. A., & Prybutok, V. R., (1998). A comprehensive model for assessing the quality and productivity of the information systems function: Toward a theory for information systems assessment. In E. J. Garrity,&G. L. Sanders (Eds.), *Information systems success measurement* (pp. 94−121). Hershey, PA: Idea Group.

National Institute of Standards and Technology; (2000). An introduction to computer security: the NIST handbook. *Special publication* 800–81

Ndou, V.D. (2004). e-government for Developing Countries: Opportunities and Challenges, *The Electronic Journal on Information Systems in Developing Countries*, Volume l18, pp 1-24

Norris, N. (1997). Error, bias and validity in qualitative research. *Educational Action Research*. 5 (1), p. 172-176.

Nyrhinen, M. (2006), IT infrastructure: structure, properties and processes, Working Paper on Information Systems 6(22), Helsinki School of Economics, Helsinki.

Oates, B. J., (2006). *Researching information systems and computing*. Thousand Oaks, CA: Sage.

OECD (2003), *The e-government Imperative*, OECD Publishing. doi: 10.1787/9789264101197-en

OECD, (2005). e-government for Better Government. Paris, France: *OECD*, ISBN: 92-64-01833-6.

Oman Educational Portal – Oman, (2012), Education system in Oman (04 Mar 2012), Available: http://home.moe.gov.om/english/pages.php?CatID=11 Last accessed: 11th April, 2012

Pardo, T. (2000), "Realizing the promise of digital government: It's more than building a Web site", *Unpublished manuscript, Albany, NY* at. Available at www.netcaucus.org/books/egov2001/pdf/realizin.pdf

Park, H.M. (2005) "A Cost-Benefit Analysis of the Seoul OPEN System: Policy Lessons for Electronic Government Projects," Proceedings of the 38th Hawaii International Conference on System Sciences.

Pascual, Patricia. J. (2003). e-government. Asia-Pacific e-Primers Series. *United Nations Development Programme - Asia-Pacific Development Information Programme*. Available at http://eprimers.apdip.net/series/ Accessed on July 11, 2005.

Patton, M. Q., & Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, CA: Sage

Persson A. and Goldkuhl G. (2005) Stage-models for public e-services - investigating conceptual foundations, accepted to the 2nd Scandinavian Workshop on e-government, Köpenhamn.

Peterson, R.R. (2003). Information strategies and tactics for information technology governance. in Strategies for information technology governance, W. Van Grembergen (ed). Idea Group Publishing. Pfhleeger CP. Security in computing. 2nd ed. United States of America: *Prentice Hall*; 1997.

Preece, J., Rogers, Y. & Sharp, H., (2002). *Interaction Design: Beyond Human-Computer Interaction*: New York: John Wiley & Sons.

PRLog, (2011). "Oman Information Technology Report 2011." *PR Log*. N.p., 30 June 2011

Pulliam, D., (2005). E-gov Spending Expected to Rise, Despite Congressional Dissatisfaction. Retrieved March 7, 2012, from <http://www.govexec.com/dailyfed/1204/010605p1.htm/>.

Rabiah, A, and Vandijck, E. (2009). ―A Strategic Framework of e-government: Generic and Best Practice *Electronic Journal of e-government* Volume 7 Issue 3 2009, (pp241 - 258).

Ray, D., Gulla, U., Dash, S., Gupta, M.P. (2011) "A critical survey of selected government interoperability frameworks", *Transforming Government: People, Process and Policy*, Vol. 5 Iss: 2, pp.114 – 142

Reddick, C. G., (2006). Information resource managers and e-government effectiveness: A survey of Texas state agencies. *Government Information Quarterly*, 23, 249−266.

Reynolds, M. and Regio, M. (2001), "e-government as a Catalyst in the Information Age, Microsoft e-government Initiative', e-government 2001, retrieved from: www. netcaucuso. rg/books/egov200l/

Robey, D. and S. Sahay (1996) "Transforming Work through Information Technology: A Comparative Case Study of Geographic Information Systems in County Government," *Information Systems Research*, 7(1), 93-110.

Saekow, A. and Boonmee, C. (2009), "A Pragmatic Approach to Interoperability Practical Implementation Support (IPIS) for e-government Interoperability." *Electronic Journal of e-government* Volume 7 Issue 4 2009, (pp403 - 414), available online at www.ejeg.com

Scatolini, E. and A. Cordella (2005) "Technological artifacts and sense making in an Italian Public Administration," 21st *European Group for Organisational Studies*(EGOS) Colloquium, Berlin.

Schneider, G. P. and Perry, J. T. (2000) *Electronic Commerce*, Cambridge MA, Course Technology.

Scholl, H.J. (2005), Interoperability in e-government: More than Just Smart Middleware, Proceedings of the 38th Hawaii International Conference on System Sciences.

Schwester, R. W, (2009). Examining the Barriers to e-government Adoption. *Electronic Journal of e-government* Volume 7 Issue 1 2009, pp. 113 – 122.

Seale, C., (1999). *The quality of qualitative research*. California: SAGE Publication.

Seifert, J., and Petersen, E, (2002). The Promise of all Things E? Expectations and Challenges of Emergent E- Government, *Perspectives on Global Development and Technology*, (1:2), 2002, pp. 193-213.

Sekaran, U. (1992). *Research Methods for Business – A skill building approach*. (2nd Ed). United States of America: John Wiley & Sons, Inc.

Sethi, N. & Sethi, V., (2008). "e-government Implementation : A Case Study of Dubai e-government". Integration *The Vlsi Journal*, p.185-195.

Shareef, M. *et al*., (2010). e-government Adoption Model (GAM): Differing service maturity levels. *Government Information Quarterly* 28 (2011) 17–35.

Sharifi, H. and Zarei, B. (2004), "An adaptive approach for implementing egovernment in I. R. Iraif', *Jounial of Government Information*, Vol. 30, No. 5-6, pp. 600-619

Sharma, D., Ma, W. & Tran, D.(2005). On an IT Security Framework Knowledge-Based Intelligent Information and Engineering Systems. In: KHOSLA, R., HOWLETT, R. & JAIN, L. (eds.). Springer Berlin / Heidelberg.

Sharma, S. (2000). Managerial cognitions and organizational context as predictors of firm choice of environmental strategies. *Academy of Management Journal*, 43(4): 681-697.

Siau, K. and Y. Long (2004) "Factors Impacting e-government Development," Twenty- Fifth International Conference on Information Systems.

Siau, K., Long, Y. (2005), "Synthesizing e-government stage models – a meta-synthesis based on the meta-ethnography approach", *Industrial Management & Data Systems*, Vol. 105 No.4, pp.443-58.

Spence, W.R., (1994). *Innovation: the communication of change in ideas, practices and products*. London; *New York:* Chapman & Hall

Siau, K & Yuan , L (2009) FACTORS IMPACTING E-GOVERNMENT DEVELOPMENT. *Journal of Computer Information Systems*. 50 (1) p98-107

Sprecher, M. H., (2000). Racing to e-government: Using the Internet for citizen service delivery. *Government Finance Review*, 16(5), 21−22.

Swartz, N. (2003) British slow to use e-government services. *Information Management Journal*, 37, 7.

Tan, B. C. C., Pan S. L., and Cha, V, (2007). The Evolution of Singapore's Government Infocomm Plans-Singapore's e-government Journey from 1980 to 2007. Singapore e-government Leadership Centre Report, *National University of Singapore*. Technology Guide. In: BULLINGER, H.-J. (ed.). Springer Berlin Heidelberg.

Tender Board – Oman, (2012) *Oman Tender Board* (27 April 2012), Available: https://etendering.tenderboard.gov.om , Last accessed: 27 April 2012

The Gulf Secretariat General, (2012). The Cooperation Council For The Arab States of The Gulf Secretariat General. Retrieved April 29, 2012. From *The Gulf Secretariat General*: http://www.gcc-sg.org/eng/index.html

The World Bank Group, (2012). e-government - Definition of e-government. Retrieved March 7, 2012, from *The World Bank Group*: http://go.worldbank.org/M1JHE0Z280

Thong, JYL. & Yap, CS, (1995). CEO Characteristics, Organizational Characteristics and Information Technology Adoption in Small Businesses. *Omega*, 23(4). pp. 429-462.

Tung L. Lai and Rieck, O., (2005), "Adoption of electronic government services among business organizations in Singapore", *Journal of Strategic Information Systems* 14 (2005) 417–440.

Turban, A., King, D., Lee, J., Warkentin, M., & Chung, H. M. (2002). *Electronic Commerce 2002: A Managerial Perspective*. Prentice Hall .

United Nations and American Society for Public Administration, (2003). UN Global Egovernment Survey. Retrieved September 7, 2006 from http://unpan1.un.org/intradoc/groups/public/documents/un/unpan016066.pdf.

United Nations, (2008). e-government Survey 2008 From e-government to Connected Governance. New York: *Department of Economic and Social Affairs*. Retrieved March 7, 2012 from: http://unpan1.un.org/intradoc/groups/public/documents/un/unpan028607.pdf .

United Nations, (2010). e-government Survey 2010 From e-government to Connected Governance. New York: *Department of Economic and Social Affairs*. Retrieved March 7, 2012, from: http://www2.unpan.org/egovkb/global_reports/10report.htm .

United Nations, (2012). e-government Survey 2012 e-government for the People. New York: *Department of Economic and Social Affairs*. Retrieved March 7, 2012, from: http://www2.unpan.org/egovkb/global_reports/12report.htm .

Ventura, S.J. (1995) The Use of Geographic Information Systems in Local Government, Public *Administration Review*, 55(5), 461-467.

Vishanth Weerakkody, Ramzi El-Haddadeh, Shafi Al-Shafi, (2011), Exploring the complexities of e-government implementation and diffusion in a developing country: Some lessons from the State of Qatar, *Journal of Enterprise Information Management*, Vol. 24 Iss: 2, pp.172 – 196

Von Solms SH, (1999). Information security managment through measurement. In*: Proceedings of the SEC99 conference*, Johannesburg, South Africa.

Wagner, *et al*., (2003): Enhancing Egovernment in Developing Countries: Managing Knowledge through Virtual Communities, *Electronic Journal on Information Systems in Developing Countries*, 14 (4)1-20.

Wangler, B., Persson, A. and Soderstrom, E. (2001), "Conceptual Modeling for 11213 Integration", International Conference on Advances in Infrastructure for Electronic Business, *Science and Education on the Internet* (SSGRR 2001), VAquila, Italy

Warkentin, M, D. Gefen, P.A. Pavlou and G.M. Rose (2002) "Encouraging Citizen Adoption of e-Governement by Building Trust," *Electronic Markets*. 12(3), 157-162.

Weerakkody, V., and Dhillon, G, (2008). "Moving from e-government to T-Government: A Study of Process Reengineering Challenges in a UK Local Authority Context," *International Journal of Electronic Government Research*, (4:4), 2008, pp. 1-16.

Yin, R. K. (2003) *Case study research: Design and Methods*. Sage, Thousand Oaks

Yimbo, D. W. (2011), *Analyzing e-government in developing countries using a Stages Model approach: A case study*. Minnesota: *University of Minnesota*. ISBN: 9781124603629

Zweers K and Planque', K. (2001), "Electronic Government, From the Organizational Based Perspective Towards the Client Oriented Approach! ', In: Designing E Government, Prins J. E. J.(Ed.), *Kluwer Law international*, pp. 92