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**Ph.D. Dissertation in Engineering**

**An Empirical Analysis of the Policy Makers’  
Preferences towards e-Government Adoption**

**-A Discrete Choice and Analytical Hierarchy Process Approaches-**

**February 2013**

**Mahdi Abdullah Alsebaei**

**Technology Management, Economics and Policy Program**

**College of Engineering**

**Seoul National University**

# **An Empirical Analysis of the Policy Makers' Preferences towards e-Government Adoption**

**-A Discrete Choice and Analytical Hierarchy Process Approaches-**

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**Submitting a Doctoral Thesis of Engineering**

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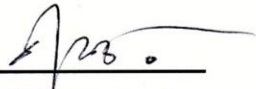




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*Dedicated to  
my respected and beloved father, mother,  
my dearest wife,  
my sweeties kids, Abdullah, Lamya, and Mahmoud,  
and all members of my great family.*

# **Abstract**

## **An Empirical Analysis of the Policy Makers’ Preferences towards e-Government Adoption: A Discrete Choice and Analytical Hierarchy Process Approaches**

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Over the last several years, advances of Internet and networking technologies (especially e-Government) have pushed the boundaries forward and attracted the attention of governments in developed and developing nations. Government organizations, particularly in the developing world, have realized that the world is changing at an incredible pace because of these technological changes. This realization has led to a strong desire and ambitious vision to empower new technologies in their reform processes. Thus, governments should develop and formulate national strategies and policies to promote information economy and achieve socioeconomic benefits. In doing so, governments can attain a more efficient operations reform and enhance productivity and transparency. To this end, implementing an e-Government system is considered essential to attaining this goal.

The process of innovation in government sectors is still a major challenge for many developing governments. Yemen is a third-world country that is trying to implement a new electronic government system in public agencies; however, as seen in other developing countries, Yemen has faced many failures due to several reasons, most importantly, the high rate of resistance to change by employees in government sector. To this extent, the goal of this research is to investigate the preferences and opinions of various government staff (normal employees, technical staff, and decision makers) toward e-Government system implementation. Policy recommendations are driven based on this aim in terms of e-Government adoption promotion with specific empirical analysis in Yemen.

To date, no study, experimental or otherwise, has been conducted in this field. As such, this research will provide valuable insights for the government and expert policy makers concerning research on e-Government in developing countries. This research used quantitative and qualitative methods and applied two recent methodologies to achieve that goal.

The first method was Conjoint Analysis (CA), based on Discrete Choice Modeling (DCM) and Random Utility Theory (RUT), with rank-ordered mixed logit model. The second methodology was an Analytical Hierarchy Process (AHP), based on Multi-Criteria Decision Making method (MCDM), to examine government officials' opinions in ranking successful factors in the implementation of a robust e-Government in Yemen.

To build a policy setting, this study also included heterogeneity into the mixed logit model via a random coefficient setting and the interaction of the identified e-Government attributes with demographics and respondent characteristics.

The attributes involved for the conjoint analysis study are e-Government Strategy, Legal framework, Government Electronic Administration Office (GEA), Portal language, Privacy as a proxy of security, Training, and Operational Cost as an annual budget for the e-Government system.

Moreover, the factors tested for the analytical hierarchy analysis are Governing factors including (administrative and legislative factors), Organizational factors including (organizational structure and technological factors), and External factors including (citizen-centric and economic factors).

The result of the analysis of the conjoint study proved that the privacy of government and personal data clearly exerts the greatest impact on preference structure, followed by a strong legal framework for the implementation of e-Government. However, there was evidence for the cost sensitivity that policy makers experience in this field. Government officials should address this issue through electronic obligation policies for penetration of e-Government. Additionally, respondents preferred implementing the e-Government system with a clear and tailored long-term strategy that outlined different stages of the implementation.

The findings of this study are imperative to create policies for enhancing e-Government implementation in Yemen, which should include strengthening the government to adopt the system in government agencies, generating and enabling an environment that supports user access, and expanding e-Government capabilities with reliable and fast online services for citizen.

Based on the quantitative findings of the CA and AHP, this study applied a qualitative research method to supplement the empirical results by interviewing decision makers within the Yemen government. The researcher then applied priority settings for policies to drive the Gap Analysis and identify reasons for the mismatch found between the research's perceptions and realities in Yemen.

Ultimately, this study anticipates warranting the need for a supply-based analysis of e-Government adoption by government officials in developing countries, thus, increasing the rate of adoption and reducing the rate of resistance to change to this electronic system of government.

**Keywords:** AHP, conjoint analysis, discrete choice method, e-Government adoption, e-Government in Yemen, mixed logit, stated preference, willingness-to-pay.

**Student Number:** 2010-30811



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# Chapter 1 Introduction

This chapter presents an overview of this thesis and covers the introduction, purpose of the study, research questions, and the structure of the dissertation.

## 1.1 Overall Introduction

Since the turn of the 21<sup>st</sup> century, there has been a worldwide paradigm shift heading toward knowledge-based information society and Information and Communication Technology (ICT) is being regarded as a key element of national development in many countries. South Korea (ROK) is one of the most advanced information-oriented societies and its achievements in ICT are in line with most advanced nations in OECD<sup>1</sup> countries. Such achievements were realized not only by a great epoch in the development of ICT, but also by continuous efforts of public and private sectors that have helped the effective establishment of national strategy for an information-oriented society.

Recently, many Middle East countries designated 'Informatization' as a major task and have tried to use information as a driving force for economic growth. These efforts have made the region an area with great potential for the IT market that has

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<sup>1</sup> Organization for Economic Co-operation and Development.

high possibilities and opportunities for future IT developments. In addition, there has been a steep incline in the wireless market and expansion of network modernization businesses. The information-communication market in the Middle East is expanding because of informatization of the public sector and efforts to vitalize mobile communication business.

However, except a few countries, there is still limited policy effectiveness in developing countries that have poor ICT infrastructure. This lack of policy is because of a lack of human resources, irrationality of government policies, and an inadequate social system. Meanwhile, there has been rapid growth in the use of new information and ICT across a range of government, private, and commercial sectors. Many governments worldwide have introduced e-Government systems as a means of reducing costs, improving services to citizens, and increasing effectiveness and efficiency in the government sector. E-Government uses information technologies to provide better efficiency in which government services are available to different e-Government's stakeholders (e.g., citizens, businesses, employees, and agencies) and increases the convenience and approachability of government information and services to citizens (Carter and Belanger, 2005).

Yemen is a third-world country in the Middle East that is trying to adopt an e-Government system throughout all government agencies to improve efficiency, productivity, and deliver better quality public services to citizens. Therefore, the Yemeni government is trying to identify a proper framework and master plan for e-Government to help enhance economic growth and provide citizens with fast and efficient government services that are offered online.



As a result, the Yemen government has given attention to the importance and potential use of e-Government. However, most trials with the system have been severe failures. These results can be attributed to many factors; however, the most critical factor among them is that no in-depth study or analysis was conducted to gather information on the opinions of users, developers, government authorities concerning their preferences. Therefore, the relative importance of success factors has not been based on quantitative analysis.

As a hope of a country's policy toward the development of an e-Government system, Sana'a city, the capital of Yemen, has implemented electronic services that targets providing access to all citizens (Yemeni e-Government documentation, 2008); however, dynamic argument, debates, and questions have been raised by e-Government leaders and policy makers on the concept of this new electronic government system in Yemen. These arguments include the questions of why they are pursuing e-Government, what kind of e-Government they are ready for, whether they are selecting e-Government projects in the best way, and how should they plan and manage these projects.

For the purpose of this dissertation, the researcher will consider several different definitions and systematic literature to explain the concept of the e-Government phenomenon in terms of benefits, application, different stages of implementation, and policies of adoption. For example, Almazan, and Gil-Gracia (2011) defined e-Government as,

“The implementation and use of ICT technologies in government to provide public services, improve the managerially effectiveness, and to boost the

promotion democratic mechanisms and values, as well as to develop a regulative framework that alleviates and fosters the knowledge society and the information-intensive initiatives”.

Other e-Government definitions and concepts are illustrated under the literature review in the Chapter 3.

In most developing countries, when it comes to the transformation to e-Government, governments continue to face various challenges when implementing ICT programs in its organizations to reduce costs, improve efficiency and productivity, and become more citizen-oriented; this is especially the case in e-Government.

In fact, when it comes to the practice of implementing an e-Government system in developing countries (Yemen in particular), there is a high rate of resistance to change. Some scholars have acknowledged that the adoption of e-Government needs to apply organizational change to be supported by government employees. Recently, global technological, and financial and environmental shocks have pushed organizations toward adoption and transformation of their activities. These changes include establishing new relationships, practices, and new understandings (Thomas and Hardy, 2011). However, to achieve these changes, the cooperation of government employees is highly required because their resistance can hamper the change initiative.

Until now, several research investigations have been conducted concerning the implementation of e-Government in different developing countries (Heeks, 2003). Unfortunately, no study has considered the e-Government adoption and

implementation to accommodate the Yemen case. Additionally, no previous research has engaged in an analysis or proper survey to gain the opinions of government employees as implementers on their preferences toward e-Government in Yemen. Finally, no relative study has determined success factors based on quantitative analysis that contributes to implementing such a robust system.

From the perspective of this study, involving government employees and considering different groups and position titles such as (normal employees, technical staff, managers, decision makers, and leaders) is an important key factor toward the successful implementation of an e-Government system.

To that extent, this study employs two different methodologies to identify and analyze policy makers' preferences toward e-Government implementation and adoption in Yemen. These methodologies are Discrete Choice Modeling (DCM) and Analytical Hierarchy Process (AHP), which are explained in detail in Chapters 4 and 5. Of note, DCM and AHP were specified to use information gathered through officially-conducted surveys, which integrates a conjoint analysis and analytical hierarchy process for Yemeni government officials in the capital city Sana'a in the Republic of Yemen and, theoretically, were based on technology adoption and user preference theories.

The frameworks purposed in this study consider different aspects of e-Government implementation policy and include factors of governing, organizational, and external factors based on the theory of AHP. In addition, attributes of strategy, legal framework, GEA, privacy, training, and operational cost are considered according to the theory of Conjoint Analysis which is a method of Discrete Choice Modeling.

This study is unique in that the requirements to implement an e-Government system are considered from the perspective of government employees with empirical investigation of the Yemen case. First, the originality of this study is that it is one of the first studies on e-Government adoption and implementation in Yemen and is the first study to use the integration and combination of Conjoint Analysis and Analytical Hierarchy Process approaches to introduce a comprehensive methodological framework to measure government officials' preferences and identify success factors that influence individual user adoption of e-Government in Yemen.

Second, this study is specific to the Yemen context; therefore, the findings will provide significant implications for Yemeni government policymakers in the design of tailored policies and strategies to overcome the obstacles of e-Government implementation, increase the adoption of an e-Government system, and enhance a better plan for future related projects in Yemen.

## **1.2 Purpose of Dissertation**

The e-Government system has been widely adopted in developed countries; however, it is still regarded as a new technology for developing countries. Considering this e-Government as a new technology for some developing countries, especially Yemen, this study aimed determine the types of supply phenomena that will take place; that is, what type of interactive e-Government will consider policy makers (government employees and decision makers), regulators, and other related government agencies as part of a supply analysis and adoption of e-Government in the metropolitan city of Yemen.

Moreover, in the absence of an appropriate preference framework in e-Government literature, this study aimed to fill this gap by employing Discrete Choice Modeling and Analytical Hierarchy Process as two different methodologies to approach the policy makers' preference structures in terms of the objectives discussed below.

The first objective of this study with the methodological framework of CA was to introduce the preference structure of Yemeni government officials by conducting a comprehensive investigation of the preference and preference variance of Yemeni e-Government policy makers in terms of strategy, legal framework, type of Government Electronic Administration office (GEA), level of privacy as a proxy of security, portal language, training of staff, and operational cost as an annual budget for the e-Government system. This objective will reveal the importance of the various components of an e-Government implementation package. Second, the impact of package modifications on the adapt-decision will be outlined. Third, the willingness-to-pay (WTP) that each component poses will be investigated.

The second objective of this study concerned the methodological framework of AHP that provided the hierarchal structure of success factors that contribute to implementing a robust e-Government system in Yemen. This was accomplished by analyzing the opinions and preferences of decision makers within Yemeni government who rated the involved criteria and levels identified in the hierarchal tree concerning e-Government success governing, organizational and external factors. Thus, this study aimed to determine the perceived success factors for implementing a robust e-Government system. Following this initial ranking, respondents identified

the most relative and critical factors that had a significant effect in the successful implantation of a robust e-Government system.

The third objective of this study was to provide overall recommendations and policy implications to help government policy makers design strategies for a successful e-Government implementation in Yemen.

In addition, the impact of demographic variables in respondents' ratings was assessed to identify which population, in relation to age, gender, education, profession, etc. should be given priority from a policy perspective.

Based on the motivation, background and objectives of this research, the following main research questions guided this study:

1. What are the preferences of Yemeni policy makers toward the attributes of e-Government adoption and implementation, and how do these preferences influence their decision of e-Government implementation?
2. What are relevant criteria and alternative must be considered to contribute to implementing a robust e-Government system in Yemen as perceived from policy makers?
3. What policy implications can be drawn based on policy makers' preferences, and what recommendations would help the government achieve a successful e-Government implementation in Yemen?

To provide accurate insight and create policy implications based on the findings of this research, the first and second research questions are derived into subquestions.

The derivative subquestions for the first research question are as follows:

1. What are the relevant attributes' parameter values given by the choice set?

By examining the preferences choice of government officials involved, the utility that each attribute's level raised to the average individuals was derived. Based on this fundament, it was possible to rank the attributes and levels according to their relative importance.

2. What impact does each attribute have on the implementation decisions of the average policy makers?

This research exposed every component exertion that influences the preference structure of average policy makers by incorporating the stated preference data into a choice estimation. This process provided insight to drive conclusions on the impact of all changes in choice sets for adoption likelihood.

3. What is policy makers' relative WTP for the various package components?

This study estimated the relative WTP of each attribute compared to another by calculating the implicit value of the attributes. This method permitted the researcher to depict policy makers' preferences for e-Government operational costs in U.S. dollars.

The derivative subquestions for the second research question are as follows:

1. Among factors (criteria and alternatives) that are perceived by government decision makers, how does one aggregate different opinions of the different groups involved, and what are their preferences in terms of e-Government implementation criteria and alternatives?
2. What are the most critical factors that governments should consider first

when implementing e-Government?

To address the above mentioned research questions and subquestion, as well as the limitations of previous studies, this researcher used the frameworks of conjoint analysis, which is a method of discrete choice modeling; and AHP, which is MCDM. These frameworks are adaptable when examining policy makers' behaviors and preferences toward e-Government adoption and implementation. Specifically, these frameworks are targeted for developing countries using an empirical case study of the Yemen government.

Further, the objectives of this study allowed the researcher to review e-Government in Yemen and analyze its related concepts, which are among the early stages of the e-Government project. Finally, this study analyzed several factors that contributed to the successful implementation of the e-Government project in Yemen.

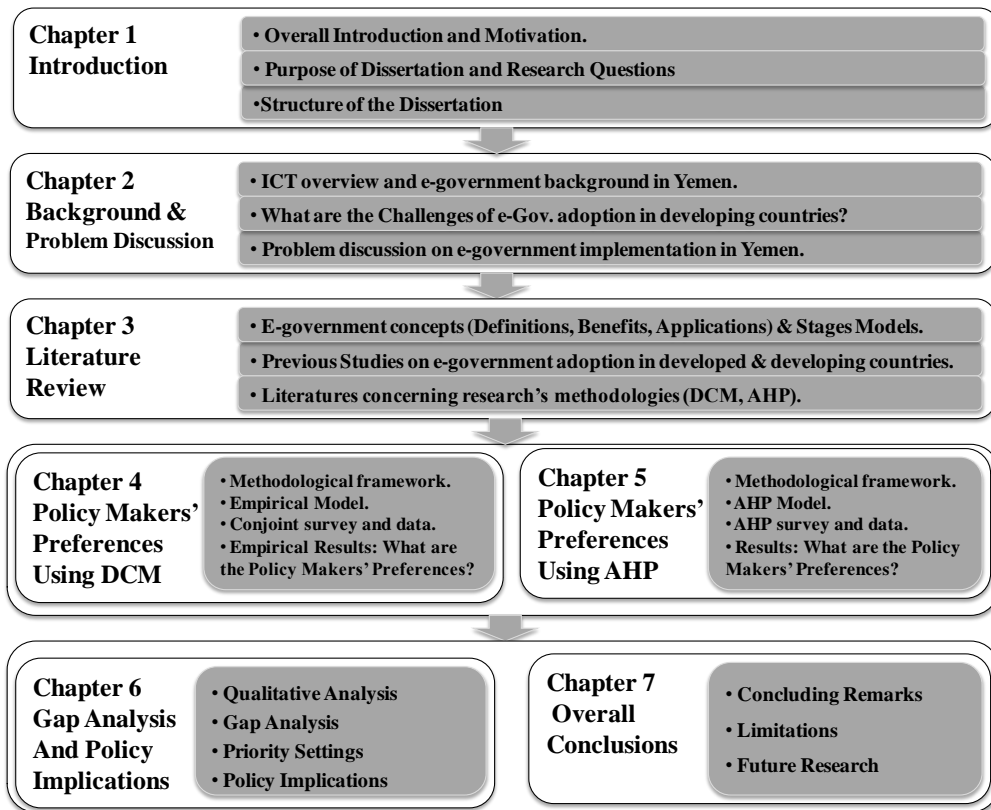
### **1.3 Structure of the Dissertation**

This thesis was organized into seven chapters as it can be seen in Figure 1-1. Chapter One introduced the importance of overall preferences for e-Government implementation and included the research questions, objectives of the study, and contribution and structure of the dissertation.

Chapter Two provides the research background of the study, offers an overview about Yemen's ICT, discusses views on the current situation of e-Government, and explores challenges of e-Government adoption and implementation in developing countries. Chapter Two concluded with a discussion of the problem of the study. Chapter Three investigates relevant literature with the aim to determine key factors



that affect e-Government implementation in developing countries, in general, and Yemen, in specific. This chapter also covers basic concepts on the adoption of an e-Government system, such as e-Government definitions, applications, and benefits. This overview is followed by the literature review concerning e-Government adoption in developed and developing countries. This literature review includes concerns of stated preferences, Conjoint Analysis (CA), and Analytical Hierarchy Process (AHP) approaches to determine consumer preferences in different areas of research. Chapter Three concludes with the research motivation and contribution to existing literature.



**Figure 1-1: Structure of Dissertation**

Chapter Four; covers the first research method used in this study, which includes the methodology setting for the study on policy makers' preferences toward e-Government implementation in Yemen using CA approach. The policy makers' behavioral model for e-Government implementation is also introduced and the conceptual framework to define the heterogeneity of preferences for the discrete choice model is established and estimation procedure of the model setting and the framework are discussed. Chapter Four also covers the identification of suitable variables and measurements, questionnaire development, participant selection, materials used, and methods of the data analysis. Chapter Four concludes with the CA and detailed descriptive statistics of all demographic factors involved.

Chapter Five covers the second research approach, which used a theoretical framework to describe the constructed model based on AHP concepts. The hierarchal structure of e-Government success factors is defined and includes the estimation procedure for the hierarchal setting and framework.

Chapter Six offers a summary of the quantitative findings of both CA, and AHP. This chapter also discusses the structure of the qualitative analysis that was conducted to supplement the empirical results via telephone interviews with policy makers in Yemen. Thereafter, Chapter Six draws the Gap Analysis between the empirical findings and realities in Yemen. Finally, the researcher discussed priority settings to derive policy implications and policy recommendations based on the quantitative findings of the two methods involved in this study with the supplemental qualitative results.

Chapter Seven discusses the overall conclusion of the dissertation, limitations, and suggestions for further research.

# **Chapter 2 Research Background and problem discussion**

This chapter covers the research background of the study, gives an overview about the ICT profile and e-Government development in Yemen, explores the obstacles of e-Government implementation in developing countries, and discusses the research problem of the study.

## **2.1 ICT overview in Yemen**

Nowadays, Information and Communication Technology (ICT) is considered as an efficient tool promoting the progress and development of countries. “Like other less developed countries, the Republic of Yemen is seeking to develop this vital sector to carry on its development process” (ESCWA, 2007). Republic of Yemen, a southwestern Asian country is the only country, which is republic in the Arab World. Compare to other countries throughout the world, Yemen is in lowest level of ICT infrastructure, this level is characterized by the following: (a) low penetration rates of fixed telephone lines; (b) lack of an environment conducive to widespread the use of telecommunication services by businesses and citizens; and (c) insufficient national bandwidth, inadequate infrastructure’s backbone for data and voice telecommunication and low number of Internet players in the market (ESCWA, 2009).

According to the National Information Center (NIC, 2005), Yemen’s effort towards constructing an Information Society can be summarized as follows:

- During the second half of 1995, the (NIC) was established.
- In 2003, the Ministry of Telecommunication and Information Technology (MTIT) was entrusted with IT management in addition to development and organization of communication policies. It has many campuses that deal with IT, including Telecommunication and Information Technology city, Electronic Library, General Telecom Council, Data communication.
- In 2006, the Central Statistics Department, affiliated with the Ministry of Planning and International Cooperation, adopted a national strategy for statistical work.
- In 2009, Yemen Electronic Government's Portal was designed and published as a one-way interaction as it only provides information of government agencies but there is no services can be provided to citizen. .

According to the Economic and Social Commission for Western Asia (ESCWA, 2007) report, Yemen is still among the countries that benefit little from communication services. The main challenges and obstacles are the country's difficult topography, spread out population groups and low density, weak infrastructure services and low level of distribution networks in urban as well as in rural areas. Regarding the Internet services in Yemen, it started in 1996 with a single governmental provider 'Teleyemen'. In April 2002, a second provider started offering Internet services. Wireless access to networks was launched at the end of December 2006. According to the, General Statistical Organization, Ministry of Planning and International Cooperation (2012), Yemen has improved its mobile communication services between 2009 and 2011 as the number of mobile telephone subscribers jumped from 8.312 million in 2009 to 12.349 million in 2009 as per in

Table 2-1. However, there had been a rapid growth after the year 2009 as stated in the main statistical indicators of ICT in Yemen presented in Table 2-1.

To summarize, the General Statistical Organization in the Ministry of Planning and International Cooperation in Yemen, offered the updated main ICT indicators in the Republic of Yemen up to the year 2011. Table 2-1 shows the majority national indicators for Yemen's Internet, telephone communications and mobile services.

**Table 2-1: Main statistical Indicators of ICT in Yemen**

<b>Indicator/ Year</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
Total of residents population (people)	22,492,000	23,145,000	23,833,000
Overall number of mobile phone subscribers (subscriber)	8,312,773	11,085,344	12,349,860
Overall Internet subscribers (subscriber)	452,132	581,752	690,229
Total Internet users	2,260,660	4,072,264	4,831,603
Total Telephone station capacity (equipped)	1,336,824	1,353,839	1,360,373
Number of working telephone lines (line)	996,981	1,046,263	1,075,412
Telephone density (telephone/ per 100 inhabitances)	4.43%	4.52%	4.51%
Total telecommunications centers and Internet cafés (number)	16,234	16,772	17,109

Source: General Statistical Organization, Ministry of Planning and International Cooperation (2012). Available online at <http://www.cso-yemen.org>

## **2.2 E-Government development in Yemen**

Like many developing countries, the Yemeni government is still trying to implement IT in governmental organizations, as well as establishing projects as a step forward to adopting e-Government, such as the National Program for Information Technology (also known as Yemen e-Government project 2003) and the official government

portal, which was announced in 2009, (Yemeni e-Government documentation, 2009).

### **2.2.1 UN e-Government ranking for Yemen**

The United Nations (UN) e-Government Survey 2012, showed that Yemen is still ranked as one of the lowest countries in terms of e-Government development between 2010 and 2012, (United Nations e-Government Survey, 2012).

According to UN e-Government Survey 2012, the majority of countries in this region have witnessed noticeable changes in their respective rankings. Specifically, the United Arab Emirates (0.7344) has emerged as the new leader in the region, and Bahrain (0.6946) and Saudi Arabia (0.6658) were ranked as the second and third in the region, respectively. Cyprus held the fourth position in 2010 and 2012; Syria and Iraq also held their positions in the ranking between 2010 and 2012. Additionally, Qatar, Lebanon, Azerbaijan, Oman, Armenia, and Georgia improved their rankings in the 2012 Survey, while, Jordan, Kuwait, and Turkey dropped in the rankings. However, Yemen dropped in the ranking from 164 in 2010 to 167 in 2012 making this country last in the region.

Table 2-2 compares Yemen to other countries in western Asia region and shows that Yemen is one of the lowest countries in terms of e-Government development between 2010 and 2012 as introduced by the UN e-Government Survey in 2012.

**Table 2-2: E-Government development in western Asia countries (including Yemen)  
between 2010 and 2012.**

Country	E-Government development index value		World e-Government development ranking	
	2012	2010	2012	2010
United Arab Emirates	0.7344	0.5349	28	49
Bahrain	0.6946	0.7363	36	13
Saudi Arabia	0.6658	0.5142	41	58
Cyprus	0.6508	0.5705	45	42
Qatar	0.6405	0.4928	48	62
Kuwait	0.5944	0.5290	63	50
Oman	0.5944	0.4576	64	82
Georgia	0.5563	0.4248	72	100
Turkey	0.5281	0.4780	80	69
Lebanon	0.5139	0.4388	87	93
Armenia	0.4997	0.4025	94	110
Azerbaijan	0.4984	0.4571	96	83
Jordan	0.4884	0.5278	98	51
Syrian Arab Republic	0.3705	0.3103	128	133
Iraq	0.3409	0.2996	137	136
<b>Yemen</b>	<b>0.2472</b>	<b>0.2154</b>	<b>167</b>	<b>164</b>

Source: United Nations e-Government Survey 2012, “E-Government for the People”.

### 2.2.2 History Development

As the previous Table 2-4 compare Yemen to other countries around the region and shows that Yemen is still one of the lowest countries in term of e-Government development between 2010 and 2012. Though Yemen like other developing country is trying to implement e-Government system, and Yemeni government went through e-Government projects as follows:

***a) First e-Government Project in Yemen (2003)***

The first endeavor to build e-Government in Yemen was announced in 2003 and its websites were launched in the same year, although they were failures; however, the project was derailed in the absence of a change-inducing environment. Moreover, most of the available information systems are lacking in terms of technical compatibility and updated information (Dada, 2005). This first e-Government project faced some problems which led to the failure of the project. These problems can be summarized as follows:

- Absence of clear vision and strategy for the purpose of the e-Government stages;
- Lack of coordination and collaboration between the e-Government project team and different stockholders from the relative government and agencies;
- Absence of political leadership;
- Conflicting priorities of the responsibilities among involved agencies for the e-Government project;
- Reluctance of some organizations to diffuse their information;
- Lack of technical knowledge and shared technical culture;
- Lack of sense and social awareness of the importance of e-Government system;
- Lack of clear methodologies and models;
- Lack of e-readiness among government organizations employees, including the top management and leaders, and;
- Gap between the project vision and the real situation.

As a result of the above factors, the 2003 project failed. The failure of the first e-Government project was seen from the perspective of other top management as



adjournment and not failure because the government was giving priority for other projects such as; improving education sectors and health sectors.

***b) Second e-Government Project in Yemen (2008)***

This project was begun in September 2008. Its main aim was to completely design and implements the Yemen official electronic portal. The first stage was to design the electronic information content of all government organizations, taking into account the need of daily updating. In this stage the citizen got benefit from e-Government website in two different ways. The first way is to find information from the portal via the Internet. The second way is to inquire about government services via emails and contacts available on the government portal.

From this new e-Government plan, there were projects working in parallel with the main project aim of developing a shared technical culture. Other projects aimed to diffuse the technical skills by offering many technical courses in locations throughout Yemen (e.g., summer camps).

The second stage in the new e-Government plan was to consider the concept of one-way interaction between e-Government and citizens (semi-interaction). The third stage of this plan will be to focus on e-payment. This stage will aim for full interaction in two directions.

**2.2.3 Current situation**

The Yemeni e-Government portal at [www.yemen.gov.ye](http://www.yemen.gov.ye) is the first step toward the full implementation of the e-Government project. The main aim of this government portal is to link all of the websites of all government ministries and agencies into one unified site. This electronic portal must be the official source of all government

information. This portal can be considered as the first track to the e-services and the first step toward full e-Government. This portal has many benefits, including the following: reducing the cost of searching for information, reducing the time and effort involved in searching for information, and preparing society for the next step (i.e., semi interaction with government websites).

One of the main reasons behind the success of designing and launching such a government portal linking to all government ministries is the project team, which consists of ten members, five from the Ministry of Telecommunication and Information Technology for technical and hosting issues and five from the Information Center of the Secretary of the Cabinet in the Prime Minister's office for administration and policy issues. This helps to motivate the various ministries and related agencies to upload their information to the official portal in a particular timeframe and each of them take the responsibility for upgrading their information. This could not be possible without the participation of the Secretary of the Cabinet in the Prime Minister's office, who gives directions and instructions to the different ministries and agencies to uphold their responsibilities with respect to the deadlines specified by the project team.

### **2.3 Challenges for e-Government implementation in developing countries**

E-Government challenges or (barriers) are the real perceived characteristics within the social, technological, legal and institutional contexts that affect the development of e-Government through the supply and demand for e-Government services by the different stakeholders (Song, 2002). In general, developing countries are lagging

behind developed countries in their levels of e-Government adoption because they face serious issues and challenges (Dada, 2005; ESCWA, 2005; Gant, 2008; Heeks, 2003; Sang *et al.*, 2010). For example, Heeks (2003) provided a baseline estimate produced for e-Government projects in developing countries as:

- 35% are total failures,
- 50% are partial success, and
- 15% are successes.

The above high rate of e-Government projects failure implies that developing countries face many challenges to implement a successful e-Government system. Heeks (2003) identified a key challenge to implementing e-Government in developing countries as a lack of strategic e-readiness. This key challenge has several strategic e-readiness factors that include technological infrastructure, legal infrastructure, institutional infrastructure, human infrastructure, leadership, and strategic thinking.

The ESCWA report (2003) has summarized number of obstacles and challenges in the process of creating information society via electronic government in Middle East as follows:

- The digital gap between communities. Some aspects of this gap include slow economy growth, low ability of creation, and fast learning and training to keep track of international scientific development.
- Lack of national policies regarding science and technology developments which, if present, should create opportunities for all citizens, regardless of their incomes and education, to connect to the Internet and national information networks.

- Lack of policies lead to the lack of organizational and legislation laws that, if maintained, could otherwise be used to organize the expansion of technology and deepen its effect on the society.
- Lack of sufficient ICT applications that enhance the information society. The ICT infrastructure needs proper funding and facilities to be completed.
- The ICT sector is weak in most Middle East countries; therefore, needs a large financial investment that would support: communications, electronics, digital content and software services and industries.
- Lack of experienced work forces that are essential to building information societies.
- The existence of traditional and technological illiteracy in the Arab World makes it difficult for such a population to interact with the changes needed in an information society.
- Development of the Arabian digital content. The lack of Arabian websites and the limited information via the Internet on English language affects the development of an information society.

There are numerous of factors to the development, acceptance, and use of e-Government services in developing countries, and many other scholars differentiate these barriers from different aspects and areas (Rakhmanov, 2009). This study will add to these factors with a focus on the challenges of e-Government implementation in developing countries in terms of six types of issues , Administrative, Legislative, Organizational, Technological, Citizen-Centric, and Financial challenges.

### 2.3.1 Administrative Challenges

Administrative challenges are related to a lack of appropriate business models, justification of costs, availability and allocation of skilled e-Government leaders and the need for structural reforms (Rakhmanov, 2009). These challenges affect the development of government organizations' capabilities to provide online government services and transactions. However, these challenges can also be classified into factors such as leadership, top management support, effective project management, Vision and Strategy as explained below.

*a) Leadership:* Heeks (2003) identified a lack of leadership as a major challenge for e-Government success in developing countries. Variations in support among leadership are among the critical challenges in developing countries. This challenge stems from the fact that, even though leadership in developing countries clearly supports the development of e-Government and ICTs, their understanding of these systems varies significantly (Sang *et al.*, 2009).

*b) Top Management Support:* Top management support is one of the key factors in the adoption and implementation of e-Government within the government sector.

Adoption of e-Government projects needs strong management support especially in its early stages of implementation which can be costly to instantiate and take a long time to deliver results. Top management support refers to the commitment from top management to provide a positive environment that encourages participation in e-Government applications (Alshehri and Drew, 2010).

From the researcher's viewpoint, in order to gain support for e-Government projects in Yemen, leaders and top management might benefit by increasing their

understanding of the value of e-Government and the advantages and benefits that be gained from these projects.

*c) Effective project management:* Effective project management includes defining clear responsibilities, having good planning and consideration of risk, good monitoring and control system in place, good organization of resources, and well-managed partnerships between public agencies and public-private joint initiatives (Hossan *et al.*, 2006).

*d) Vision:* The public sector in developing countries presents unique challenges for leadership. Accordingly, changing and hazy visions of leadership confuse expectations for reforms and leaders (OECD, 2003). Vision is the roadmap for reaching the intended objectives, which becomes the goal of all decisions and plans in an agency. Every project or initiative needs to be rooted in a careful, analytical, and dynamic strategy (Ndou, 2004).

*e) Strategy:* A main challenge for an e-Government project is the establishment of an appropriate and tailored strategy. E-Government projects are large, costly, and long term, and require organizational change and clear strategy (Alshehri and Drew, 2010; ESCWA, 2007; Heeks, 2003; Hossan *et al.*, 2006; Ndou, 2004). Therefore, the government must have a clear vision and strategy to overcome barriers to change. Part of the strategy is engaging in a rigorous assessment of the current situation, understanding the reality on the ground, and taking an inventory of existing projects, articulating costs, and understanding the impacts and benefits of programs as well as continuously monitoring and evaluating project upgrading (Ndou, 2004).

### 2.3.2 Legislative Challenges

Most of the time, government organizations are created and operated by virtue of a specific formal rule or group of rules. In making decisions, including those in e-Government or IT projects, public managers must consider a large number of restrictive laws and regulations (Gil-Garcia and Pardo, 2005). These legal challenges are related to the existence of an appropriate legal framework as well as rules and detailed policies (laws, regulations, directives) that allow or facilitate the deployment of electronic government and services.

*a) Legal Framework:* Because the concept of e-Government is radically changing the way the public sector does business, new legal issues have arisen. As a result, e-Government implementation requires the development of a legal framework and range of legislative changes. The success of e-Government implementation and its services in developing countries are highly dependent on government's role in ensuring the development of a proper legal framework for operation (Basu, 2004). Establishing protections and legal reforms are also needed to ensure, among other things, the privacy, security, and legal recognition of electronic interactions and electronic signatures (Ndou, 2004).

*b) Rules and detailed policy:* Processing e-Government principles and functions requires a range of new rules, policies, laws, and legislative changes to address electronic activities and include electronic signatures, electronic archiving, and freedom of information, data protection, computer crime, intellectual property rights, and copyright issues. However, lack of policies leads to a lack of organizational and legislation laws that limit the ability to organize the expansion of technology and

deepen its effect on society. According to ESCWA (2007), one problem in creating an appropriate legal framework is that existing laws may actually reduce the contribution of private sectors in several activities that are needed to build an information society in developing countries.

### **2.3.3 Organizational Challenges**

Organizational challenges are also prevalent with the adoption of e-Government. These challenges include organizational structure, collaboration and cooperation between government agencies, and employee resistance to change. Any government contemplating adopting such technologies must consider and treat these issues carefully (Alshehri and Drew, 2010). In addition, researchers have found that identifying relevant stakeholders (especially end-users) and getting them involved in the project development process is an effective strategy in overcoming organizational challenges (Gil-Garcia and Pardo, 2005).

a) *Organizational Structure:* Electronic government systems are a new phenomenon that, in many developing countries, means the transformation from manual methods of work to electronic methods. Therefore, governments in developing countries often face common challenges that arise from traditional governmental structures and must be changed. This is especially necessary so appropriate organizational redesign of organizations can occur to meet the required technological infrastructure and readiness to implement and adopt e-Government and ICT systems. These organizational innovations significantly influence the success of e-Government adoption. As a result, governments introduce innovations into their organizational structures, practices, and capacities, as well as into the way they



mobilize, deploy, and utilize human capital, information, technological, and financial resources for service delivery to citizens (UN, 2008).

b) Lack of Collaboration and cooperation: Collaboration and cooperation at local, regional, and national levels, as well as between public and private organizations, are important elements in the e-Government development process (Ndou, 2004). Successful e-Government requires that many government agencies, departments, policy makers cooperate and coordinate their efforts to prepare the technology and support infrastructure (Heeks, 2007; OECD, 2003).

c) Resistance to change: Resistance to change refers to barriers of resistance to innovation at all levels of government personnel that can slow down, impair, or prevent the necessary redesign of organizations and their processes required to implement e-Government and deliver effective government services online.

According to Ndou (2004), in many developing countries, employee resistance to change is still the most significant barrier in a successful change to an electronic system of governments. Employees fear change, in general, and ICT and e-Government applications, in particular, because they believe these technologies might replace them and they would lose their job. Addressing resistance successfully means ensuring the existence of incentives for employees to learn, change, and establish well-structured plans that embrace employee participation during all stages of a change process. For example, in Yemen, government employees resist the shift of power that result from the introduction of e-Government. Further, the initiation of this technology will require structural reforms and modifications of job descriptions and duties.

### **2.3.4 Technological Challenges**

The most important challenge that governments in developing countries face in the successful implementation of e-Government is technological standardization (OECD, 2003; UN, 2008; Sang *et al.*, 2009). However, inadequate technological infrastructure is the most critical contributing factor in the failure of e-Government implementation (Hossan *et al.*, 2006). These technological challenges also include inadequate technological infrastructure, collaboration and cooperation between government agencies, and employees' resistance to change.

a) Inadequate technological infrastructure: In many developing countries, especially in Yemen, the poor telecommunication infrastructure is a major barrier for quality implementation of electronic governance and online government service delivery. The operation of e-Government requires the construction of a strong technologically sound telecommunications infrastructure. However, in most Middle East countries, a significant financial investment is required to develop this infrastructure that could support communications, electronics, digital content, and software services and industries (Alnagi and Hamdan, 2009; Bhuiyan, 2011).

b) Lack of Security and Privacy of Information: Privacy and security are reoccurring issues in e-commerce and e-Government research (Belanger and Hiller, 2006). They are also serious factors in the implementation stage of e-Government for developing countries. Securing government's information and users' personal data from threats, hackers, and unauthorized access are among the serious technical challenges of e-Government implementation. Absence of these security measures leads to the expectation of leaking the government's or users' information. Further,

underestimating the importance of these factors can result in unauthorized access to sensitive information, loss of trust etc., which could lead to e-Government failure (Alsheri and Drew, 2010; Ndou, 2004). In summary, privacy and security in e-Government systems and services seem to be a significant challenge in the implementation and adoption processes in Yemen.

c) Lack of qualified personnel and technical training: Qualified technical staff and proper IT training are critical success factors to avoid facing obstacles in e-Government adoption. Lack of IT professionals and required computer training courses are major issues in developing countries (OECD, 2003). According to Alsheri and Drew (2010), the training of the exiting governmental staff members is also an important factor to accelerate the adoption and diffusion of any new technology. Therefore, investing in training for government employees is vital because these individuals have strong workplace knowledge that will help them to adopt and integrate the use of the e-Government system, services, and applications.

In Yemen and neighbor countries, it is urgent and highly important to focus on training for all government employees in terms of basic IT and improving their computer literacy by enabling them to have the International Computer Driving License (ICDL). The Yemen government has often argued that their employees are not well trained in using information technologies, and this inadequate training has result in resistance to change to an electronic system of government. To address human capital development issues, knowledge management initiatives are required to focus on staff training, seminars, and workshops to create the basic skills to handle for e-Government.

### 2.3.5 Citizen-Centric Challenges

Citizen-centric challenges include cultural, social, and economic barriers that affect the processes of adoption and implementation of e-Government in developing countries. The current study aimed to add contribution factors to these challenges and categorize them as external factors that contribute to the successful implementation of e-Government system in Yemen and other similar countries.

a) **Cultural Challenges:** The adoption of e-Government systems in developing countries also includes cultural issues that governments should consider and treat carefully to achieve the goals of e-Government adoption and diffusion. To ensure successful adoption, cultural issues need careful study with planned development of interventions to aid in the acceptance and trust in the use of e-Government systems (Alshehri and Drew, 2010). This study discusses these cultural issues including culture differences in terms of, education, religion, and digital divide which are explained in the following sections:

(1) *Education:* Citizens with higher levels of education are more likely to accept and interact with any new technology and e-Government systems practically. Therefore, the Yemeni government should improve their educational systems and encourage all students to develop their technical skills to take advantage of new technology and communication skills. This education should also include English language training so individuals can be effective online communicators and share and learn about the developed technologies of the Western world effectively (Alshehri and Drew, 2010).

(2) *Religion:* Another important aspect of cultural issues in Middle East countries

especially in Yemen is religion. In Yemen, the Islamic religion and traditions diffuse through all aspects of society. Thus, it is essential for researchers to be aware of the cultural characteristics and values of the research environment throughout the nation. The religion of Islam is reflected in different aspects of social life. As a result, the researcher believes that the government should seriously consider these facts when providing e-services to its citizens and such services should be compatible with Islamic rules. To conclude, cultural issue is a critical matter that needs to be considered and treated carefully at governmental and societal levels to realize a successful e-Government system in Islamic countries (Alshehri and Drew, 2010).

(3) *Digital divide*: Many developing countries suffer from the digital divide, and are not able to deploy the appropriate ICT infrastructure for e-Government deployment (Ndou, 2004). The digital divide between wealthy, developed countries and developing countries is large with high-income economies having 416 personal computers per 1,000 people and low-income economies only 6 per 1,000 (World Bank, 2002). The digital gap between communities include aspects such as slow economy growth, low ability of creation, and fast learning and training to track international scientific development. These aspects might lead to differences in knowledge levels between the communities; and these differences are called the digital divide (ESCWA, 2007).

In addition to the above digital divides, this researcher argued that Yemen faces another digital gap between genders. Yemeni women today face many obstacles in their efforts to achieve gender equality and empowerment; gender inequality in the law remains a major problem today, and legal implementation and protections for

women are very poor (Alsebaei *et al.*, 2012).

In Yemen, only 8.2% of women report paid employment. Additionally, the Yemen government does not have effective mechanisms in place to enforce the compulsory education for cultural and economic reasons. Gender inequalities in education persisted in 2002, with female literacy at only 28.5% while, this is contrast to 69.5% male literacy. In the area of ICT the typical Yemeni Internet users of males around 86% of Yemeni internet users are male. The low internet access rate among females can be attributed to a number of social and economical factors; however, the high illiteracy rate among adult females 74.8% is probably the main contributing factor (ESCWA, 2007).

b) **Social Challenges:** The adoption of e-Government in developing countries also faces significant social issues that must be considered and treated carefully by government to achieve e-Government adoption and implementation (Alshehri and Drew, 2010). Therefore, issues relating to Yemeni culture and societal structure should be addressed carefully to influence and convince Yemeni citizens to participate and become involved in e-Government systems and services. This study included social challenges into two important social factors, namely, trust, and information availability.

(1) *Trust:* Trust in the internet and other new technology is an essential element of e-Government adoption. Citizens must have confidence in both the government and the enabling technologies, and they must believe that these mechanisms are in place to ensure secure and private data transmission over such an impersonal medium (Belanger and Hiller, 2006; Gil-Garcia and Helbig, 2006; Moon, 2002; Ndou, 2004).

However, it is understandable that, citizens want to ensure their information and other data are safe when using e-services. The indications are that governments should provide a secure access point to their online services to develop citizen trust (Alsheri and Drew, 2010). Additionally, government agencies should take advantage of trust-building mechanisms used by e-commerce vendors such as posting security and privacy seals, to encourage adoption of e-Government system services (Belenger and Carter, 2008).

Citizens have a negative attitude against e-Government and electronic online services and they still prefer conducting business with the government through paper-based administration and physical presence, or by contacting authorities by phone and following up face-to-face rather than using on-line services. Many Yemen citizens distrust the government, especially where there has been a history of political instability and large-scale corruption. Other barriers to citizens using e-Government services include unfamiliarity with ICT, lack of access, and lack of training. These reasons indicate that people are worried about trusting the government for online interactions because of concerns about privacy and security of their personal data. However, a high level of confidence and trust among all users will be the foundation of successful e-Government initiatives. To ensure that public and government employees will be partners in the e-Government effort, it is important for the Yemen government to build a trust bridge to the citizens.

(2) *Information Availability*: In many developing countries, especially Yemen citizens and enterprises are not always informed of the web addresses through which e-Government websites are available, or even whether an e-Government portal exist

at all. In Yemen, the e-government portal was developed and implemented in 2009 and allows users to obtain certain information. This portal may allow for more intensification of interaction between government and society, but it is a one-way interaction. Today, only ministries have their own websites, which are connected to the government portal (Alsebaei, 2012a). However, one review shows that almost 50% of ministries websites are not updated on weekly basis (Yemeni e-Government documentation, 2009).

### **2.3.6 Financial Challenges**

Worldwide, the most significant barrier to the implementation of e-Government is a lack of money (Alshehri and Drew, 2010; UN e-Government survey, 2012). Operation of e-governance requires the construction of a strong technological infrastructure of telecommunications. Therefore, a significant financial investment is required to develop this infrastructure (Bhuiyan, 2011).

Of note, this study was limited to the perspective of Yemeni government employees and included different policy makers such as leaders from the public sector and, the e-Government project team or IT managers view whose main concerns are e-Government implementation costs. As a result, the study outcomes showed that the majority of participants count the lack of funding as an essential barrier for e-Government adoption and implementation in Yemen. This barrier was the highest ranking for e-Government system adoption. For the present study, the researcher viewed these financial barriers from two identified obstacles, limited budget, and low personnel income.



a) **Limited Budget:** In developing countries, especially in most of Middle East region, the ICT sector is weak because of budgets constraints. Specifically, developing countries need a large financial investment that can support communications, electronics, digital content, and software services and industries (Alnagi and Hamdan, 2009). To implement an e-Government project in a developing country, governments need to understand the available resources that can be devoted to achieve the project's reasonable and attainable goals. Additionally, the availability of sufficient funding is a significant factor for government organizations to move toward e-Government and e-service success. (Hassan *et al.*, 2010). However, according to OECD (2003), the difficulty of measuring costs and potential benefits for e-Government projects makes it difficult to develop funding cases for projects and compare alternatives in a budget-setting context. In a democratic system, such as Yemen, the government needs to obtain budget approval from the national parliament for any project.

b) **Personnel Income:** Online activities such as scientific research, online shopping, e-commerce, and internet government transactions are either underutilized or virtually not-existent because of the lack of institutional support, Low Gross Product (GDP) per capita, and poor Telecommunication infrastructure. Even though these pricing systems are affordable for individuals with high income, the General National Income (GNI) per capita in Yemen is only US\$370; therefore, most Yemenis find this cost very expensive. Table 2-3 summarizes the above discussed challenges for e-Government in developing Countries.

**Table 2-3: Challenges for e-Government Adoption in Developing Countries**

<b>Category</b>	<b>Challenge</b>	<b>Related Literature</b>
<b>Administrative</b>	Leadership	Heeks (2003); Sang <i>et al.</i> (2009).
	Top Management Support	Ndou (2004); Hossan <i>et al.</i> (2006); Alshehri and Drew (2010).
	Vision	OECD (2001); Ndou (2004).
	Strategy	Heeks (2003); Ndu (2004); ESCWA (2007); Hossan <i>et al.</i> , (2006); Alshehri and Drew (2010).
<b>Legislative</b>	Legal Framework	Gil-Garcia and Pardo (2005), Ndu (2004).
	Detailed Policies	ESCWA (2003), Basu (2004).
<b>Organizational</b>	Organizational Structure	UN e-Government survey (2008).
	Collaboration	OECD (2003); Ndou (2004); Heeks (2007).
	Resistance to Change	Ndou, (2004); Gil-Garcia and Pardo (2005).
<b>Technological</b>	Inadequate Technological Infrastructure	Bhuiyan (2011); Alnagi and Hamdan (2009); Sang <i>et al.</i> (2009); UN (2008); OECD (2003).
	Lack of Security and Privacy	Alsheri and Drew (2010); Belanger and Hiller (2006); Ndou (2004).
	Lack of qualified personal & technical Training	Alsheri and Drew (2010); OECD (2003).
<b>Citizen-Centric</b>	Cultural challenges (Education, Religion, Digital gap)	Alsebaeai <i>et al.</i> (2012); Alsheri and Drew (2010); Ndou (2004); OECD (2003); ESCWA (2003); World Bank (2002);
	Social Challenges (Trust, Information Availability)	Alsebaeai (2012a), Alsheri and Drew (2010); Belenger and Carter (2008); Gil-Garcia and Helbig (2006); Ndou (2004); Moon (2002).
<b>Financial</b>	Limited Budget	Hassan <i>et al.</i> (2010); Alnagi and Hamdan (2009); OECD (2003).
	Personnel Income	ESCWA (2007)

## **2.4 Problem discussion on e-Government implementation in Yemen**

Yemen went through a significant change in 1990 as the country transitioned from conflict to unity, from a centrally-planned economy to a market and oil-based economy, and from a one-party rule to a democratic system of governance. However, despite this political progress, the system of Yemeni governance has not improved in comparison, traditional management systems using paper forms are the still main way to gather routine administrative approvals in most government agencies; after forms are completed, they are filed, retrieved, and archived. These environments are usually not effective and the workload caused by paper forms is enormous. A paper-based system also requires physical presence of applicant to the targeted government agency to submit forms and process the work. In addition, government agencies often lose documents without knowing who is responsible and, in these cases, processing documents is significantly delayed without a reasonable cause.

It is clear that the most urgent challenge is how to move from a traditional service delivery to an efficient electronic one such as e-Government. To realize this transition, government organizations should try to establish electronic services for their customers and become more citizen-oriented. To achieve this goal and the strategic advantages of an e-Government system, the government has invested significant time and money in e-Government projects. However, as with many technologies, e-Government has been accompanied by various failures.

During the last few years, the Yemen government has given attention to the importance and potential use of e-Government, which introducing and implementing this new system of governance; however, most trials have resulted in severe failures because of high rates of resistance to change by government employees. Specifically, the Yemen government announced the first e-Government project in 2003. This project failed and no positive results were observed. Following this attempt, the Yemen government introduced a new project in 2008; this e-Government realized a partial success. In 2009, the Yemen government announced the government official portal, [yemen.gov.ye](http://yemen.gov.ye), as a one-way interaction with the public; however, only information on services was provided; there is no integration and connectivity between government agencies and the portal was not frequently updated.

According to the UN e-Government Survey 2012, Yemen is still one of the lowest-ranking countries in terms of e-Government development, Yemen held its position at 164 from 2008-2010 and dropped the ranks to 167 in 2012. This position is among the lowest in a region of 196 countries. Concerning the investment costs of the e-Government system, the government depends on international funds or subsidiaries, which could result inefficient funding of government. Therefore, there are many problems and questions arose during the implementation stages of e-Government in Yemen.

These above mentioned failure results can be attributed to many factors, the most critical of which is that, before designing and implementation of e-Government system, no in-depth study or analysis utilized a proper survey to investigate the opinions and preferences of users, developers, and government authorities or

quantitative analysis to assess the relative importance of the various success factors.

Given the above problems descriptions, it can be inferred that there is a need to investigate the opinions and preferences of government employees (implementers of e-Government) in different government agencies in Yemen. Additionally, it is necessary to assess the relative importance of various success factors in the implementation of e-Government agencies and analytical frameworks that are suitable for developing countries such as Yemen.

This researcher was aware of the importance of introducing the preference structure and WTP of policy makers (government employees, technical staff and decision makers) toward e-Government implementation and estimation of operational costs. Therefore, this study thoroughly analyzed preferences and heterogeneous changes to reveal important factors in implement a robust e-Government system in Yemen.

The following three chapters discuss previous literature reviews and offer analytical frameworks to address the problems of interest.

## **Chapter 3: Previous Studies and Literature Review**

This chapter includes a literature review related to ICT and e-Government adoption and contains four parts. The first part views different concepts of e-Government including definitions from different perspectives, benefits, and applications of e-Government. The second part covers recent and previous literatures on e-Government adoption in both developed and developing countries. The third part contains key existing literature of ICT and e-Government using different methodologies involved in this study. The chapter ends with a summary includes limitations of the key existing literature, contribution of the research to remedy the literature gaps.

### **3.1 E-Government Concepts**

#### **3.1.1 Definition of E-Government**

Existing literature includes many definitions for e-Government and uses term such as *digital government*, *internetworked government*, and *government online*. This section describes these different definitions of e-Government from different perspectives of experts. Starting with (Almazan, and Gil-Gracia, 2011) who defined e-Government as the selection, implementation, and use of information and

communication technologies in government to provide public services, improve managerial effectiveness, and promote democratic values and mechanisms, as well as the development of a regulatory framework that facilitates information-intensive initiatives and fosters the knowledge society. E-Government composes the use of ICT with the objective of delivering public services to citizens and businesses electronically. Further, e-Government implicates the transformation of government services that are available to citizens using new organizational processes and technological trends (ITU, 2008).

E-Government uses ICT technologies to facilitate and meliorate the efficiency with which the government services are accessible to citizens, employees, agencies, and businesses; and enhances the accessibility and convenience of government information and services to citizens (Carter and Belanger, 2005).

To this extent, e-Government facilitates the integrated mode of governance and strengthens the relationships between governments and their citizens. Specifically, the goal is to create more accessible government service that are relevant and focused on citizens, and that meet citizens' expectations and needs.

From this view, this researcher defined e-Government as a way for governments to use the most innovative information and communication technologies, particularly internet-based technology, to provide stakeholders (citizens, businesses) access to government information and deliver government services efficiently. Heeks (2003) declared that the definition of e-Government is the use of ICT technologies as a means of improving the public sectors' activities. According to the World Bank (2002), e-Government denotes the use of IT by government agencies that have the

power to transform relations with businesses, citizens, and other divisions of government. Moreover, Layne and Lee (2001) defined e-Government as a government's use of technology, such as the Internet, to aid the delivery of information and services to citizens, employees, business partners, other agencies and other government entities.

OECD (2003) defined e-Government as the use of information and communication technologies, and particularly the internet, as a tool to achieve better government". Considering this definition, the internet is as an essential requirement and possible medium for e-Government.

Table 3-1 represents these definitions of e-Government from different broad and narrow perspectives as follows:



**Table 3-1: Examples of e-Government broad and narrow definitions**

<b>Perspective</b>	<b>E-Government Definition</b>	<b>Author</b>
Public services implementation	The selection, implementation, and use of ICT in government to provide public services, improve managerial effectiveness, and promote democratic values and mechanisms.	Almazan and Gil-Gracia, (2011)
Transformation of public services	E-Government entails the transformation of public services available to citizens using new organizational processes as well as new technological trends	ITU (2008)
Governance	The use of ICTs to improve the efficiency, effectiveness, transparency and accountability of government.	World Bank (2002)
E-Government dimension	E-Government should have four distinct aspects of activity; e-administration, e-services, e-citizens and e-society.	Ndou (2004)
Using Technology for political reasons	The use of Information and Communication Technologies (ICTs), and particularly the Internet, as tools to achieve better government.	OECD (2003)
Reforming public sector	E-Government asserts that the use of information and communication technologies as a means to improve the activities of public sector organizations.	Heeks (2003)
Relationships with partners	A government's use the Internet technology to aid the delivery of services and information to citizens, employees, business partners, other agencies and other government entities.	Layne and Lee (2001)

### **3.1.2 E-Government Benefits**

The OECD (2009) e-Government Study titled with ‘Rethinking e-Government Services: User Centered Approach’ thoroughly examined e-Government initiatives in its members’ countries (Australia, Austria, Belgium, Canada, Czech Republic,

Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxemburg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, UK, USA), and listed the benefits of e-Government as follows:

- Improves efficiency in processing large quantities of data which makes it easy to find information about government services;
- Improves services through better understanding of users' requirements, thus aiming for seamless online services to be available 24/7;
- Helps achieve specific policy outcomes by enabling stakeholders to share information and ideas;
- Assists a government's economic policy objectives by promoting productivity gains inherent in ICT and e-commerce;
- Contributes to governmental reform by improving transparency, facilitating information sharing and highlighting internal inconsistencies; and
- Helps in building trust between governments and their citizens, an essential factor in good governance by using Internet-based strategies to involve citizens in the policy process, illustrating government transparency and accountability.

### **3.1.4 E-Government Applications**

E-Government applications also called as "E-Government functions" offers services to those within its jurisdiction to transact electronically with the government. These services differ according to users' needs and ICT capacity, and this diversity has given rise to the development of different applications of e-Government, described in the following subsections:

G2G: interconnection between the government agencies,

G2C: interconnection between government agencies and citizens,

G2B: the government interconnection with the private business sector,

G2E: the government interconnection with the public and private employees.

### **1) Government- to- Government (G2G):**

G2G function involves interconnections between government agencies. This function or application serves both internal processes and activities (between public organizations themselves) and external ones (between government organizations, citizens and businesses). The ultimate aim of G2G function is to enhance inter-government organizations' processes by streamlining collaboration and coordination.

In order to realize a one- window access, collaboration and cooperation among different governmental agencies and departments is required. Online communication allows government agencies to cooperate and share databases, resources, and pool capabilities and skills, thereby enhancing the efficiency and effectively of processes (Sharifi and Zarei, 2004). Most of government routine transactions need collaboration and data entry from different government and public organizations. The e-Government application serves both internal processes and activities (between government organizations themselves) and external ones also (between government organizations, citizens and businesses).

Collaboration between agencies is an important factor for seamless services but e-Government coordinators should maintain a balance between the benefits of collaboration and the need to preserve accountability of the individual agencies (OECD, 2003). To establish this application, association and cooperation along with different governmental departments and agencies is strictly required.

## **2) Government- to- Citizens (G2C):**

G2C function involves interconnections between government agencies and the citizens (public). This application or function, enable government organizations to publish information and contact details, and offer public services regularly online 24/7. The eventual aim of G2C is to provide users various options and communication channels for government transactions.

G2C allows public to access government services and information straightaway, conveniently, from anywhere using multiple channels (e.g., PC, smart phone, Web TV or wireless device). It also enhances and strengthens their participation in local community life, e.g., “contribute to an online discussion forum or send an email” (Ndou, 2004). All government services that can be provided online come under this category of e-Government applications. With government-to-citizen (G2C) applications, the government organizations provide its information and services to the citizens with 24/7 online availability.

The initial objective of this application is to give users different options and communication channels to deal with government services. As an example, the Government Online (GOL) project in Canada that provides a client-centered service delivery across different delivery channels such as the Internet, in person, and by telephone (OECD, 2003). Another good example of such an approach can be found in Mexico’s web portal ([www.gob.mx](http://www.gob.mx)) that includes more than 1500 informative and transactional services from over 100 government institutions (OECD, 2003).

### **3) Government- to- Businesses (G2B):**

G2B function involves government communication with the private business sector. G2B allows businesses as well as individuals to have transactions with the government, (e.g., renewing registrations, paying taxes, downloading tenders' information, and many others. The government-to-business (G2B) application is as useful as the G2C system, enhancing the efficiency and quality of communication and transactions with business. Therefore, this should be thoroughly considered by the government.

Companies everywhere are conducting business-to-business (B2B) e-commerce in order to lower their costs and improve inventory control. The opportunity to access online transactions with the government reduces bureaucratic procedure and simplifies regulative processes, thereby assisting businesses to be with a greater extent of competitiveness. The delivery of integrated public services creates opportunities for government and businesses to partner together in establishing faster and cheaper Web presence (Ndou, 2004). This e-Government application also serves external business inquiries. Tourism portals are a good example of an e-Government system that benefits both foreign and local businesses.

According to OECD (2003), the Spanish government developed a web portal ([www.spain.info](http://www.spain.info)) to use as a tourism portal. The portal gathers its information from different public and private sector databases. The portal has a multilingual facility, to help tourists, and locals to plan and book holidays and accommodation packages with local businesses online.

#### **4) Government- to- Employees (G2E):**

G2E function involves interconnections between government agencies and the employees from different sectors (public and private). G2E is per chance the least adopted application of e-Government. Countries and scholars around the world usually center on the first three applications only; others also consider G2E function as an integral part of G2G.

G2E is an effective way to provide e-learning to bring employees together and to promote knowledge sharing among them. It gives employees the ability to access relevant information regarding: compensation and benefit policies, training and learning opportunities, civil rights laws, etc (Ndou, 2004). G2E is another large area which requires a full attention G2E facilitates the management and communicates with government employees in order to make e-career and e-office.

Overall, government of Yemen, however, started the first function (G2G) which consists of interconnections between government agencies but not as required. Yet, there is no full interaction with citizens as they can only browse information about government services from the different government agencies through the official government portal, which was announced in 2009. Moreover, there is no electronic interaction between the Yemeni government and the private business sector as well.

### **3.2 E-Government Adoption Studies**

#### **3.2.1 The Developed Countries**

In the last decade, most developed countries have developed e-Government services as alternative channels to deliver public service. Even though those countries have

implemented e-Government successfully, most have concentrate on e-Government to electronically enable present front-office processes without substantial improvement or efficiency (Irani *et al.*, 2007; Weerakkody *et al.*, 2011).

Weerakkody *et al.* (2011) used a case study to analyze how the perspectives of e-Government strategy, vision, and organizational change influence the implementation and adoption of e-Government in developed and transitioning countries in Europe. Specifically, the researcher offered a comparative study of e-Government strategies, development, and implementation between the UK (developed economy) and Slovakia (transitioning economy) to better understand the challenges that transitioning and developed economies in Europe face in their efforts to implement and diffuse e-Government, and to identify lessons to enable transitioning economies to develop appropriate strategies for e-Government implementation and diffusion. In this respect, the current research also aimed to draw lessons on how national strategies are interpreted at the local level during implementation in two different economies in Europe. Weerakkody *et al.* (2011) argued that the elaboration of e-Government experiments for European transitioning countries and lessons learned from advanced countries that designate financial, political, social, organizational, and strategic issues are required when formulating plans for e-Government adoption and development. However, this study's empirical evident demonstrates the need to skew central and local e-Government plans, political will and consignment, guidelines for local-level implementation, the development of user-centered solutions, strong leadership, and a mutual understanding of the benefits of e-Government.

Ganapati and Reddick (2012) investigated the adoption of open e-Government initiatives in state governments within the United States on three dimensions of open government as introduced by a U.S. President's administration, transparency, participation, and collaboration. They conducted a survey for the Chief Information Officers (CIOs) of United States local governments to define the level of adoption. Findings demonstrated that open e-Government initiatives were partially developed. Additionally, almost two-thirds of the CIOs surveyed believed that they had reached high levels of open e-Government; however, fewer felt similarly with respect to each mainstay of the open government. Conversely, a majority of CIOs conveyed confidence in the accomplishment of transparency and were less optimistic toward achieving precocious methods in citizen participation or cooperation among agencies. However, these findings are revelatory and depict that few local state governments in the United States have concertized policies for general transparency efforts. Yet, this study concluded that CIOs sensed that transparency has been reached to a better degree than has citizen participation and cooperation. This finding discloses the opportunity for additional growth along these dimensions.

Chan and Pan (2008) studied the research and practice of e-Government systems implementation by conducting a comparative case study of two e-Governments in a single government agency in Singapore. The comparative analysis of these systems was conducted using stakeholder theory as a sense-making theoretical lens. In the literature on e-Government systems implementation, one relevant issue that has been elevated is the need to involve users in e-Government systems. In fact, researchers have exalted such participation as a key issue in this discipline (Carter and Belanger,



2005; Chan and Pan, 2008). However, a number of e-Government scholars have preserved stakeholder theory as an auspicious theoretical lens for developing the incipient e-Government phenomenon as governments essentially function within a complex stakeholder environment where performance is scrutinized and held accountable by stakeholders (Chan and Pan, 2008).

Chan and Pan (2008) generated four findings that pertained to the form and strategies of user engagement in e-Government system implementation. The first finding proffered the alternative to engage a salient intermediary. The second finding suggested that user engagement in e-Government system implementation was not merely about attracting user participation, but inculcating strategic convergence of interest. Chan and Pan also identified the need to coalesce coercion and conviction in engaging stakeholders in e-Government system implementation. Finally, the researchers posited that sustained engagement of users in e-Government system implementation could help enhance user acceptance and contribute to success of the implementation. These findings provided the author of this dissertation insight into examining government employees' practices of user engagement in e-Government system implementation, especially because most existing studies on user engagement are not sensitized to the context of e-Government implementation.

Kim *et al.* (2007) analyzed and described the experiences of e-Government implementation at the Supreme Court Registry Office as an in-depth case study in South Korea. The authors used retrospective data by conducting interviews and gathering documentation as key data collection instruments to explore a diversity of implementation issues within the e-Government initiative. The findings included

the alliance of technology and business processes; integration of resources into core business activities; integrating stakeholders' commitment and trust; and an understanding of the theoretical role of organizational learning, which could enhance the institutionalization and adoption of e-Government initiatives. However, Kim *et al.* also provided major research and practical implications for future research. Specifically, this research contributed to the literature by providing a processual perspective on the way an e-Government project is implemented in a public sector organization. For practitioners, this study demonstrated that managers should not confine the involvement of stakeholders only to the design and development phases. Rather, engaging stakeholders after system rollout can enable managers to correctly assess stakeholders' overall acceptance of the system and gather feedback for continual system improvement. For this reason, it is important to have sufficient and effective means of communication between the various stakeholders. Kim *et al.* concluded that it is important to continually generate an effective learning environment as individual organizational members become comfortable with new knowledge that is put in practice.

For developed countries, it is likely that e-Government can be considered an innovative change. In association with the fact that the penetration rate of using e-Government services is still about average, it is certainly appropriate and adaptive to focus on end users and engage different stakeholders after full implementation and integration to assess overall acceptance of e-Government systems.

### **3.2.2 The Developing Countries**

Almazan and Gil-Garcia (2012) appraised local e-Government portals in Mexico and argued that the most important interactions between the government and citizens occur at the local level. This relationship could be closer and more frequent with the use of ICT technologies. In fact, government portals are not only channels for providing government services and information, but are also powerful tools for exchanging knowledge and information between different government entities and social actors. Almazan and Gil-Garcia also argued that, although important changes to institutional and organizational frameworks are necessary, the potential for local e-Government through networks of government and non-government sectors via Internet portals clearly exists. However, the inclusion of more interaction, participation, and collaboration mechanisms in government portals would be a very important first step for e-Government development. The researchers concluded that the progression toward citizen engagement is slow in local government and there are few efforts to increase participation, collaboration, and interaction channels on their portals. This finding indicates that local electronic governance models in Mexico are still in the initial stages and reflects the reality that e-Government in municipalities, at least in some developing countries, are still more rhetoric than practice.

Gupta *et al.* (2008) demonstrated the importance of integrating ICT applications to transform government service delivery by improving accountability, quality of services, and efficiency. They investigated the adoption of ICT to enhance government-to-employee interactions in a government organization in a developing

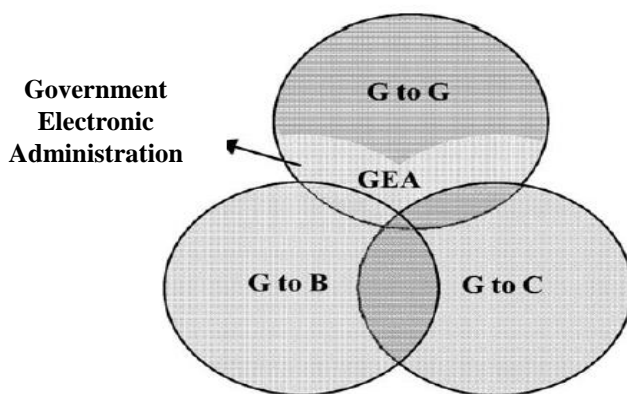
country (i.e., India). Specifically, Gupta *et al.* examined this adoption using unified theory of acceptance and use of technology model, which provides an integrated view of user acceptance. They surveyed 102 employees from a government organization to collect quantitative data. The findings suggest that effort and performance expectancy, facilitating conditions, and social influence positively influenced the use of the ICT and facilitated conditions that affect actual use in government organizations among developing countries, particularly India. Moreover, the finding did not reveal a significant effect of gender within these relationships. Gupta *et al.* concluded that government organizations need to pay special attention to providing adequate training and support during the implementation and use of such systems. However, the Gupta *et al.* (2008) study was instrumental for the research motivation of the current study concerning supply analysis using preference structure analysis of government employees.

Dada (2005) provided insight into existing trends within academic writing in the area of e-Government and the potential they hold for developing countries. This scholar argued that Heeks' (2003) model was a simplistic, 'archetype of failure' that occurred because of gaps between the design of the technology itself and the reality of the context of e-Government in developing countries. Dada provided brief views concerning the reasons that many e-Government projects fail in developing countries. The major problem is seen to be the gaps that exist between the design and reality of the system. However, Dada also argued that this concept of 'gap analysis' could be applied to almost any situation of governmental and organizational change. However, it is more difficult to successfully implement a new system of e-

Government because of various factors that may be related to culture, preconceptions, and existing rigidities. The author concluded by demonstrating a need for further research in both the failures and successes of e-Government in developing countries. Dada (2006) also provided insight for the current research motivation to provide an analysis and discussion of the most important success factors that contribute to implementing a robust e-Government system in Yemen and other developing countries.

Sharifi and Zarei (2004) acknowledged the necessity of using new electronics, information, and communication technologies, and moving toward implementation of e-Government in Iran. The authors linked their argument to the fact that enabling e-Government is a great opportunity for developing countries, such as Iran, to streamline and improve government operations, provide productive performance, and reduce existing gaps with developed countries. Sharifi and Zarei reviewed the history of e-Government in Iran and analyzed its related concepts. The researchers also highlighted the cruciality of a government-to-government system and proposed a model to develop e-Government in Iran as a tailored implementation model based on the national government structure, complexities, and experiences. The adaptive approach of this study heavily relied on a process perspective that showed the Iranian movement toward achieving a full-scale e-Government beginning with the development of the GEA. The GEA is the major subsystem and engine of the G-2-G system, and is expected to assist in improving the performance of the country's administration system and achieve a targeted democratic society. This approach is considered viable as it will minimize the complexities associated with the movement

toward an e-Government. However, moving toward these set objectives needs careful planning to use existing capabilities effectively and cause the least possible troubles and complexities. This movement shall be transformed into a national culture within the government organization and society by educating people and through promotional campaigns. Finally, the authors introduced the structural form and concepts of the Iranian G-2-G, and elaborated upon the requirements for its successful implementation. The following diagram shows the position of GEA in e-Government networks.



**Figure 3-1: Position of Government Electronic Administration in e-Government**

*Source: H. Sharifi, B. Zarei (2004) / Journal of Government Information 30 (2004) 600–619.*

Sharifi and Zarei's (2004) research helped the author of this dissertation to consider the implementation of the GEA while establishing or introducing the e-Government system in the republic of Yemen.

For developing countries, it is obvious that economies should make the effort toward a fully successful and integrated e-Government system. Further, governments should conduct supply and demand analysis as well as in-depth studies

on policy makers' preferences and decision making for e-Government system implementation. Moreover, they should work simultaneously to reduce the digital gaps between capital cities and other cities, urban and rural areas, and males and females in each developing nation.

### **3.3 The Research Methodologies' Related Literature**

Many econometric studies on the adoption of the ICT and internet have used discrete choice modeling, particularly Conjoint Analysis (CA) by employing a variety of socioeconomic, demographic, and policy variables, both at the individual and aggregate levels (Choi *et al.*, 2008, Ida and Sato, 2006; Rosston *et al.*, 2010; Savage and Waldman, 2009). Other studies have used revealed and/or stated preference data from household surveys to explain how fee and non-fee characteristics affect consumer utility. Still other studies have explored the adoption of e-Government using analytical hierarchy analysis (Chen and Wang, 2010; Ishizaka and Labib, 2011; Salmeron and Herrero, 2005; Syamsuddin, 2011). The following section provides the rationale for the current study by reviewing the existing literature on ICT, internet, e-Government adoption with regard to state-of-the-art methods for deriving utility to maximize behaviors for ICT and e-Government adoption.

#### **3.3.1 Discrete Choice Modeling**

Mangham *et al.* (2009) stated that discrete choice modeling (DCM) is a quantitative technique for eliciting individual preferences and allows researchers to uncover individuals' values of selected attributes of a program, product or service by asking them to state their choices of hypothetical alternatives. Each alternative is

expressed by several characteristics, known as attributes, and responses are used to deduct the value assigned on each attribute. Discrete choice modeling presents a reasonably straightforward task that more closely resembles a real-world decision compared to other stated preference techniques that require the individual to rank or rate alternatives (Mangham *et al.*, 2009).

Since the 1970s, scholars have developed a new measurement technique for DCM called conjoint analysis (CA), which aids marketing managers in sorting the relative importance of a product's multidimensional attributes. This technique starts with consumers' overall or global judgments about a set of complex alternatives then decomposes the original evaluations into separate and compatible utility scales by which the original global judgments can be reconstituted (Green and Rao, 1971; Green and Wind, 1975).

In the 1980s, CA gained popularity, at least among leading researchers and academics that possessed considerable statistical knowledge and computer programming skills. Eventually, CA became the most widely used and powerful survey-based instrument for measuring and predicting consumer preferences using hybrid methods to combine data sources and reduce respondent burden (Green and Srinivasan, 1990).

In the 1990s, researchers realized that the conjoint method was not the best approach for every problem; therefore, Sawtooth Software Company introduced computer software named Adaptive Conjoint Analysis, which was simpler for respondents who had difficulty dealing with numerous tables and providing accurate answers. The company also promoted the use of conjoint methods by developing



additional commercial software systems for DCM such as Choice Based Conjoint and the application of Hierarchical Bayes to estimate individual-level models from discrete choice data using full-profile CA and DCM (Hensher and Greene, 2003; Hauser and Rao, 2004).

Since 2000, academics and researchers have acknowledged that CA is rooted in solving important industry and academic problems. Using this method, researchers have achieved great lengths to making CA views more directed and linked to reality (Hauser and Rao, 2004).

Currently, CA represents one of the great successes in quantitative academic and marketing research. The studies discussed below used CA in the fields of internet and ICT adoption.

Crabtree and Vandebroek (2012) acknowledged that Choice-based conjoint studies, also referred to as stated choice analyses or discrete choice, have become a deep-rooted tool to attain insight into the choice behaviors of consumers and are widely applied and used in different research fields such as marketing, environmental, transportation, political, and health studies. Crabtree and Vandebroek included covariates in the development of efficient individual designs for the mixed logit choice model and in the analysis of corresponding choice data to increase design efficiency, estimation, and prediction accuracy. The author argued that this method is not only useful for descriptive purposes in choice experiments but that, in addition to individuals' choices, these variables might also hold information about choice behaviors, thereby aiding substantially in modeling the choice behaviors of consumers.

The author used a simulation study to investigate the effect of incorporating covariates on choice behaviors and predictions at the individual level. The simulation results showed that, when specific covariates affected consumers' choice behaviors, it was highly beneficial to incorporate these into the individualized designs and the specifications and estimates of the mixed logit choice model. Moreover, the findings suggested that the possible loss of design efficiency in prediction and estimation accuracy by including choices that were unrelated to respondents' characteristics was minimal. In contrast, at least some prior information on the effect of covariates on choice behaviors in the population is necessary to attain benefits of incorporating choice-related covariate information in the development of individualized efficient designs. Finally, Crabbe and Vandebroek showed that the use of covariates with a pilot study of 25 respondents improved considerably the efficiency of the individualized designs. This research confirms the value of covariates in discrete choice analysis and, more specially, in individual experimental design and in hierarchical Bayes estimation of a mixed logit choice model that includes covariates in the heterogeneity distribution.

Long (2010) examined consumer preferences of internet service in a rural area of Vietnam, and focused on the digital divide and rural locations as the source of preference heterogeneity. This research answered two questions: (1) How can one use government universal funding effectively and efficiently and (2) What are the valuations and demands of rural consumers to internet access considering both the internet subscription by households and public internet. The answers to these questions are critical in terms of laying a strong background for developing proper

rural universal internet service funding and related policies. The author addressed the above questions by presenting methodology framework of conjoint and discrete choice analysis that are adaptable for examining rural consumer behaviors that correspond with both the internet at the household level and at public or community centers. The author used discrete choice model based on the random utility framework to describe preference and welfare changes to rural internet adoption and usage. Additionally, this study incorporated the heterogeneity into the model using random coefficient settings and by interacting internet attributes with the demographics and characteristics of individuals to lay out the policy setting for the study.

The findings suggested that governments should fund the establishment of public internet at the center of rural communities and remote or scattered areas, subsidization of household internet access should be done in the rural centers, and the universal service funding for rural IT training should be provided to improve rural community awareness on the benefits of using the internet and to encourage willingness to access the internet. However, Long (2010) also found that a majority of rural citizens had negative marginal utility for distance to move to access to internet. Other findings speak to rural consumer preferences of internet speed. Specifically, the majority of rural citizens were indifferent to internet speed, and only a minority reported a positive preference; the marginal utility level was very low and reduced along the locations from provincial centers to remote and scattered areas. Finally the author identified a critical finding of high consumer preference to ISP brand name recommendations that the government should consider as priorities when

accepting bids for ISPs in rural internet universal service projects. The findings also showed the importance of mobile telephone services of providers that made them more preferable in choosing the internet service of the same provider.

Savage and Waldman (2005, 2009) have investigated preference and demand for broadband internet services in the United States. They measured the broadband demand and its antecedents of American consumers in three studies.

Savage and Waldman (2005) used discrete choice methodology to examine the preference and demand for broadband internet services in the United States. He estimated a random utility model for internet service choice to evaluate the importance of attributes such as always-on functionality, price, speed, installation, and reliability. The finding revealed that the most important attributes were speed, reliability of service, and non-stop connectivity. This research was extended to focus on consumers' preference of heterogeneity between rural and urban locations (Savage and Waldman, 2009). The study employed stated and revealed preferences and examined the heterogeneity in the preferences of consumers using the random parameter settings and including variation in the demographics. This study revealed that urban customers were willing to pay a substantial monthly premium subscription for improvement in speed relative to rural customers. With regard to their previous study, Savage and Waldman repeated their finding that reliability and speed are the most important internet access attributes. The authors derived Willingness-to-Pay (WTP) for single attributes and improvements in speed and reliability.

Rosston *et al.*, (2010) combined household data, obtained from choices in real market and experimental settings, with a DCM model to estimate the marginal WTP

for improvements in eight internet service attributes. Among the total sample of 6,271, they found that WTP increased with education, income, online experience, and decreased with age.

Ida and Sato (2006) used DCM by applying conjoint analysis to investigate consumer preferences for the Japanese broadband internet market. This study revealed that different access technologies led to differences in WTP. The researchers also found that people who do not prefer fiber-to-the home, for instance, have a higher WTP for such services.

Choi *et al.* (2008) studied how consumers of the Korean market form preferences toward new mobile television (TV) services. They applied conjoint analysis using the Bayesian mixed logit approach to estimate the effect of consumer preferences regarding the core attributes of the mobile TV market in South Korea. The findings indicated that consumers view subscription cost and media quality as the most important attributes of mobile TV. Nevertheless, this finding is in line with experiences from fast innovations of the mobile TV services in South Korea. Considering this finding, the authors confirmed that conjoint analysis with Bayesian mixed logit estimation, is a useful and accurate method for understanding consumer behaviors with regard to mobile TV use.

### **3.3.2 Analytical Hierarchy Process**

This section is presented in two parts. First, the researcher offers an introduction of AHP according to the foundation and history elaborated in previous literature. Second, this section reviews different e-Government adoption studies with regard to using AHP as a research method.

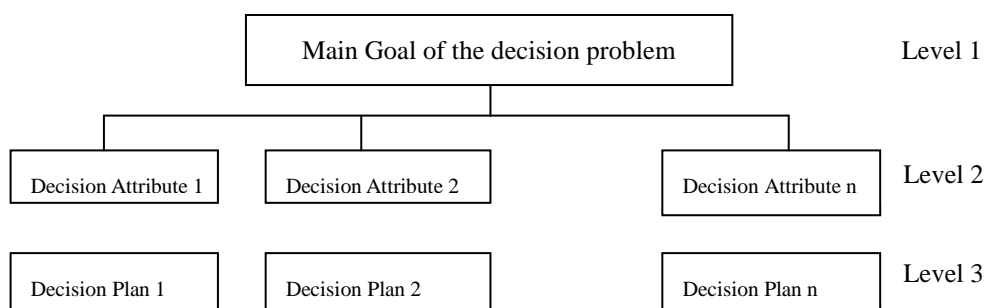
Thomas L. Saaty (1980, 1994) introduced and developed AHP as a multi-criteria methodology formulated to analyze a decision problem following a hierarchical structure. This technique is often used to model subjective decision making process based on multiple attributes (Saaty, 1997). The ranking of decision plans is carried out through trade-offs that clarify the advantages and disadvantages of policy options under circumstances of uncertainty. Additionally, AHP reflects the natural behaviors of human thinking. This technique examines the complex problems based on their interaction effects. Analytical hierarchy process is a popular approach to a Multi-Criteria Decision Making method (MCDM) and helps decision-makers to handle complex problems with multiple conflicting and subjective criteria such as location or investment selection, projects ranking, and so forth (Ishizaka and Labib, 2011).

The AHP approach requires decision makers to provide judgments for the relative importance of each criterion and then specify a preference on each criterion and for each decision alternative. Moreover, MCDM method allows decision makers to rank and select alternatives according to different criteria and is classified into Multi-Objective Decision-Making (MODM) and Multi-Attribute Decision-Making (MADM) (Pirdashti *et al.*, 2009). The AHP is a powerful tool in applying MADM by obtaining the priority vector or weights of alternatives or highly required criteria. For this purposes, Saaty (1980) used and developed the Pair-wise Comparison Method (PCM). The AHP decision making process begins by structuring the problem into a hierarchy to be considered in the work. This hierarchical design helps simplify the description of the problem and brings it into a precondition that is easily understandable. At each hierarchical level, weights of the

involved elements are mathematically calculated. Thereafter, the decision of the final goal is achieved considering the weights of criteria and alternatives.

According to Ishizaka and Labib (2011), AHP is based on four steps to solve a decision problem, problem modeling, weight valuation, weights aggregation and sensitivity analysis. The application of AHP to solve a decision problem involves four steps for a single decision maker (Saaty, 1980). These four steps used by AHP and its evolutions can be summarized as follows:

-The first step is to define and structure the problem by providing users with a focus on specific criteria and sub-criteria when allocating weights. This step is used to discompose the decision problem into a hierarchal map where attributes and plans are present as inter-related elements as shown in Figure 3-2 (Contreras *et al.*, 2008). This step is important because a different structure could lead to a different final decision. When setting up the AHP hierarchy with a large number of sub criteria, the decision maker should attempt to arrange elements into clusters so they do not differ in extreme ways (Ishizaka and Labib, 2011; Saaty, 1994).



**Figure 3-2: Example of hierarchical map for individuals' participation**

-The second step is pair-wise comparison of elements based on a nine-point weighted scale to generate input data. The AHP uses a ratio scale that is contrary to methods that use interval scales (Saaty, 1994). Comparisons are recorded in a positive reciprocal matrix (1) (Ishizaka and Labib, 2011). Each comparison is carried out to each decision element at 1–(n–1) levels, where  $n$  is the matrix size. During this process, it is possible to know which alternatives and attributes are preferred and the size of this preference gap. The data generated are aggregated according to the hierarchical map to its final value. Additionally, decision elements on the hierarchical map are used as a basis for formulating questions on the questionnaire. The decision plans (Fig. 3-2, level 3) are compared to each other according to each decision attribute (Contreras *et al.*, 2008).

$$A = [a_{ij}] = \begin{pmatrix} 1 & & a_{12} \\ & \ddots & \\ a_{1n} & & \end{pmatrix}$$

Where,  $a_{ij}$  is the comparison between element  $i$  and  $j$ .

If the matrix is perfectly consistent, the transitivity rule ( $a_{ij} = a_{ik} \cdot a_{jk}$ ) holds for all comparisons. The matrix of pair-wise comparisons ( $A=[a_{ij}]$ ) represents the intensities of the expert's preference between individual pairs of alternatives ( $A_i$  versus  $A_j$ , for all  $i, j = 1, 2, 3, \dots, n$ ). The pairs of alternatives are usually chosen from a given scale (1~ 9).

-The third step is the judgment scales of pair-wise comparison, which are based in the use of the pair-wise as an input to create a comparison matrix (Sataty, 1980).



Thus, the preference scale should be numerical to derive priorities as shown in Table 3-2. Of note, ratio scales are the only possible measurement if one wants to aggregate measurements as in a weighted sum (Saaty, 1994).

**Table 3-2: AHP pair-wise comparison scale**

Relative importance	Definition
1	Equal importance
3	Weak importance of one over the other
5	Essential or strong importance
7	Demonstrated importance
9	Absolute importance
2,4,6, and 8	Intermediate values between two judgments

-The fourth step is priorities derivation or integration of relative weights, which involves the estimation and rating of the final weight of decision plans based on the local priorities for each plan and its attributes. By comparing the final values, it is possible to determine and suggest the most relevant plan (Contreras *et al.*, 2008). The goal is to find a set of priorities that match the comparison in a consistent matrix. When slight inconsistencies are introduced, priorities should vary only slightly. In other words, to rank the decision alternatives, the relative weights of each element must be multiplied to the final weight obtained. In this this step for each option, the value of the final weight can be obtained.

-The final step involves synthesizing the results to determine the overall outcome considering local priorities across all criteria determine the global priority (Ishizaka and Labib, 2011). The AHP uses priorities obtained from the comparisons to be weighted at the level below, which is continued for every element. Following this

process, each element in the level below adds its weighed values and gains its overall outcome (global priority). Thus, the process of weighing and adding continues until the final priorities of alternatives at the most bottom level are obtained.

Syamsuddin (2011) used AHP to evaluate information security policy of e-Government by proposing a framework based on MCDM which was constructed based on the previous literature of security from four points of view, technology, management, economy, and culture. The study highlighted the importance of evaluating information security policy as an instrumental measure against different security threats toward the new era of integrated e-Government service in Indonesia. Syamsuddin conducted a survey based on AHP pair-wise comparison to obtain decision experts' preferences on security criteria and security alternatives in more natural way. Experts were divided into three groups of public officers who were engaged in e-Government planning in Indonesia. The researcher strongly argued that information security policy evaluation must be addressed using MCDM methods by incorporating the four main aspects (technology, management, economy, and culture) that serve as different values to evaluate how information security policy should be improved under the umbrella of embracing the new area of integrated e-Government services in Indonesia. The findings revealed that the different groups of the experts varied in terms of information security criteria and alternatives. Government decision experts rated technological aspects as the most important security criteria, followed by management, economic, and culture aspects, respectively. The findings suggest that these main points should be improved to ensure availability of security protection in terms of three levels, end user security,

network security and application security.

Chen and Wang (2010) used AHP to find critical operational factors within the information service industry in developing the market, providing and proposing a referential business framework for developing international goal market, including market segment, strategy partner, and service and implementation. This research was based on the existing business models discussed in previous literature. Chen and Wang used a case study to observe different knowledge bases for operational strategies and critical factors of information service industries combined with interviews with experts, top management executives, and consultants. The authors concluded their study by proposing 20 critical factors using AHP method, and calculating the quantitative weights of those factors.

Salmeron and Herrero (2005) proposed the use of AHP to set critical successes factors (CSF) as priorities of information systems development and implementation. Their research aimed to rank the CSF related to executive information systems (EIS) using an AHP approach. The main strength of this research was the use of MCDM model for ranking CSFs, which allowed the researchers to measure the consistency of results. The researchers argue that technical elements are less critical important compared to other factors related to EIS.

However, in the overall opinion of respondents conducted by Salmeron and Herrero, 'right information needs' seems to be the highest priority criteria with higher weight than the priorities of the other criteria. The weights for the different criteria obtained using the AHP method could be subsequently used to rank different computer-based information systems. Of Salmeron and Herrero focused on the

users' point of view; therefore, it could be a useful approach because user satisfaction is more critical in information systems than it is in others systems.

### **3.4 Implications of Existing Literature**

Based on the objectives of this research and an investigation of previous related literature, this study has theoretical contributions in many aspects. The previous studies reviewed in this chapter reveal that little policy maker's research has been conducted in the field of e-Government adoption, and no research has been conducted in the context of Yemen.

In terms of theoretical contribution, this researcher intended to contribute to the literature on e-Government adoption theories in many ways. First, the literature review disclosed many studies on e-Government adoption in developed countries. For example, Ganapati and Reddick (2012) investigated the adoption of e-Government initiatives in the state governments of the United States; Weerakkody *et al.* (2011) used a case study to analyze how perspectives on e-Government strategy, vision, and organizational change influence the implementation and adoption of e-Government in developed and transition countries in Europe; Chan and Pan (2008) studied e-Government systems implementation in Singapore; and Kim *et al.* (2007) analyzed and described experiences with the implementation of e-Government at the Supreme Court Registry Office in South Korea.

Other studies investigated the e-Government implementation in developing countries. For example, Almazan and Gil-Garcia (2012) examined the progression toward citizen engagement for e-Government in Mexico; Gupta *et al.* (2008)

conducted an e-Government adoption study on actual use in government organizations in India; and Sharifi and Zarei (2004) used an adaptive approach for the implementation of G2G application for e-Government in Iran. To this extent, no study has deeply investigated the adoption and implementation or the participation of government employees in the adoption and implementation of e-Government system in Yemen or in any other developing country. Therefore, this study differed from previous literature in the sense that it involved government employees participation to investigate preferences toward e-Government implementation in Yemen. Thereby, this study examined the supply side of e-Government rather than the demand side as seen in previous literature. The originality of this study is that it was the first study on e-Government adoption and implementation in Yemen. Additionally, this study aimed to overcome the real obstacle of resistance to change, which has been experienced when implementing e-Government in developing countries, especially in Yemen. However, this study assumed that participation of government employees in the implementation process of e-Government would significantly reduce the ratio of resistance to change to the electronic system of government and would increase the rate of adoption.

This study also offered a theoretical contribution in terms of individual preferences. There are numerous studies on individual preferences and adoption of ICT technologies, especially on internet service adoption in Vietnam (Long, 2010), broadband internet services in United State (Savage and Waldman, 2005), and Korean consumers preferences towards new mobile TV services (Choi *et al.*, 2008). However, to date, such studies have not been conducted in Yemen. Therefore, this

study was conducted to fill this gap and provide evidence of the applicable use of CA and AHP in the context of e-Government in Yemen.

Moreover, no previous research has used CA or stated preference methods to investigate e-Government policy makers' preferences in both developed and developing countries. In contrast, this study is the first to use the integration and combination of CA and AHP approaches to introduce comprehensive methodological frameworks to measure government employees' preferences and opinions, and to identify success factors that influence individual users' adoption of e-Government in Yemen.

With regard to the research methods, this study successfully applied CA in the context of e-Government implementation, which has never been done before. Thus, this study offers a vital contribution to the existing knowledge and literature in the method conjoint analysis. This study is also unique in that the CA approach was used as a tool for e-Government adoption and implementation theories for the first time. As a result, the findings contribute to the methods used in e-Government research.

As the first study that focused on government officers' preferences and behaviors concerning the adoption of e-Government in Yemen, this research will flatten the way for future studies to contribute to the successful implementation of e-Government in Yemen.

In sum, this study provides a great contribution to the literature on e-Government from many angles. First, it provided a foundation for the literature review related to e-Government success factors in developing countries as it synthesized much for the current research on e-Government. Additionally, the study serves as a research foundation for future e-Government studies in Yemen.

# **Chapter 4 Preferences based on Discrete Choice Modeling**

In this chapter, the first research methodology of the study is presented in four sections. The first section presents the methodological framework and briefly describes the basic concepts that were needed to use DCM in this study. The second section illustrates and discusses the empirical model of this method. Following this discussion, the survey, technique of data collection, and model specification are explained. Finally, the empirical results are presented and discussed.

## **4.1 Methodological Framework**

In this section, the methodological framework of CA is discussed based on the RUM and WTP approaches with regard to the previous literature presented in Chapter 3.

### **4.1.1 Random Utility Model (RUM)**

Random utility models were developed to describe choice among mutually-exclusive discrete alternatives and received considerable academic and industry attention (Baltas and Doyle, 2001). The RUM provides a theoretical basis for many forms of preferences using discrete choice analysis. In RUMs, the assumption is that individuals choose their preferred alternative based on utility maximization as the objective of their decisions. Hence, utility maximization helps individuals determine their best choice, which, according to the utility maximization rule, is supposed to provide individuals with a great deal of utility (Fritz, 2010). The utility

maximization rule further implies that “there is a function contains attributes of alternatives and characteristics of individuals that describes an individual’s utility valuation for each alternative” (Koppelman and Bhat, 2006). Therefore, this study assume that policy makers would perceive the utility relevant to each attribute of the e-Government implementation and select the best possible choice for utility. A random utility model that incorporated the effects of choices on individuals’ random utilities was driven as follows:

$$U_{in} = V_{in} + \varepsilon_{in} \quad (4.1)$$

Where,  $i$  indicates individuals, and  $n$  is for alternatives.  $U_{in}$  is the true but unobservable utility obtained from alternative  $n$  by  $n$ th individuals.  $V$  becomes the explainable proportion of variance in choice, and  $\varepsilon$  is the non-explainable (Kajer, 2005). RUM assumes that individuals act rationally and choose the alternative with the highest level of utility, thereby, individuals are utility-maximizers. Because the researcher cannot observe individuals true utility functions, a probabilistic utility function was used as the estimation.

Following Kajer (2005), the most appropriate probabilistic choice model to apply depends on assumptions made about the random parameter, assuming that the individual can choose between two alternatives,  $i$  and  $j$ , then the probability that alternative  $i$  is chosen by  $n^{\text{th}}$  individual is given by:

$$P_i = \text{Prob}(U_i > U_j) = \text{Prob}(V_i + \varepsilon_i > V_j + \varepsilon_j) = \text{Prob}(V_i - V_j > \varepsilon_i - \varepsilon_j) \quad \forall i \neq j \quad (4.2)$$

Equation (4.2) shows that the higher the probability of choosing an alternative, a larger difference in utility is observed. Because probability is defined on a cardinal



scale, so are the estimated utility scores, which is the main reason why we can obtain meaningful WTP estimates. The difference in utility for two alternatives ( $V_i - V_j$ ) must be estimated and characterized by the utility for each attribute. This means that every respondent makes a discrete choice of the either alternative  $i$  or alternative  $j$ . After having viewed the necessary background of RUM, it is necessary to discuss the stochastic part of utility (Train, 2003).

#### **4.1.2 Willingness To Pay (WTP)**

The WTP concept is defined in consumer research as the maximum amount that the consumer or individual is willing to pay to obtain a certain service or good. A value of WTP is needed in cases where no market for the good exists and, consequently, the good has no explicit price. Therefore, it is crucial to reveal the WTP to optimize prices. Unlike market research, WTP for e-Government implementation have to be given economic value to optimize the allocation of scarce resources; therefore, in this study, WTP was likely related to a set of packages the government had to select without explicit market prices (Hogberg, 2007). Several factors affect WTP for e-Government system implementation. These factors are the marginal valuations for the e-Government system, quality of the system, government affordability (budget), ability to pay to implement the system, and individuals' (government employees) level of awareness of the benefits of an e-Government system.

To determine WTP, several techniques can be used to determine the value that people assign a service or good in the case of non-market assets. One example of these techniques is surveys, which can be used to investigate individuals' preferences for revealed or stated preferences methods that aim to elicit WTP for sets of attributes.

When one attribute is cost, the marginal utility indicates WTP for a change in the qualitative attribute (Kjaer, 2005). The marginal WTP (MWTP) of individuals can be regarded as the ratio of the attribute's marginal utility to the marginal utility of cost. This study followed Kjaer (2005) to calculate the MWTP of individuals as follows:

$$MWTP_i = \frac{\beta_{x_i}}{-\beta_{cost}} \quad (4.3)$$

Based on the discussed theories (RUM and WTP), this study introduced the methodological framework used to collect data on a case study of the Yemeni government and build and derive a synthesis model and best practices. Previous studies have used CA in developed and developing countries to measure consumer preference in areas related to market and ICT. However, in the case of e-Government adoption in developing countries, none have used CA to estimate users' preferences toward e-Government adoption. Therefore, this study applied CA methods to investigate government employees' preferences on e-Government implementation. This method is probably suitable for understanding the behavior responses of individuals in businesses and government sectors (Louviere et al., 2000). Therefore; discrete choice models and conjoint analysis were chosen to quantify government employees' preference because the researcher believed these methods would assist in building a relevant background to design policies for e-Government system implementation in developing countries with a focus on Yemen.

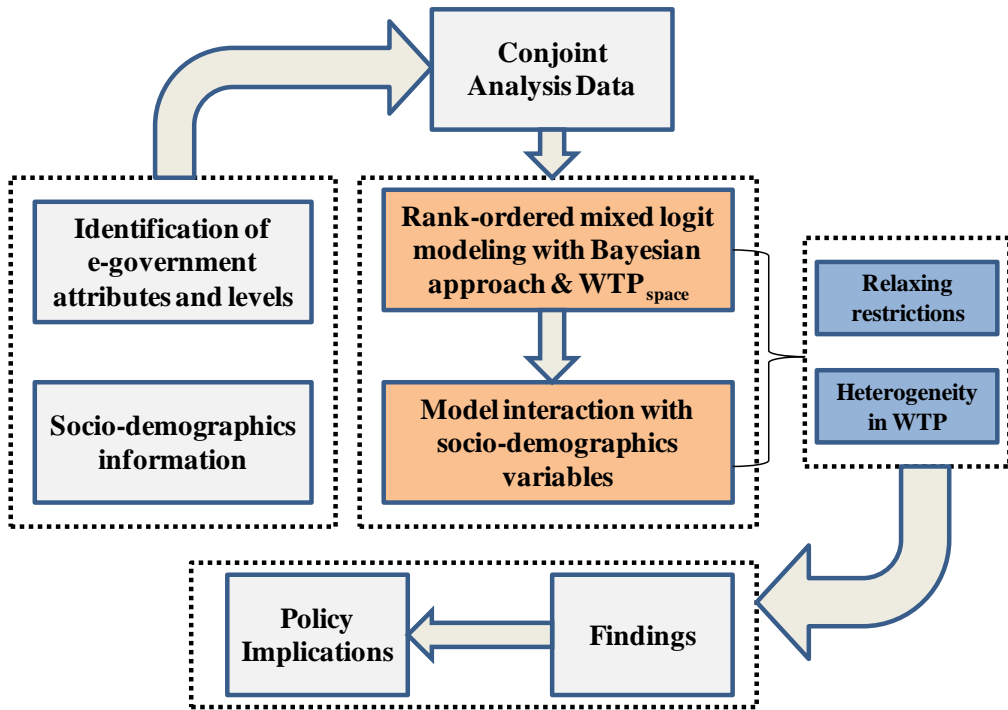


Figure 4-1: The methodology framework of Conjoint Analysis

## 4.2 Empirical Model

The decision of selecting an e-Government implementation package by a government officer can be regarded as a choice from among a limited set of alternatives. In marketing research, these choices are usually modeled by discrete choice approaches. However, this study applied these choices in the government sector which is non-market area of research. Therefore, this section provides the sequence details of the mixed logit model that involved for the discrete choice analysis in this study.

### 4.2.1 Rank-ordered Mixed Logit Model

The logit family of models is recognized as an essential toolkit for studying discrete choices. The mixed logit model (MXL) is likely to be the most promising state-of-the-art discrete choice model currently available (Hensher and Greene, 2003, Hensher *et al.*, 2005).

The MXL is highly flexible model and can approximate any random utility model (Train, 2003). Lee et al. (2006) stated that the flexibility MXL helps in approximating any random utility model and is widely applied in ICT as a new product choice analysis using stated preferences methods. Additionally, the MXL incorporates individuals' different preferences and considers the unobserved information to be sufficiently rich to induce correlations across different alternatives and changes among individuals. Therefore, following Train (2003), the MXL probability can be derived under a variety of behavioral specifications, and each derivation provides a particular interpretation. Thus, MXL probabilities are integrals of standard logit probabilities over a density function with regard to the random coefficient, which can be specified in the following form:

$$P_{ni} = \int L_{ni}(\beta) f(\beta) d\beta \quad (4.4)$$

Where,  $L_{ni}$  is the logit probability at parameter  $\beta$  and  $f(\beta)$  is a density function:

$$L_{ni}(\beta) = \frac{e^{V_{ni}(\beta)}}{\sum_{j=1}^J e^{V_{nj}(\beta)}} \quad (4.5)$$

$V_{ni}(\beta)$  is the observed portion of the utility. Train (2003) proved that, if utility is linear in  $\beta$ , and  $V_{ni}(\beta)$  becomes equal to  $\beta'x_{ni}$ . In this situation, the mixed logit probability takes the usual form:

$$P_{ni} = \int \left( \frac{e^{\beta' X_{ni}}}{\sum_j e^{\beta' X_{nj}}} \right) f(\beta) d\beta \quad (4.6)$$

According to Train (2003), “the mixed logit probability is a weighted average of the logit formula evaluated at different values of  $\beta$ , which the weights given by density function  $f(\beta)$  as the mixing distribution”. This mixing distribution is then generated at fixed parameters  $b$ :  $f(\beta) = 1$  for  $\beta = b$  and 0 for  $\beta \neq b$ . As such the choice probability becomes the simple logit formula:

$$P_{ni} = \left( \frac{e^{b' X_{ni}}}{\sum_j e^{b' X_{nj}}} \right). \quad (4.7)$$

The mixing distribution  $f(\beta)$  can be discrete, with  $\beta$  taking a finite of distinct values. However, the mixed logit model is most widely based on random coefficients, and thus, can be derived from utility-maximizing behavior in several ways resulting in different interpretation. Accordingly, the decision maker (individual) face a choice among  $n$  alternatives, and then the choice utility of individual  $i$  from alternative  $n$  can be specified as:

$$U_{in} = \beta_n X_{in} + \varepsilon_{in} \quad (4.8)$$

Where,  $X_{in}$  is the observed values related to the alternatives,  $\beta_n$  is the unknown parameter comprising a vector of coefficients of variables for person  $n$  representing his taste, and  $\varepsilon_{ni}$  is a random term from that iid extreme value. In the case of distribution, this study applies normal, and log normal distributions for the random parameters of e-Government implementation attributes.

An extension to the mixed logit model is the rank-ordered mixed logit model in which individuals rank alternatives instead of simply choosing one alternative that they may choose. Therefore, alternatives ranked from best to worst, in this case, the researcher should obtain data that constitute a ranking of alternatives that presumably reflects the utility that respondent obtain from each alternative (Train, 2003). This data called Ranked Data, which can be handled in mixed logit model using the available code without changing. The original full ranking of  $J$  alternatives hypothetical products was subsequently transformed into ‘pseudo-observations or pseudo-choices’ to maximize preferences (Train, 2003).

In this study, ranked data collected, and a rank-ordered mixed logit model has been applied to examine the impact of e-Government implementation perception on choice experiment.

Following Resano *et al.*(2012); the rank-ordered data can be analyzed by estimating a rank-ordered mixed logit model which combines the statistical flexibility of the mixed logit and its ability to investigate heterogeneous preferences, with the sufficiency of the rank-ordered logit model for ranking observations. In the usual theoretical framework defined by the random utility model (RUM), each individuals  $n$  faces a choice among  $J$  alternatives, and obtains utility ( $U_{j,n}$ ) from choosing alternative  $j$  over other specific alternative. The Utility ( $U_{j,n}$ ) has two components: the first one observed by ( $V_{j,n}$ ) and function of the specific features of the alternative or individual characteristics ( $X_{j,n}$ ):  $V_{j,n} = \beta' X_{j,n}$ , and the other one unobserved and random ( $\epsilon_{j,n}$ ), under the assumption of the standard logit model, the probability of individual  $n$  ranking  $J$  a set choice of alternatives from best to worst as  $j_1, \dots, j_m, \dots, j_J$ , where  $j_m$  represents the alternative chosen at the ranking order  $m$ , and can be

expressed as the product of logit choice probabilities. This rank-ordered mixed logit econometric model's formulation can be expressed as in the following equation (4.9):

$$\begin{aligned} Prob(\text{ranking } j_1, \dots, j_m, \dots, j_J) &= Prob(U_{j_1} > \dots > U_{j_m} > \dots > U_{j_J}) \\ &= \prod_{m=1}^{J-1} \frac{e_{jm,n}^V}{\sum_{k=m}^1 e_{jk,n}^V} \end{aligned} \quad (4.9)$$

In equation (4.9), the utility for each alternative is the same for all the implicit choice occasions under the assumption that the individuals have the same protocol for choosing the preferred alternative at all of the ranking levels of (Srinivasan *et al.*, 2006). Heterogeneous preferences across individuals can be represented by specific coefficients or taste parameters in  $\beta$  is random, with a density  $g(\beta | \theta)$ , where  $\theta$  are the parameters of the distribution (i.e. mean and standard deviation). The term of standard error (deviation) assumed to be identically, independently, and normally distributed among individuals. Most of the applied literatures usually uses the normal distribution which allows the possibility that individuals show opposite preferences toward a particular attribute. Equation (4.9) also provides the probability for an individual  $n$  of choosing as specific ranking, but conditional on  $\beta$ .

Lat and least the unconditional probability of ranking  $j_1, \dots, j_m, \dots, j_J$  for individual  $n$  is the integral of the product of probabilities over the density of  $\beta$  and is obtained as:

$$Prob(\text{ranking } j_1, \dots, j_m, \dots, j_J) = \int \prod_{m=1}^{J-1} \frac{e_{jm,n}^V}{\sum_{k=m}^1 e_{jk,n}^V} \times g(\beta | \theta) d \quad (4.10)$$

However, the above estimations make the use of simulation methods which explained in details in (Train, 2003). Estimation of the rank-ordered mixed logit informs about the existence of heterogeneous preferences toward particular attributes if the standard deviation of the attribute is significant (Rensano *et al.*, 2012).

## 4.3 Survey and Data

### 4.3.1 Conjoint Survey

To date, CA has been used in marketing research as an efficient and effective tool when constructing consumer preference (Green and Srinivasan, 1990; Long, 2010; Louviere *et al.*, 2000; Train, 2003). In order to apply the CA method, a conjoint survey must be designed first. This researcher constructed a conjoint survey questionnaire that asked participants to rank a set of alternatives for e-Government implementation.

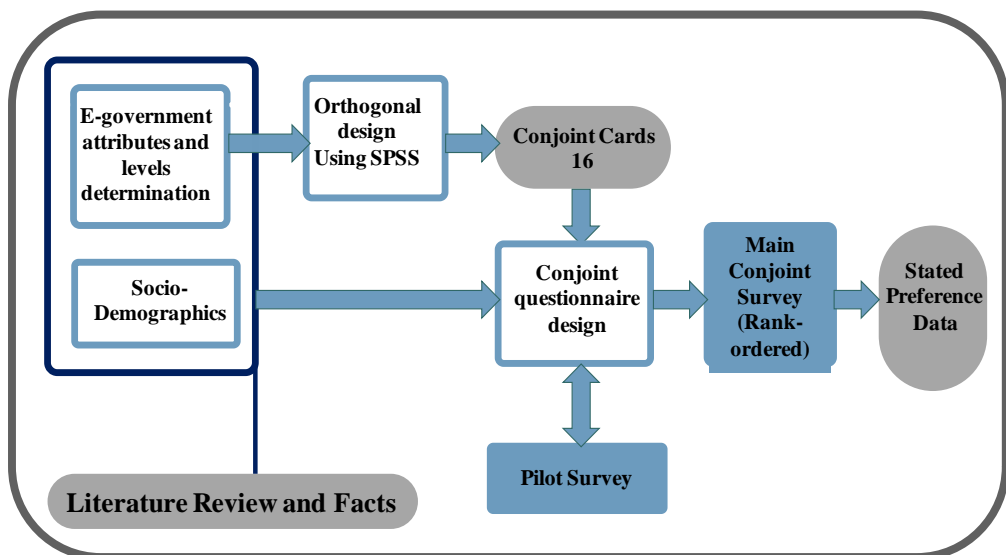


Figure 4-2: The Analytical frame work of conjoint analysis' survey



The CA survey questionnaire was designed in three sections. The first section contains the overall introduction of the research and survey explanations. The second section contains the rank-ordered conjoint choice questionnaire, which includes a table that describes the attributes and levels involved in the study to simplify understanding. This second section also includes the conjoint card questions presented in four choice sets. Each choice set has four packages that comprise of different alternatives of seven attributes in which respondents rank their choices as 1 for the most preferred, 2 for the less preferred than 1, 3 for the less preferred than 1 and 2, and 4 for the least preferred. The third section the survey captures respondent demographic information and their experiences using the e-Government portal (see appendix B for more details).

Survey items were adapted to suit the context of e-Government in Yemen; however, most of the attributes may not be found in the previous studies. The survey questionnaire was originally written in English and then translated to Arabic to help those respondents who only know Arabic. The population of this study consisted of government officers and decision makers in Yemen; which ensured that respondents were stakeholders of e-Government and would be more likely to answer the questionnaire carefully. Additionally, the distribution of respondents was in accordance with the demographist of e-Government adoption in Yemen.

The researcher first tested the questionnaire with a pilot survey among government employees from six different Yemeni government agencies to determine whether there were ambiguities in the survey questionnaire items. The government agencies involved for the pilot study were the Prime Minister's office, Ministry of Telecommunication and Information Technology, Ministry of Planning and

International Cooperation, Ministry of Justice, Ministry of Electricity, and Ministry of External Affairs. Based on respondents' comments and feedback, some survey items were rephrased to increase clarity. All items in Arabic languages were also rephrased to increase clarity and understandability in the context of Yemen.

#### **4.3.2 Attributes and attributes levels**

In discrete choice experiments and conjoint analysis survey, the first step should be considered is identifying the attributes relevant to the research questions and then assigning levels for each of those attributes (Hensher *et al.*, 2005; Mangham *et al.*, 2009). However, the most important and supercritical aspect to design a good conjoint study is identifying the proper conjoint attributes and attributes levels. This is a highly important and fundamental step for the conjoint survey design, as these attributes and attribute levels describe the hypothetical scenarios under consideration in the discrete choice analysis.

In order to identify the attributes and levels of Critical Success Factors (CSF) that contribute to the successful implementation of e-Government, this study conducted a systematic review of the previous literature, as well as added some contributions factors; to specify the relevant attributes.

Thereafter, this study involved seven attribute as highly important to measure the policy makers' preferences and opinions to implement e-Government system. These attributes are Strategy, Legal framework, GEA, Portal language, Privacy, Training and operational Cost (OPEX). Then, the levels assigned for each of the seven attributes (See Table 4-1). The first attribute in the choice experiment is "Strategy" which indicates that the government must have a clear strategy to road

map all the different stages of e-Government implementation. This attribute is a dummy variable with three levels, ten years period of strategy planning as long term, five years strategy planning as mid-term, and two years strategy planning as short term period. An appropriate and context tailored strategy is one of the main challenges for an e-Government project establishment (Alshehri and Drew, 2010; ESCWA; Heeks, 2003, 2003; Hossan *et al.*, 2006; Ndou, 2004;).

The second attribute is “Legal framework”, a dummy variable with two levels; *Strong and Weak*; which indicates that government should establish a proper legal framework for their e- e-Government implementation which is strictly required in early stages of implementation. This legal frame attribute is a legal Information System on the level of national legislation which has to be built as an open non-commercial system with the aim to ensure an access to the integrated source of legal information within the country (Alpar *et al.*, 2005). However, the success of e-Government implementation and its services in developing countries is highly dependent on government’s role in ensuring a proper legal framework for their operation (Basu, 2004).

The third attribute is “GEA” Government Electronic Administration office. This attribute GEA is one of the main components in e-Government which in practice, as a tool for coordinating various sections of the government (Sharifi and Zarei, 2004). GEA provides the foundation required to monitor and support the G-to-G system in particular, and to enhance the capacity of e-Government in policy making in general. This attributes has two levels *Centralized and Decentralized*. Centralized denoting that GEA is established in the Prime Minister’s Office (PMO) to operate, monitor and support e-Government functions, reducing the variation and

duplication in e-Government systems. With centralized systems, the web portal, or a “one-stop-shop,” functions as a fully integrated, user-friendly system. This means back office of e-Government is exists only in PMO or any responsible agency but not in each and every other government agencies.

**Table 4-1: Attributes and attributes’ levels for conjoint analysis**

	<b>Attributes</b>	<b>Levels</b>	<b>Relevant Literature</b>
<b>1</b>	<b>Strategy</b>	10 years	Heeks, 2003; ESCWA, 2003; Ndou, 2004;
		5 years	Hossan <i>et al.</i> , 2006; Alshehri and Drew,
		2 years	2010.
<b>2</b>	<b>Legal Framework</b>	Strong	Gil-Garcia and Pardo, 2005; Ndou, 2004;
		Weak	ESCWA ,2003; Basu, 2004.
<b>3</b>	<b>GEA</b>	Centralized	Sharifi and Zarei, 2004.
		Decentralized	
<b>4</b>	<b>Portal Language</b>	Only Arabic	Criado and Ramilo, 2003.
		Arabic and English	
<b>5</b>	<b>Privacy</b>	100 %	Alsheri and Drew, 2010; Belanger and Hiller, 2006; Ndou, 2004.
		98 %	
		95 %	
<b>6</b>	<b>Training</b> (Technical Staff)	1 month	Alsheri and Drew, 2010; OECD, 2003.
		3 months	
<b>7</b>	<b>Cost</b>	20 millions USD\$	UN e-Government survey, 2012; Alshehri and Drew, 2010; Hassan <i>et al.</i> , 2010; Alnagi and Hamdan, 2009; OECD, 2003.
		30 millions USD\$	
		40 millions USD\$	

In contrast, decentralized GEA indicates that GEA is established in each government agency, allowing the individual agency more control over e-Government administration and content. The decentralized GEA is also linked to and monitored by the central GEA. However the estimation results of the pilot survey show that the respondents were not quite familiar with the meaning of those levels. Hence in order to make the respondents to understand easily the levels of GEA, proper explanations of the levels were depicted in the main survey questionnaire.

The fourth attribute is “Portal Language”, introduced in two levels Arabic and Arabic & English. Having the e-Government portal as only Arabic platform means that e-Government websites can be browsed only in Arabic language but there is no English (international) version, which will be a barrier in any international transactions and for those citizens who may not know Arabic. Having the portal in both languages Arabic and English, means that there will not be any barriers for international and local transactions for all layers of citizens. However; the accessibility of the services offered by the e-Government portal in foreign language extends widely reach and better take-up of the portal. Foreign language features on the portal enhances access to non-native language speaking users. Foreign language access could generally be enabled via accessibility features, such as text translation of the information into a preferred chosen language (Criado and Ramilo, 2003).

The fifth attribute “Privacy”, which has three levels, as a proxy for the system’s, shows the level of privacy that should be exist to protect the government’s information and the user’s personal data. The 100% level of privacy indicates that at this level, no leakage of information is observed for both the government and the user.

The second level 98% of privacy means that at this level, there is a rare chance (say 2%) of the government or user's information leakage. And the third level 95% means that, at this level, there is more chance (say 5 %) of information leaking. These levels rate the expectation of the government's or user's information being leaked. Indeed, securing the user's personal information and the government's data from hackers, threats, and unauthorized access is crucial in the implementation and adoption stages of e-Government. However; privacy and security are reoccurring matters in e- government and e-commerce research (Belanger and Hiller, 2006), and important components of the implementation stage of e-Government in developing countries.

The sixth attribute "Training" has two levels, a one month period of training, and three months of training. Only one month of training indicates government employees prefer this period for training basics of e-Government system and usage of the portal. Three months means government employees are willing to spend three months to learn the basics of ICT and the e-Government system. However as all the respondents are government officers, they do not seem to leave their offices for long time, therefore, the results show that most of them prefer only one month of training. According to Alsheri and Drew (2010), training exiting governmental staff members is very important in accelerating the adoption and diffusion of new technology. Moreover, qualified technical staff and proper IT training are critical success factors that help avoid facing obstacles in the implementation of e-Government. Lack of IT professionals and required computer training courses are major issues in developing countries (OECD, 2003).

The final attribute is “Cost”, which reflects the estimated operational cost (OPEX) needed to be available annually for the operation of e-Government system (i.e., maintenance and administration of the portal, maintenance all equipments and devices, communication and operational services, portal staff payments, technical support and consultancy, etc.). This attribute has three levels based on Yemeni e-Government project team documents (2008) that estimates the approximate total budget required for implementation of an e-Government system in Yemen. These levels are 20, 30, and 40 million United States Dollars. This study proposes that the Yemeni government should assign one of these amounts to be designated as available and allocated from the government total budget, in order to guarantee the continued implementation of the different stages of e-Government in Yemen. Further, the cost attribute would then allow for estimation of the WTP in monetary terms. The most serious and significant barrier to implement e-Government in the world is a lack of money (UN e-Government Survey, 2012, Alshehri and Drew, 2010). The operation of e-governance requires construction of strong technological infrastructure of telecommunications. A significant financial investment is required to develop this infrastructure (Bhuiyan, 2011). However, as this study is limited to the Yemeni government employees’ perspective and includes different policy makers such as leaders from the public sector, the e-Government project team or IT managers view whose main concerns are the e-Government implementation cost. As a result, the study outcome shows that the majority of participants count the lack of funding as an essential barrier for e-Government adoption and implementation in Yemen. This barrier ranked as the highest barrier for e-Government system adoption in the challenges list from the government employees’ view.

In general, developing countries, especially most of Middle East region, the ICT sector is weak due to budgets constraints. It needs a large financial investment that would support: communications, electronics, digital content and software services and industries (Alnagi and Hamdan, 2009). In order to implement an e-Government project in a developing country such as Yemen, the government needs to understand what resources are available to be devoted to achieve the project's reasonable and attainable goals. The availability of such sufficient funding is a significant factor for government organizations to move towards e-Government and e-service success. (Hassan *et al.*, 2010). According to OECD (2003), the difficulty of measuring costs and potential benefits for e-Government projects makes it hard to develop funding cases for projects and compare alternatives in a budget-setting context. In contrast, this study for the first time involve the government employees to determine the budget required for e-Government system implementation, their views will help the government to estimate the amount required to uptake the adoption and implementation of e-Government. Therefore, this attribute is very important factor in this study in order to calculate the willingness-to- pay that government is willing to assign for each e-Government attributes involved in this research to contribute for the successful implementation of this new electronic system.

Those above seven attributes were defined as an important attributes to the respondents. The aim is to establish the choice experiment to the requirements of a good or system understanding of the target population and experience (Howard and Salked, 2009). This research conducted a pilot survey of this discrete choice study in 30 participants indicating that the respondents were able to complete 16 discrete



choice questions without an onerous concern. Respondents were also able to understand correctly the attribute descriptions. As the identified four attributes with two levels and the remaining three attributes with two levels sum up total 480 choice sets, the final fractional factorial design (Orthogonal design) generated 16 cards using SPSS software. These cards hypothetically are the e-Government implementation packages using seven attributes along with their factor levels. These 16 generated cards with an array contains four sets with four alternatives in each set that each respondent could rank in terms of likelihood to adopt the e-Government system. These generated conjoint cards by SPSS are presented in Appendix C.

#### **4.3.3 Data Collection**

This section discussed the data collection strategy for this discrete choice study. Data collection was conducted in the form of a conjoint survey between March and May 2012. Previous sections (section 4.3.1) already explained the construction of the survey led by the rules of discrete choices. Data were collected via a conjoint survey that was divided into three sections. Respondents were chosen using a random sampling technique of different government agencies in Yemen. These government agencies included 14 ministries and the Prime Minister's Office. In total, 125 government employees participated in the survey. Of note, only 115 responses were accepted as 10 respondents were invalid because the participants did not fully complete the survey questions. The collected data was computerized and systematically coded and arranged into a database to be used in the discrete choice program "Gauss 6.0" (Hakim and Pathak, 1999).

For survey management and to conduct the official survey three technical staff were employed to distribute and explain the survey to participants with respect to the official cover letter the General Secretary of the Yemeni Cabinet in the Prime Minister's Office (see Appendix A).

#### 4.3.4 Descriptive Statistics

The survey data collected from 125 government officials representing (normal employees, e-Government team and technical staff, and top management) who have a wide range of position titles in 14 different government agencies. Therefore, the dataset was restricted to government employees in the most important ministries which practically wanted to implement IT technologies especially e-Government. Table 4-2 depicts the layout of the sample design.

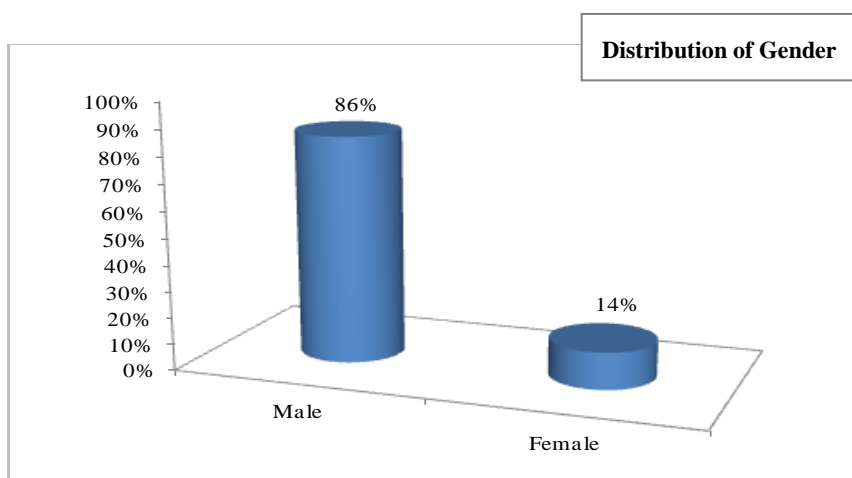
**Table 4-2: Sample design**

	Description
Population	Ranging in age from 18 to 60 years and working in 14 different ministries
Survey period	May 2012
Sample size	125 individuals

After the conjoint survey's data collected from 125 respondents "Yemeni official" (decision makers and top management, government employees, e-Government project team and technical staff), those respondents are located in 14 different government entities in the Republic of Yemen. Out of 125 respondents, 10 samples were invalid due to the incompleteness of answers of the questions and had been removed as a result. Therefore, only 115 acceptable answers were obtained to

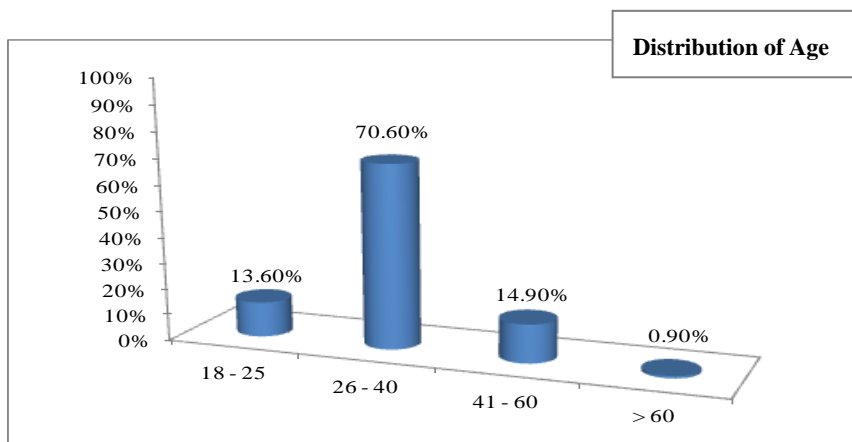
be eligible to make the conjoint ranking. As the questionnaire had 115 absolute and complete answers out of 125 respondents' answers, the compilation rate is over 80% of the total responses.

The survey also collected information on the respondents' socio-demographic information such as; gender, age, educational level, occupation, and experience. The survey answers shows that, the majority of the 115 respondents were male (86% males versus 14% females). This distribution reflects the fact of the Yemen national statistics forecasts for vulnerable employment of male and female in the country. This gender distribution is shown in figure 4-3.



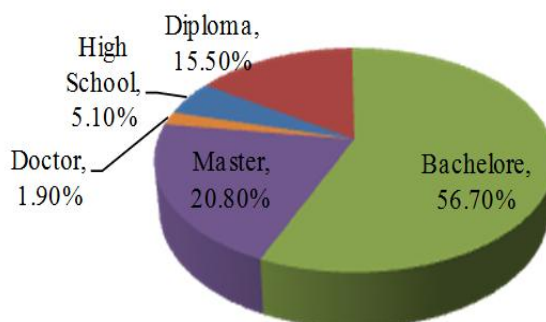
**Figure 4-3: Gender's Distribution**

Age distribution in Figure 4-4, shows that a majority number of the respondents (70.6%) were in the age between 26 and 40, while (13.6%) of them were between the age of 18 and 25. And (14.9%) of respondents were between the age of 41 and 60; but, only (0.9%) were older than the age 60.



**Figure 4-4: Age's Distribution**

Figure 4-5 shows the distribution of the respondent's level of education. The results show that majority of the respondents have a bachelor degree taking 56.7% out of 115 respondents. And 20.8% of them have master degree qualifications; this indicates that, a substantial number of respondents are well educated and have university degrees. However, the results also have shown that 15.5% of the respondents have diploma qualifications, while 5.1% have only high school education level, and 1.9% have a doctoral degree.

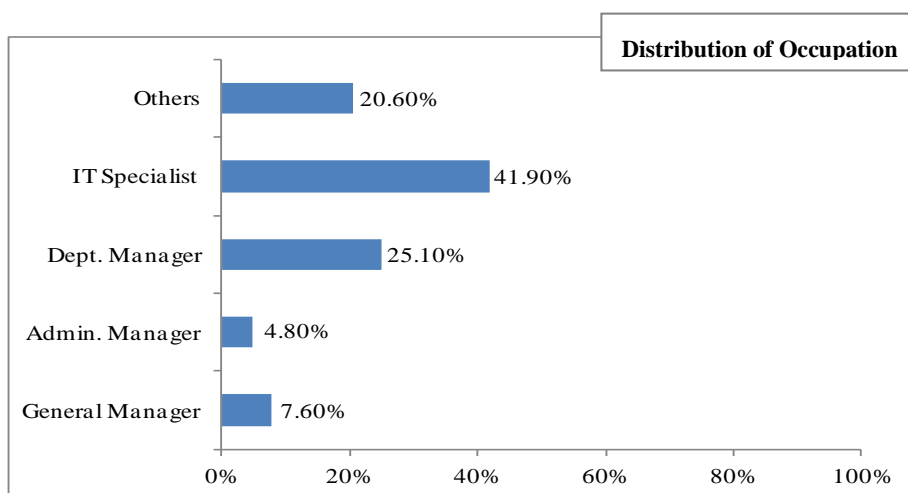


**Figure 4-5: Educational Level distribution**

In case of occupation (position titles), the respondents have a wide range of position titles; therefore, this study simplifies those titles by grouping them into five categories: general manager, administration manager, department manager, IT specialist, and other. Ministers, assistants, consultants, and other position titles (government employees) were grouped under “others” category.

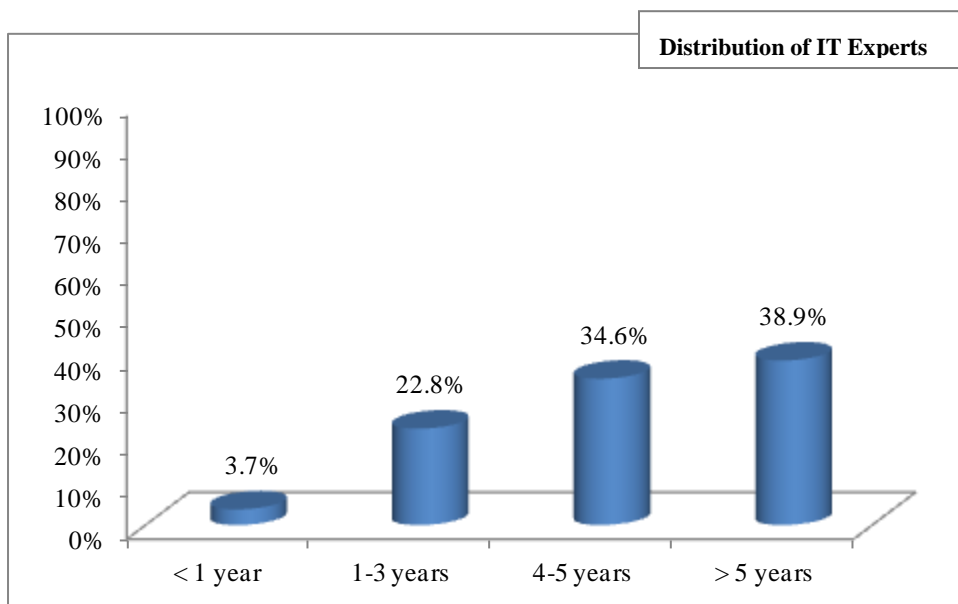
Figure 4-6 presents the distribution of the respondents’ occupations. The majority are technical staff (IT specialists) with 41.9%, followed by department managers with 25.1%, general managers (7.6%) and administration managers (4.8%). Others positions, which constituted 20.6% of the total, include general government employees, three ministers, two deputy ministers, and other positions.

For the respondents’ IT and e-Government usage experience, as they are all government officers, it is not surprising that they most of them were familiar with the Internet and various computer applications. Besides, some of them are used to access the government official portal at [www.yemen.gov.ye](http://www.yemen.gov.ye).



**Figure 4-6: Occupations of Respondents**

The respondents' years of experience in the IT field were investigated in the conjoint survey because the extent to which they have experienced the IT technologies in general, and e-Government in particular, is an important factor affecting the adoption and diffusion of e-Government system in government agencies. The results show that a majority of the respondents have used the IT technologies and e-Government portal for more than five years (38.9%). Figure 4-7 shows the distribution rates of the respondents' experience using the IT technologies and e-Government.



**Figure 4-7: Respondents Experience of using IT**

The following Table 4-3 summarizes the respondents' demographics profile.

**Table 4-3: Respondents' demographics profile.**

	<b>Category</b>	<b>Frequency</b>	<b>Percent</b>
<b>Gender</b>	Male	98	85.6%
	Female	17	14.4%
<b>Age</b>	18 ~ 25	17	13.6%
	26 ~ 40	77	70.6%
	41 ~ 60	18	14.9%
	> 60	3	0.9%
<b>Education Level</b>	High School	7	5.1%
	Diploma	18	15.5%
	Bachelor	62	56.7%
	Master	24	20.8%
	Doctor	4	1.9%
<b>Occupation</b>	General Manger	9	7.6%
	Admin. Manager	7	4.8%
	Dept. Manager	28	25.1%
	It Specialist	46	41.9%
	Others	26	20.6%
<b>Experience</b>	< 1 year	6	3.7%
	1 ~ 3 years	25	22.8%
	4 ~ 5 years	39	34.6%
	> 5 years	45	38.9%

## 4.4 Empirical Results and Discussion

### 4.4.1 Model Specification and Estimation

Section 4.1 provided insight into the methodological framework for the discrete choice analysis used in this study. As the empirical model discussed previously in this chapter (section 4.1.1), this section, thus, explains the specification and estimation of the mixed logit model with regard to the Random Utility Theory (RUT) and interactions with demographics and individuals' characteristics.

The estimation of the mixed logit model on stated preference data is illustrated based on random utility theory for understanding the individual choices among sets of alternatives. Accordingly, the government officials' utility for e-Government adoption is expressed as a function of e-Government implementation attributes and socio-demographic characteristics. In this study, policy makers are asked to consider seven-attribute scenario using the conjoint analysis method. These attributes are: (1) Strategy, (2) Legal framework, (3) GEA, (4) Portal language, (5) Privacy, (6) Training, and (7) Cost. Each respondent is asked to select his preferred alternative among four alternatives in four choice sets. To measure the importance of the e-Government implementation alternatives for the adoption of the e-Government system, this study applied rank-ordered mixed logit and empirically analyzed the obtained data from the rank-ordered experiment following Srinivasan *et al.*(2006). As explained earlier in this chapter, the setting of choice probability estimation is measured as depicted in equations (4.10, 4.11) in addition to socio-demographic interactions. Ultimately, this research applied rank-ordered mixed logit model in order to test the heterogeneity on preferences towards e-Government



adoption among government employees in Yemen as the choice preference for e-Government implementation may vary between respondents with regard to their personal preferences (tastes), backgrounds, ability, awareness, and other aspects.

Mixed logit model specification with random utility theory is defined as follows:

$$U_{nij} = \beta_{Strategy} STRATEGY + \beta_{Legalframe} LEGALFRAME + \beta_{GEA} GEA + \beta_{p.language} P.LANGUAGE + \beta_{privacy} PRIVACY + \beta_{Training} Training + \beta_{OPEX} OPEX + \varepsilon_{nij}$$

The variables definitions and descriptions used in the above model are presented in Table 4-3. In this specification of the model, STRATEGY, and LEGAL FRAMEWORK are dummy variables that should be exist for the adoption and implementation of e-Government in the government sector. GEA (Government Electronic Administration Office) is a dummy variable that reflects how the government employees (respondents) want the GEA to be centralized or decentralized. PORTAL LANGUAGE is the interface language of the official e-Government site. PRIVACY is the proxy of security denoting how secured e-Government system that respondents need. TRAINING is the variable to denote how much training the government officials willing to undergo to learn the concepts of e-Government. And the last variable is the operational cost (OPEX) of the e-Government system that respondents may define as an annual budget for the operational of the e-Government system. All attributes have levels in which respondents are chosen as the base alternatives.

**Table 4-4: Variables Definitions for the conjoint analysis**

Variable		Description	Definition
<b>Strategy</b>	10 years	Dummy variable for e-Gov. implementation with long term strategy plan	10' if it is long strategy; '0' otherwise
	5 years	Dummy variable for e-Gov. implementation with Mid-term strategy plan	5' if it is Mid strategy; '0' otherwise
	2 years	Dummy variable for e-Gov. implementation with short term strategy plan	2' otherwise
<b>Legal Framework</b>	Strong	Dummy variable for e-Gov. implementation with strong legal framework	'1' if strong legal framework; '0' otherwise
	Weak	Dummy variable for e-Gov. implementation with weak legal framework	'0' if weak legal framework; '1' otherwise
<b>GEA</b>	Centralized	Dummy variable for e-Gov. implementation with centralized GEA in PMO only	0' if centralized GEA in PMO only ; '1' otherwise
	Decentralized	Dummy variable for e-Gov. implementation with decentralized GEA in each and every government agency as well as in Prime Ministers' Office (PMO)	1' if decentralized GEA in each government agency and PMO; '0' otherwise
<b>Portal Language</b>	English & Arabic	Dummy variable for e-Gov. implementation with Arabic & English portal	1' if the language of portal is English & Arabic; '0' otherwise
	Arabic only	Dummy variable for e-Gov. implementation with Arabic only portal	0' if the language of portal is only Arabic, '1' otherwise.
<b>Privacy</b>	100%	Dummy variable for e-Gov. implementation with 0% of information leakage	0' if the expectation of information leakage is 0 %
	98%	Dummy variable for e-Gov. implementation with 2% of information leakage	0.02' if the expectation of information leakage is 2 %
	95%	Dummy variable for e-Gov. implementation with 5% of information leakage	0.05' if the expectation of information leakage is 5 %
<b>Training</b>	1 month	Dummy variable for e-Gov. implementation with 1 month for training the staff	1' if the training has to be 1month; '3' otherwise
	3 months	Dummy variable for e-Gov. implementation with 3 months for training the staff	3' if the training has to be 3 months; '1' otherwise
<b>Cost (OPEX)</b>	20	Dummy variable for e-Gov. implementation with annual budget 20M \$ as OPEX	20' if the annual operational cost has to be is 20 million USD
	30	Dummy variable for e-Gov. implementation with annual budget 30M \$ as OPEX	30' if the annual operational cost has to be is 30 million USD
	40	Dummy variable for e-Gov. implementation with annual budget 40M \$ as OPEX	40' if the annual operational cost has to be is 40 million USD

#### **4.4.2 Rank-ordered Mixed Logit Model Estimation**

The variables definitions and descriptions in Table 4-4 enable the model to present the behavior response of the policy makers for the adoption of e-Government system. These specifications can help us to measure the government employees' preferences towards the implementation of e-Government in Yemen, filling the gap and solving the limitation in previous studies that only measured the preferences for Internet adoption and marketing areas.

As mentioned in the previous sections, this study has 115 valid responses with complete data of the choice questions. Each respondent answers the choice questions by ranking alternatives in each and every choice set. There are four choice sets, each choice has four alternatives. Therefore, the total observations for the rank-ordered mixed logit estimation are 460. The GAUSS program used in this study for estimating the data of the rank-ordered mixed logit model.

The rank-ordered mixed logit model is applied to examine the policy makers' preferences for e-Government implementation in Yemen. The estimation results are depicted in Table 4-5 which includes the parameter estimates, coefficients of mean, t-value (t-statistics), and willingness-to-pay of policy makers for each attribute of the e-Government implementation in Yemen. The result's table shows how the specified model fits the survey data properly as presented by all statistics. The signs of the parameters are also reflecting the theory and the facts in Yemen's e-Government.

**Table 4-5: Rank-ordered Mixed Logit estimation results**

Attributes	Coefficient	Standard	Coefficient	Standard	t-value	t-value	WTP
	Mean	Error	Variance	Error	Mean	Variance	Space
Strategy	2.394**	0.1546	1.453**	0.3712	15.4851	3.9135	2.65
Legal Framework	0.599**	0.1078	0.585**	0.1443	5.5566	4.0541	0.13
GEA	0.151	0.1274	1.133**	0.2514	1.1860	4.5064	0.61
Portal Language	1.063**	0.1316	0.954**	0.2462	8.0775	3.8753	2.19
Privacy	4.838**	0.8435	3.399	3.1429	5.7360	1.0815	4.87
Training	-0.0106	0.0579	0.2201**	0.041	-0.1831	5.3683	-NA-
Cost (OPEX)	-40.385**	1.2726	2.248	1.5354	-31.7342	1.4641	-NA-

Note:- N=460; Asterisk \*\* statistically significant at 1%, \*statistically significant at 5%.

Likelihood Ratio: LR (-1366.421), *Currency Unit for WTP space is (1 one million USD).*

However, this study assumes that the individuals' effect may cause the estimation bias as in the survey questionnaire government employees were asked to rank 16 alternatives categorized into 4 choice sets, then, they again rank 4 times for 4 choice sets. Therefore, the choice sets were orthogonally designed using SPSS software to avoid the individuals' effect. As depicted in Table 4-5, the result interprets the parameters as marginal utility that is as a partial derivative, which means the change in utility for one unit increase in the variable (Savage and Waldman, 2009). As shown in the table above, marginal utility order for attributes is the Privacy, Strategy, Portal Language, GEA, and Legal Framework.

Firstly, for the Strategy attribute, three levels has been defined as long term strategy for 10 year, mid-term strategy for 5 years, and short term strategy for 2 years; however, the result shows that the respondents are willing to allocate 2.65 million/USD for having a long term strategy planning. This reflects the fact that the current strategy for e-Government in Yemen is not clear and without an obvious vision which is not enough to face the e-Government issues of implementation. Therefore, comparing to mid-term and short term strategy, the respondents want to assign that much of utility for long term strategy planning.

Secondly, with regard to the Legal framework attribute which has been defined with two levels as strong legal framework, and weak legal framework, the government officers have high relative utility for implementing a strong legal framework and they are willing to assign an amount of 0.13 million/USD for introducing a strong legal framework for the e-Government system in Yemen that ensures the security and protection of government data and personal information. As matter of fact, the current legal framework for e-Government in Yemen is very weak in the sense that government officers they do not really feel like they have a legal framework. As a result, it is very justified to introduce a strong legal framework for the e-Government in Yemen.

Thirdly, regarding the Government Electronic Administration Office (GEA) attribute which has been identified with two levels as decentralized, and centralized. However, the positive sign of this parameter shows that majority of respondents in Yemeni government prefer the decentralized e-Government's GEA. The individual's relative utility with regards to decentralized GEA increases when it is

included in the e-Government implementation package offering. For the GEA (e-Government Back Office), minority of respondents have a negative utility towards decentralized GEA, which can be interpreted as the system of the country of Yemen is centralized; hence; it is normal that some of respondents prefer the centralized GEA rather than decentralized. However, their preference is to handle the functions of the e-government back office using the existing IT or Internet units or departments which saves the government expenses as it is not needed to spend on the new infrastructures for especial GEA units for e-government in each and every agency.

Fourth, in the circumstances of the attribute “Portal language” which has been defined as well with two levels as Arabic & English, and Only Arabic, it seems that respondents prefer having both languages Arabic and English for the Yemeni official e-Government portal as they assign 2.19 million/USD as a marginal utility for having the portal with both languages. Otherwise, if the portal is only in Arabic, the cost comes down. Although, the prevalent language in Yemen is Arabic, but government officers want to add English language for the portal to be beneficial for those Yemenis who do not speak Arabic as well as for a future international transactions.

Fifth, for the privacy attribute, which has been defined with three security levels as 100 % secured, 98%, and 95% secured levels, the WTP assigned for this factor shows that the respondents in the government agencies prefer highly secured system without any probability of government or personnel information leakage. Therefore, respondents’ WTP for the high secured e-Government system is up to the amount of 4.87 millions/USD which clearly implies that ‘Privacy’ is very much concerned by government employees towards implementing e-Government system in Yemen.

Considering the training attribute, it presents that government officials state the least preferences for technical training attribute which has been identified into two levels; 3 months period, and 1 month period. As they are government employees they prefer short period of training. This preference, importantly impact on the policies to promote the e-Government system and services paralleled while implementation. The negative sign of training suggests that the government officials' relative utility increases when the training period decreases. Clearly, government officers probably do not want to leave away their jobs and responsibilities for long period. As a result, it implies that the policies of promoting short period training are preferable. However this may or may not fit some other government agencies' cases in other developing countries as it is applicable in Yemen's circumstances.

Overall, according to the results in Table 4-5, e-Government policy makers in Yemen rate the Privacy as the most important attribute in terms of WTP. The least important one is the training attribute. Concerning the price attribute, the negative price coefficient is in line with economic theory. However, it is more informative and useful if we translate it into WTP for each other e-Government attribute.

As in the right column of Table 4-5, it presents the WTP space which has been estimated directly in a mixed logit model by reformulating the model in the sense that, the parameter of attributes in model in WTP space represents the parameters of WTP distribution rather than parameters of the usual WTP coefficient. The advantages of WTP space approach is that, WTP distributions can be directly specified and therefore avoid the rather 'arbitrary choice' of WTP distribution that rises up from the

estimation of WTP coefficients when dividing the coefficients of the non-monetary attributes by the cost coefficient (Hole and Kolstad, 2012; Joeng, 2008; Scarpa *et al.*, 2008; Train and Weeks, 2005 ). In line with the literature from other fields, it is suggested that models estimated in WTP space produce more realistic WTP estimates than estimates with WTP coefficients (Hensher and Greene, 2003).

Accordingly, this study used WTP space and the estimations show that government officials are willing to allocate around 2.65 millions USD for strategy, while they want to assign 0.13 million USD for a strong and suitable legal framework. For GEA, policy makers tend to advice the government to pay just 0.61 million USD for centralized GEA to operate and maintain the e-Government system in all government agencies. This means that the government agencies should use their current IT departments for the administrating and operating their e-Government sites and services without investing much money to create special units and infrastructures for e-Government. As a result, based on WTPs, policy makers and government users can establish their general vision and provision plans.

This study also followed the estimation procedure of Lee *et al.* (2006) which is applying Bayesian estimation using Gibbs sampling to generate the draws. The Bayesian procedure is different than classical approach in the sense that is aimed directly at satisfying the choices of each sampled person, and the population parameters are estimated taking this into account; but, in the classical approach the fact that the sampled population is finite and discrete is conveniently forgotten for the sake of simplicity, and the individual-level models are conditioned from parameters of an infinite population (Sillano and Ortuzar, 2005). In addition, an advantage of



Bayesian approach is that, there is no numerical maximization required, rather, draws of distribution are retained after convergence. The retained draws, then, are used to create inference in which the mean and standard deviation of these draws constitutes the estimates and standard errors. However, based on the Bayesian approach, the program Gauss 6.0 has been used to estimate the results from the coefficients. The distribution of each attribute is priory assumed to be in normal distribution except for the last attribute 'Cost' which has been set to log-normal distribution. Dummy variables have been used for the qualitative attributes such as Strategy, Legal framework, GEA, Portal language. The first alternative (long term) of attribute 'Strategy' has been set to be the base alternative. Table 4-5 also depicts the results of the random coefficients

Table 4-5 also showed the mixed logit model results (with t-statistics) based on Bayesian approach. From the results of Bayesian procedure which also presented in the same table 4-5, the coefficients of the estimated model can be interpreted as following:

All the results are statistically significant at the 1% level of significance in terms of means except Training and GEA attributes which are not significant in terms of means, but their variance estimates are statistically significant at 1% level of significance. The positive and statistically significant value of Strategy implies that the respondents are sensitive in terms of the existence of clear and tailored strategy for the different stages of e-Government implementation in Yemen. Legal framework attribute is also positive and significant parameter in the model which indicated that strong legal framework is preferred to be established along with e-

Government implementation. The GEA parameter is not significant in terms of mean, but it is significant in terms of its variance, this implies that government employees have variances in the preferences of the type of GEA. This variation implies that the respondent might have not understood well the centralized and decentralized GEA; such kind of confusion might be the reason behind having GEA not significant in terms of mean. However, the choice of centralized or decentralized GEA is relatively affect the policy makers' choice for the system type; specifically, government officials are most likely seeking for decentralized system which provide basic features and easy to use the e-Government portal and its services.

It is surprising that, Portal Language mean and variance are significant at the 1 % level of significance, the positive sign of this parameter indicates that government officials have a clear vision for future deal with local and international transactions as they prefer the e-Government portal should be available in both Arabic and English languages.

Privacy attribute is significant at 1% level in terms of its mean; however, the variance estimate of this parameter is not significant which shows that the respondents have uniform preference towards Privacy. Meanwhile, the positive sign of Privacy attribute indicates that the government officials need a fully secured e-Government system which guarantees the protection of government data and personal information.

For the Training attribute, it is also not significant in terms of mean estimates but it shows significance at 1% level for its variance. Respondents also have different preference variances according to their position titles or maybe level of education.

As discussed earlier in this chapter, respondents state the least preferences for technical training attribute as they are government employees they do not prefer long period training for the reason of not being behind of their duties back in their offices. Furthermore, the negative sign of the Training coefficient suggests that the government officers prefer short period training for e-Government concepts and usage.

Concerning the price attribute, it is significant in terms of mean but not in variance. However; the negative price coefficient is in line with economic theory. It is more informative and useful to translate this price into WTP for each other e-Government attributes in the previous section 4.3.1. As the variance of the attribute “Cost” is not significant, it shows that government officers have sensitivity and uniform preference toward this budget.

As discussed earlier in this chapter, this study also follows the transformed coefficients procedure for each variable based on the generated 2000 draws which depicted in the estimation output by Gauss 6.0 and provided us the transformed coefficients as presented in Table 4-6.

**Table 4-6: Mean and Variance of Transformed coefficients**

Variables	Mean	Variance
	Coefficient	Coefficient
Strategy	2.655	1.4032
Legal Framework	0.6177	0.594
GEA	0.127	1.1333
Portal Language	1.0533	0.9192
Privacy	482.56	366.06
Training	-0.0141	0.2276
Cost (OPEX)	-0.486	0.091

Before preferences can be determined, data are frequently transformed to approximate normality because of a skewed distribution of errors (Euser *et al.*, 2008). The results in the Table 4-6, assume that the coefficient for the attribute “Price” has log-normal distribution and the other six variables have normal distribution. The coefficients in this estimation have equal signs for the same attributes in the estimates of the rank-ordered mixed logit model. However, changes occurred in the order of the significance with this estimation. The random coefficient estimates depicted in Table 4-5 shows that there are changes or variances to the variables’ mean and variance which indicate that government employees are showing heterogeneity in their preference with regard to the e-Government implementation in Yemen. The negative sign of the ‘Training’ coefficient implies that respondents take training into consideration in the choice, preferring short period training.

For the shares of populations for the coefficients, it is clear that there is no tendency towards the coefficient Cost (OPEX). This Cost attribute is in log normal distribution which comes in negative term below zero indicating that all the respondents want to annually assign a budget for e-government operation but at the minimum values, as they are government officers trying to save the government money. Table 4-7 shows the shares of population for the coefficients, and it is interesting that all the respondents are sensitive to all attributes. This may indicate that the result we got from the rank ordered mixed logit model can be generalized. However, as the mean of the Training component is not significant, its variation is significant because of the population share depicted in Table 4-7 which presents these shares of population.

**Table 4-7: Shares of population for the coefficients**

Variables	Below zero	At zero	Larger than zero
Strategy	40%	0%	60%
Legal framework	21%	0%	79%
GEA	45%	0%	55%
Portal Language	13%	0%	87%
Privacy	0.3%	0%	99.7%
Training	51%	0%	49%
Cost (OPEX)	100%	0%	0%

The estimates above imply that 51% of the populations prefer short period training, and 49% of them prefer long period training. This strongly reveals that majority of respondents (government officials) concern to have training for the concepts and usage of e-Government technologies. All the heterogeneity observed from the shares of population has been reflected in the policy implications chapter.

In addition, this study also calculated the WTPs for attributes. In mixed logit procedure, convenient distributions (normal and log normal distribution) were applied for coefficients, and the WTPs for attributes calculated by dividing their coefficients by the ‘cost’ coefficient to generate the MWTPs; however, this may result that WTPs distributions can be highly skewed, which may provide unrealistic estimation of WTPs (Train and Weeks,2005; Lee *et al.*,2006). To overcome that problem, Hole and Kolstad (2012) suggest the use of the Median WTP based on the means and variances of the coefficients; hence; the range of WTPs can be provided based on the obtained simulation of the 2000 draws of the estimated distribution of WTPs.

**Table 4-8: Median WTP**

Quartile	Strategy	Legal		Portal			Cost
		Framework	GEA	Language	Privacy	Training	
Median	<b>7.0</b>	<b>1.74</b>	<b>1.03</b>	<b>0.03</b>	<b>2.62</b>	<b>0.20</b>	N/A
1st	-6.8	-0.09	-0.52	-1.70	0.3	-0.89	N/A
3rd	2.05	3.64	2.74	1.31	5.99	-1.51	N/A

*In 1<sup>st</sup> and 3<sup>rd</sup> quartiles, there is a clear variation. The concern here is only Median quartile.*

Table 4-8 shows the range of the median WTPs. As the rank-ordered mixed logit model reflects the heterogeneity of respondents based on the means and variances of the coefficients, this study utilizes the quartiles that contains the median WTPs distributions as presented in the above Table 4-8, and found that the values and signs are supportive for the previous discussed preferences of the government officials toward the successful implementation of e-Government system in Yemen. From the above table, it is clear that government officials are willing to assign for the ‘Strategy’ (7 million \$), for ‘Privacy’ (2.62 million \$) and for ‘Legal Framework’ (1.74 million \$). Forty nine percent of respondents have negative WTP for the ‘Training’ attribute which justifies the previous results discussed earlier in this chapter.

However, as pointed out, if we consider the government is homogenous, then these plans could be applied. Of note, as matter of fact, government officials do not have the same characteristics and demographics. Therefore, the policy may not positively affect all individuals. In order to obtain more detail and efficient outcomes that are targeted to the benefit of the whole government, more flexible policies should be done, particularly, by relaxing the restrictions of the mixed logit model. This relaxing can be done with model interaction with the socio-demographics.

#### 4.4.3 Model Estimation with socio-demographics interactions

The interaction with socio-demographics information of the respondents generates the relaxation of the rank-ordered mixed logit model. These demographic characteristics enable the heterogeneity to be incorporated into the part-worths (Savage and Waldman, 2005). Table 4-9 shows the estimation results from the interactions of the attributes involved with the socio-demographic terms such as (education and profession).

**Table 4-9: Estimation results of rank-ordered mixed logit model with interaction**

S/N	Attribute	Coefficients	t-ratio
1	Strategy	0.17379**	22.3042
2	Legal Framework	3.0139**	5.5477
3	GEA	2.5985**	6.4970
4	Portal Language	2.0583**	3.3427
5	Privacy	0.0044**	78.0020
6	Training	-0.4418	0.6811
7	Cost (OPEX)	-0.0635**	-34.8414
8	Education with Strategy	0.6107**	23.9489
9	Education with Legal frame	5.4159**	70.5346
10	Education with Privacy	0.3582**	25.8352
11	Profession with Privacy	5.2689**	556.5446
12	Education with Cost	-2.6194**	-463.5821
13	Profession with Cost	-0.4163**	-70.2665

Asterisk \*\* statistically significant at 1% level

As depicted in Table 4-9, the results of the mixed logit model with socio-demographic interactions show that education level, and profession (position titles of government employees) are the highly statistically significant; however, the gender and age characteristics have been omitted as they do not significantly affect the decision of choosing the e-Government implementation packages. The other significant factors have negative effects on government officials' preferences, this can be considered an appealing results, it implies that the officers with some education level, mostly are not aware enough of the importance of establishing the e-Government system, they are in general may not understand the purpose of the system they are adopting. By looking deeply to the results, even though the Training attribute is not significant, it has also negative effects that more training for the e-Government system usage leads to better understanding the different aspects of the system, and lower training will lead to lower understanding and satisfaction rate.

To summarize, this chapter has examined the issue of estimating the preferences across policy makers in government sector toward e-Government implementation choice. This topic is kind of new interest given the reliance on mixed logit models in e-Government fields. In addition; the interaction with socio-demographics information of the respondents generates the relaxation of the rank-ordered mixed logit model. These demographic characteristics enable the heterogeneity to be incorporated into the part-worths (Savage and Waldman, 2005). This chapter demonstrated the sample design used for inferring the characteristics of respondents and discussed how they can be combined with the elements of discrete choice model.



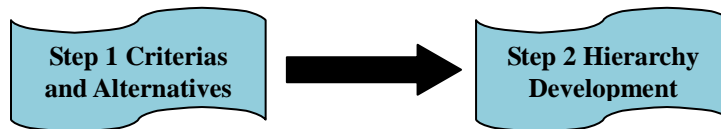
The results presented across this chapter showed that Yemeni policy makers in government agencies have higher relative utility for, strong legal framework, highly secured e-Government system without any probability of information leakage, and implementing a strong legal framework while establishing e-Government. This study also applied Bayesian approach using mixed logit model; and the results (with t-statistics) showed that all the coefficients of the estimated model are statistically significant at the 1% level of significance in terms of means except Training and GEA attributes which are not significant in terms of means, however, their variance estimates are statistically significant at 1% level of significance which implies that there is a heterogeneity among the policy makers' preferences toward the e-Government implementation in Yemen.

# Chapter 5 Preferences based on Analytical Hierarchy Process

Chapter 5 discusses the second research method used. The first section illustrates and discusses the hierarchical framework of this methodology. Then the survey and data collection techniques are explained. Thereafter, the empirical results are presented and discussed.

## 5.1 Methodological framework

In this subchapter, the AHP methodology framework of this study will be clarified in two steps, criterias and levels, and hierarchy development.



**Figure 5.1 Two steps of AHP framework development**

### Step 1 - Criteria and Levels

In this section, a comprehensive literature review has been conducted to clarify the goal of decision making problem by identifying the related criteria and alternatives as described in Table 5-1.

**Table 5-1: Criterias and Alternatives of AHP framework development**

<b>Criteria</b>	<b>Sub-criteria</b>	<b>Alternative</b>	<b>Related Literature</b>
<b>Governing Factors</b>	<b>Administrative</b>	Leadership	Heeks (2003), Sang <i>et al.</i> (2009)
		Top Management	Ndou, (2004); Hossan <i>et el.</i> , (2006);
		Support	Alshehri and Drew (2010)
		Strategy	OECD ,(2001); Ndou,(2004)
	<b>Legislative</b>	Legal Framework	Gil-Garcia and Pardo (2005); Ndou (2004);
		Detailed Policies	Basu (2004); ESCWA (2007).
<b>Organizational Factors</b>	<b>Organizational Structure</b>	Collaboration	OECD (2003); Ndou, (2004); Heeks (2007).
		Readiness	UN e-Government survey (2008)
	<b>Technological</b>	Adequate	Bhuiyan (2011); Alnagi and Hamdan
		Technological	(2009); Sang <i>et al.</i> (2009); UN (2008);
		Infrastructure	OECD (2003).
		Security	Alsheri and Drew (2010); Belanger and Hiller (2006); Ndou (2004).
<b>External Factors</b>	<b>Citizen-Centric</b>	Training	Alsheri and Drew (2010); OECD (2003).
		Gender Digital Gap	
	<b>Economic</b>	Trust	Alsebaeai <i>et al.</i> (2012); Alsheri and Drew
		Education	(2010); Ndou, (2004); OECD (2003);
		Incentive	ESCWA (2007); World Bank (2002).
		Personal Income	

## Step 2 - Hierarchy Development

With AHP, the problem should be structured as a hierarchy; therefore, hierarchy development occurred after a brainstorming and was the last step of constructing the AHP analytical framework. According to AHP methodology, the hierarchical tree should be designed accordingly as the first step of the AHP procedure. As illustrated in Figure 5-2, the structured hierarchy that was designed for this study is presented. The goal of decision problem is at the top of the tree and consists of three levels. The first level is called criteria and each criteria has its own subcriteria presented in the second level. Finally, the third level at the bottom of the hierarchy contains alternatives of the above levels.



**Figure 5-2: The AHP framework of e-Government implementation**

## 5.2 AHP Model

This study described quantitative and qualitative research of the government's efforts for e-Government adoption in Yemen by conducting an in-depth investigation of government employees' preferences towards e-Government implementation factors. The findings of the previous studies as presented in the third chapter identified factors that directly impact successfully e-Government system implementation in developing countries. This study expanded on previous literature by adding related factors that have straightforward effects on implementing a successful e-Government system that suits the country profile of the Yemen.

Moreover, both existing factors in previous literature and the identified factors for the Yemeni case have been classified into six categories:

- (1) Administrative factors
- (2) Legislative factors
- (3) Organizational structure factors
- (4) Technological factors
- (5) Citizen-Centric factors
- (6) Economic factors

Thereafter, the above six categories have been classified into sub-factors. The factors and sub-factors are depicted in the AHP empirical model which is presented in this section. Accordingly, the following hypothesis will be considered relating to each of the six categories mention above:

- **H1.** Administration related factors affect the successes of e-Government system implementation within the government of Yemen.

- **H2.** Legislative related factors affect the successes of e-Government system implementation within the government of Yemen.
- **H3.** Organizational structure related factors affect the successes of e-Government system implementation within the government of Yemen.
- **H4.** Technological related factors affect the successes of e-Government system implementation within the government of Yemen.
- **H5.** Citizen-Centric related factors affect the successes of e-Government system implementation within the government of Yemen.
- **H6.** Economic related factors affect the successes of e-Government system implementation within the government of Yemen.

The above hypothesis can be internally expressed in algebraic calculation using the tailored software for AHP which is Expert Choice 2000, to examine how the different critical success factors (CSFs) affect the successful implementation of a robust e-Government system in Yemen. Thereby, the AHP hierarchical tree represents the AHP model.

### **5.3 Survey and Data**

This study followed the AHP methodology for data gathering and analysis according to (Saaty, 1980; Ishizaka and Labib, 2011). As discussed in Chapter 3, the AHP is based on four steps: problem modeling (pair-wise comparison design, weights aggregation, and sensitivity analysis). Therefore, the procedure of AHP in this study was to solve a decision problem using these four steps for a single decision maker (Saaty, 1980).

The AHP criteria were selected based on previous literature and new specific terms about Yemen that address contribution factors. Based on the hierarchy structured, the AHP survey questionnaire was developed. Data collected from policy makers of e-Government in Yemen (decision makers, government employees, e-Government project team and technical staff) corresponded to the hierarchal structure, and was analyzed using pair-wise comparison of the attributes on a qualitative scale. Respondents rated the comparison as equal, slightly more important, more important, much more important and absolutely important. To consider the issue from top management, high level decision makers whom preference determines the importance of each factor were conducted.

### **5.3.1 AHP survey**

The AHP survey questionnaire was designed in three sections. The first section contains the overall introduction of the research and survey explanations. The second section contains the pair-wise comparison questions for three main criteria and six sub criteria, which include 15 factors that affect the successful implementation of a robust e-Government system in Yemen (see Figure 5.2). The last section contains the general demographics of respondents. The respondents were government officers and decision makers of the e-Government projects in Yemen; which assure us that the respondents filled the questionnaire carefully not randomly. Therefore, it can be guaranteed that the distribution of respondents is in accordance with e-Government adoption in Yemen.

According to the pair-wised comparison proposed by AHP method, an official survey questionnaire designed with three main parts:

- Part 1: Introduction:

This part contains the title, purpose, supporters and performers of the study. It also contains the benefits of the result of research for each group of respondent who have been conducted as policy makers' for the e-Government system (decision makers, government employees, e-Government project team (experts) and the technical staff). The contact information in a case of a query or question related to the survey was presented in this part. This part is ended with aim to motivate the different groups to fill the questionnaire.

- Part 2: Pair-wise comparison questions :

Before listing the pair-wise comparison questions, this part starts with a table describes each and every criteria, sub-criteria, and alternatives involved in the hierarchical tree of this study to be readen in order to making respondents to understand the meaning of each factor comparison and the meaning of the different criterias and their levels before answering the pair-wise comparison questions. These descriptions are shown as a table in sixth page of the survey. After that, each comparison conveyed with a question to help the respondents to do a better judgments.

- Part 3: Demographic:

The survey had also the demographic questions in the last part of the questionnaire, which was same for all groups of respondents as they are all from government sectors. In this government official questionnaire, respondent's personal information was our concern. However, in this questionnaire, the e-Government portal usage questions were also asked in a subsection of this part. Nevertheless, the respondents were allowed to remain this subsection unfilled in case they did not use the e-Government



portal before. Moreover they were also allowed to remain the demographic part unfilled in case they consider this part is confidential, however, no respondent remain this part unfilled.

After designing the AHP survey, this study conducted a pilot survey in the beginning of 2012 where the distribution of the respondents was in six Yemeni government agencies; namely, Prime Minister's office, ministry of telecommunication and information technology, ministry of planning and international cooperation, ministry of justice, ministry of electricity, and ministry of external affairs. However, the result of the pilot survey was presented and published as an academic paper in the 12<sup>th</sup> International Conference on e-Government in Spain (2012) and was authored by (Mahdi Abdullah Alsebaei, Manseok Jo, and Jongsu Lee, 2012). Then, the survey had been finalized to produce the main survey in May 2012.

### **5.3.2 Data collection**

This study used a survey based instrument as the technique for data collection.

Firstly, for the survey management, and in order to conduct an official survey to be perceived from government employees in the different ministries of the Yemeni government, we employed three technical staff to distribute and explain the survey for participants in the different ministries with respect to the official cover letter attached from the General Secretary of the Yemeni Cabinet in the Prime Minister's Office (See Appendix A). As mentioned above the survey contains three parts and the questionnaire pages are depicted in appendix B in Arabic and English languages.

After that, we collected a survey data from 75 respondents "Yemeni official"

(decision makers and top management, government employees, e-Government project team and technical staff), those respondents are the same conducted for the conjoint survey are located in 14 different government agencies in the Republic of Yemen as presented in Table 5-2. Out of 75 respondents, 10 samples were invalid due to the incompleteness of answers of the questions or their inconsistency rate is too high. Therefore, only 65 acceptable answers were obtained to be eligible to make the judgments. As the questionnaire had 65 absolute answers out of 75 respondents' answers, the compilation rate is 80% of the total responses, ten of responses were invalid and had been removed as a result. Overall Inconsistency is 0.01 which is in the acceptable range and guarantees the reliability of the survey responses.

As mentioned above, the respondents have been categorized into three different groups; the first is the normal government employees, the second group is the e-Government project's team members and the technical staff, and the third group is the top management and decision makers related to e-Government. Table 5.2 shows the different government agencies that have been chosen to survey.

**Table 5-2: Government Agencies in Yemen which conducted for the Survey**

<b>No.</b>	<b>Agency Name</b>	<b>Official Site Address</b>
1	Prime Minister's Office	<a href="http://www.yemen.gov.ye/portal/gov">www.yemen.gov.ye/portal/gov</a>
2	Ministry of Telecommunication and IT	<a href="http://www.yemen.gov.ye/portal/mtit">www.yemen.gov.ye/portal/mtit</a>
3	National Information Center (NIC)	<a href="http://www.yemen-nic.info">www.yemen-nic.info</a>
4	Ministry of Planning and Int. Coop.	<a href="http://www.yemen.gov.ye/portal/mpic">www.yemen.gov.ye/portal/mpic</a>
5	Ministry of Interior Affairs	<a href="http://www.yemen.gov.ye/portal/moi">www.yemen.gov.ye/portal/moi</a>
6	Ministry of External Affairs	<a href="http://www.yemen.gov.ye/portal/mofa">www.yemen.gov.ye/portal/mofa</a>
7	Ministry of Defense	<a href="http://www.yemen.gov.ye/portal/moddefense">www.yemen.gov.ye/portal/moddefense</a>
8	Ministry of Justice	<a href="http://www.yemen.gov.ye/portal/justic">www.yemen.gov.ye/portal/justic</a>
9	Ministry of Finance	<a href="http://www.yemen.gov.ye/portal/finance">www.yemen.gov.ye/portal/finance</a>
10	Ministry of Oil and Natural Resources	<a href="http://www.yemen.gov.ye/portal/mom">www.yemen.gov.ye/portal/mom</a>
11	Ministry of Electricity	<a href="http://www.yemen.gov.ye/portal/electricity">www.yemen.gov.ye/portal/electricity</a>
12	Ministry of Social and Labor's Affairs	<a href="http://www.yemen.gov.ye/portal/mosal">www.yemen.gov.ye/portal/mosal</a>
13	Ministry of Civil Services	<a href="http://www.yemen.gov.ye/portal/mocsi">www.yemen.gov.ye/portal/mocsi</a>
14	Ministry of Higher Education	<a href="http://www.yemen.gov.ye/portal/mohe">www.yemen.gov.ye/portal/mohe</a>

## **5.4 Analysis and Results**

AHP provides means of decomposing the problem into a hierarchy of sub problems which can more easily be comprehended and subjectively evaluated. This section explains in-depth how this research followed the AHP procedure to get the results.

### **5.4.1 Prioritizing the identified factors**

The AHP methodology can be explained in the following steps of the AHP procedure (Saaty, 2008, Ishizaka and Labib, 2011). However, decision making studies made us to involve these following steps.

First, AHP procedure starts with *Setting up the Decision Hierarchy* where the problem is decomposed into a hierarchy of goal, criteria, sub-criteria and alternatives. The hierarchy indicates the relationship between elements of one level with those of the level immediately below as shown in the hierarchy diagram (See Figure 5-2).

In this study, the criteria are the factors solicited in the “identifying the success factors that contribute to the success implementation of a robust e-Government system in Yemen”. Based on AHP method, the subsequent elements of each criterion must depend on related criterion (Saaty, 2008), the factors were categorized into three main criterias namely; Governing factors, Organizational factors, and external factors. Each main criteria has two different sub-criterias and each criteria has different number of alternatives. The hierarchy structure of this study is illustrated in the previous subchapter 5.1.

Second, performing the *Pair-wise Comparisons of factors*. Each factor in an upper level is used to compare the attributes in the level immediately below with respect to it (Saaty, 2008). This is used to determine the relative importance of the attributes involved. However, this step has been discussed in details in the AHP survey design as presented in the previous section 5.3.

Third, *collecting data regarding the hieratical structure*. As also discussed in the previous sections of this chapter, this step has been presented deeply in subchapter 5.3 as well.

Fourth, *transform the comparison into weights and consistency*. The AHP converts judgments of participants into weights, which are then automatically normalized to sum 1. A number of conversion methods are possible, but the AHP

use mathematical approach based on Eigen values (Goodwin and Wright, 2004). Because of the complexity of this method, computer software called Expert Choice 2000 is used to carry out these calculations. The weights considering the participants judgment are demonstrated in Table 5-5 for the first group (government employees). Weights according to e-Government team and the technical staff's judgments are depicted in Table 5-6 for the second group. The weights regarding top managements and decision makers' judgments are presented in Table 5-7. The overall aggregated weights resulted from aggregating the three groups are shown in Figure 5-6.

Fifth, the last step of the AHP procedure is *synthesizing the Results*. AHP uses the priorities obtained from the comparison to weight the priorities in the level immediately below and continues this for every factor. Then for each factor in the below level adds its weighted values and obtain its global or overall priority. It continues on this procedure of weighting and adding till the final priority of the alternatives in the most bottom level is obtained (Ameri, 2009). Therefore, AHP calculates the local priority with respect to each criteria. The local priority are then multiplied by the weights of the criteria and aggregated to get the global ratings. The global and local priority of each criteria according to the all three groups are shown in Tables 5-5, 5-6, and 5-7.

Finally the synthesized results based on different groups: government employees, e-Government team and technical staff, and top management officials and decision makers' preferences aggregated in each node in the hierarchy. The aggregation was obtained by calculating the arithmetic mean of global importance estimated by the

three groups and consequently the final importance of the factors was obtained. The global relative importance of each factor in the hierarchy is shown in Figure 5-6.

#### **5.4.2 AHP and Group Decision Making**

In AHP, grouping decisions is an important issue which means how to aggregate individual judgments in a group into a single representative judgment for the entire group (Saaty, 2008).

Respondents have been divided into three different groups in which each group has a collection of individuals (participants). The first group has 23 individuals as general government employees, the second group has 24 individuals as an e-Government project team members and technical staff, and the third group has 18 individuals as decision makers and high level leaders related to e-Government. In contrast, decision makers with different knowledge in one group may have different opinions and solutions for ranking the set of alternatives with regard to the goal.

In order to avoid such kind of variations, this study used the AHP procedure which is applicable to individuals and group decisions (Saaty, 2008). Therefore, this standard AHP procedure has been followed to aggregate information since there is more than one group participates in the decision process. This procedure includes:

- (1) Aggregating the individual judgments for each set of pair-wise comparisons into an aggregate hierarchy.
- (2) Synthesize each of the individual's hierarchies and aggregating the resulting priorities in which the overall inconsistency of each individual is not larger than  $> 0.19$  to guarantee the reliability of the judgments, however the respondent who had a larger inconsistency than 0.19 has been removed and regarded as an invalid response.

(3) Aggregating the individual's derived priorities in each node in the hierarchy to construct a group decision. Table 5-3 shows the different groups of participants.

**Table 5-3: Grouping Participants**

<b>Groups</b>	Group1: Government Employees	Group 2: e.Gov. team & Tech. Staff	Group 3: Gov. Top Mgt. & Decision Makers	<b>Total No. of Respondents</b>
<b>No. Of Respondents</b>	<b>23</b>	<b>24</b>	<b>18</b>	<b>65</b>

### 5.4.3 Overall Inconsistency ratio

When large amount of scattered individuals provide the judgments, inconsistency (variation) between individuals is much more important than the consistency of a single one of them (Saaty, 1993). The overall inconsistency smaller or equal to 0.1 is acceptable (Saaty, 2008). The inconsistency ratio of the government employees, e-Government team and technical staff, and top management officials and decision makers' data has been calculated by Expert Choice 2000 software which is the standard computer program to analyze the AHP pair-wise comparison data. The individual group's as well as the overall inconsistencies are presented in Table 5.4.

**Table 5-4: Overall Inconsistency**

<b>Groups</b>	Group1: Government Employees	Group 2: e.Gov. team & Tech. Staff	Group 3: Gov. Top Mgt. & Decision Makers	<b>Overall Inconsistency</b>
<b>Inconsistency</b>	<b>0.01</b>	<b>0.01</b>	<b>0.03</b>	<b>0.01</b>

#### **5.4.4 Participants' Preferences for each group**

Each group's preferences can be viewed in different ways: by discussing about the importance of each factor in each level using the global importance of each node resulted in the fourth step of AHP methodology which has been discussed in the previous sections, or by discussing about the relative importance of each factor inside the branch using local importance of each node in the AHP hierarchy. The following are the preferences obtained from each group.

##### **A) First Group (Government Employees') Preferences**

###### *1- First Group's Preferences inside each level:*

The first group "government employees" preferences can be viewed in in the above metntioned ways. The wights of the local and global importance of each criteria for the first group were obtained with the AHP technique using the expert choice software as illustrated in Table 5-5.

According to the government employees group, the factors related to the "Governing factors" ( $G, L = 0.594$ ) are the most important factors in the first level of the success factors that are affecting the e-Government adoption in their agencies. They indicate that legal framework is the most important factor while dealing with the implementations of e-Government projects and it must be established as a proper and strong legal framework for the different operations of e-governmnet because it include the protection of government data and personnel information. In addition, Yemen government roles at current stage requires to be developed to cover new legal issues and reforms which are major factors for the successful of e-Government implementation in Yemen.



**Table 5-5: First group's (government employees') Preferences**

<b>Goal: Success Factors of e-Government implementation in Yemen</b>				
<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Local Importance</b>	<b>Global Importance</b>
<b>Governing (L: 0.594, G:0.594)</b>	Administrative (L: 0.579, G:0.344)	Leadership	0.310	0.106
		Top Management	0.354	0.122
		Support		
		Strategy	0.337	0.116
	Legislative (L: 0.421, G:0.250)	Legal Framework	0.685	0.171
		Detailed Policies	0.325	0.079
<b>Organizational (L: 0.242, G:0.242)</b>	Organizational Structure (L: 0.323, G:0.078)	Collaboration	0.283	0.022
		Readiness	0.717	0.056
	Technological (L: 0.677, G:0.164)	Adequate		
		Technological	0.447	0.073
		Infrastructure		
		Security	0.240	0.039
<b>External (L: 0.164, G:0.164)</b>	Citizen- Centric (L: 0.372, G:0.061)	Training	0.313	0.051
		Digital Gap	0.150	0.009
		Trust	0.244	0.015
	Economic (L: 0.628, G:0.103)	Education	0.606	0.037
		Incentive	0.461	0.047
		Personal Income	0.539	0.055

//L: indicate to Local Importance and G: indicates to Global Importance

However, Basu (2004) emphasized that the success of e-Government implementation and its services in developing countries are highly dependent on government's role in ensuring a proper legal framework for their operation. Establishing protections and legal reforms will be needed to ensure, among other things, the privacy, security and legal recognition of electronic interactions and electronic signatures (Ndou, 2004).

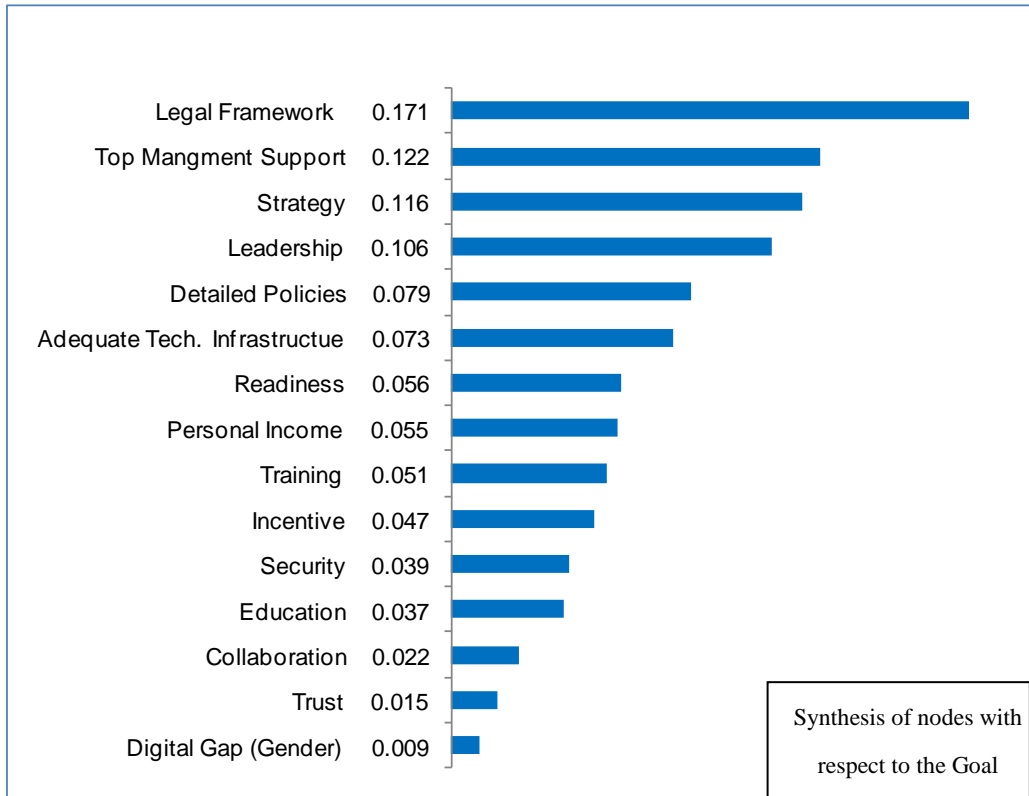
Moreover, the first group's opinions implies that, 'Organizational factors' (G, L=0.242) have the second priority in the first level of the success factors. 'External factors' (G, L=0.164) have ranked third priority and given a quite less importance in comparison with the governing and organizational factors in the same level.

#### *2- First Group's (Government Employees) nodes prioritizations:*

In the "e-Government success factors that contribute to successful implementation of a robust e-Government system" hierarchy, the nodes are identified factors that must be prioritized according to government employees' behavior. "Legal framework" factor (G=0.171) seemed to be the most important factor in nodes ranking even quit more important than "Top Management Support" (G=0.122). "Strategy" (0.116) positioned in the third importance level. The order of the importance in the remaining factors is described in the following Figure 5-3.

**Group 1: Government Employees: Overall Inconsistency=0.01.**

**Synthesis with respect to the Goal: E-Government success factors**



**Figure 5-3: First group's (government employees') node prioritization**

**B) Second Group (e-Government team & Technical Staff's) Preferences**

*1- Second group's (e-Government team & Technical Staff's) Preferences inside each level:*

The second group "e-Government team and the technical staff" preferences can be viewed similarly with the first group. The weights of criterias were obtained as depicted in table 5-6. According to the e-Government team and the technical employees the factors related to the "Governing factors" (G, L= 0.606) are the most important factors in the first level of the success factors. The "Organizational

factors” (G, L= 0.236) have the second priority in the first level of the success factors. “External factors” (G, L=0.158) have ranked third priority and given a quite less importance in comparison with the governing and organizational factors in same level.

**Table 5-6: Second Group’s (e-Government team and technical staff’s) Preferences**

Goal: Success Factors of e-Government implementation in Yemen				
Level 1	Level 2	Level 3	Local Importance	Global Importance
Governing (L: 0.606, G:0.606)	Administrative (L: 0.303, G:0.183)	Leadership	0.456	0.084
		Top Management	0.292	0.054
		Support		
		Strategy	0.252	0.046
	Legislative (L: 0.697, G:0.422)	Legal Framework	0.788	0.333
		Detailed Policies	0.212	0.089
Organizational (L: 0.236, G:0.236)	Organizational Structure (L: 0.244, G:0.058)	Collaboration	0.372	0.021
		Readiness	0.628	0.036
	Technological (L: 0.756, G:0.179)	Adequate Tech. Infrastructure	0.532	0.095
		Security	0.176	0.031
		Training	0.293	0.052
		External (L: 0.158, G:0.158)	Citizen- Centric (L: 0.366, G:0.058)	Digital Gap
Trust	0.162			0.009
Education	0.723			0.042
Economic (L: 0.634, G:0.100)	Incentive		0.225	0.023
	Personal Income		0.775	0.078

//L indicates to Local Importance and G indicates to Global Importance

This decision of the second group is very much similar to the decision of the first group in terms of the first level of the hierarchal tree. This indicates that they have no variances toward the final decision of the e-Government implementation in Yemen.

## *2- Second Group's (e-Government team and technical staff's) nodes prioritizations:*

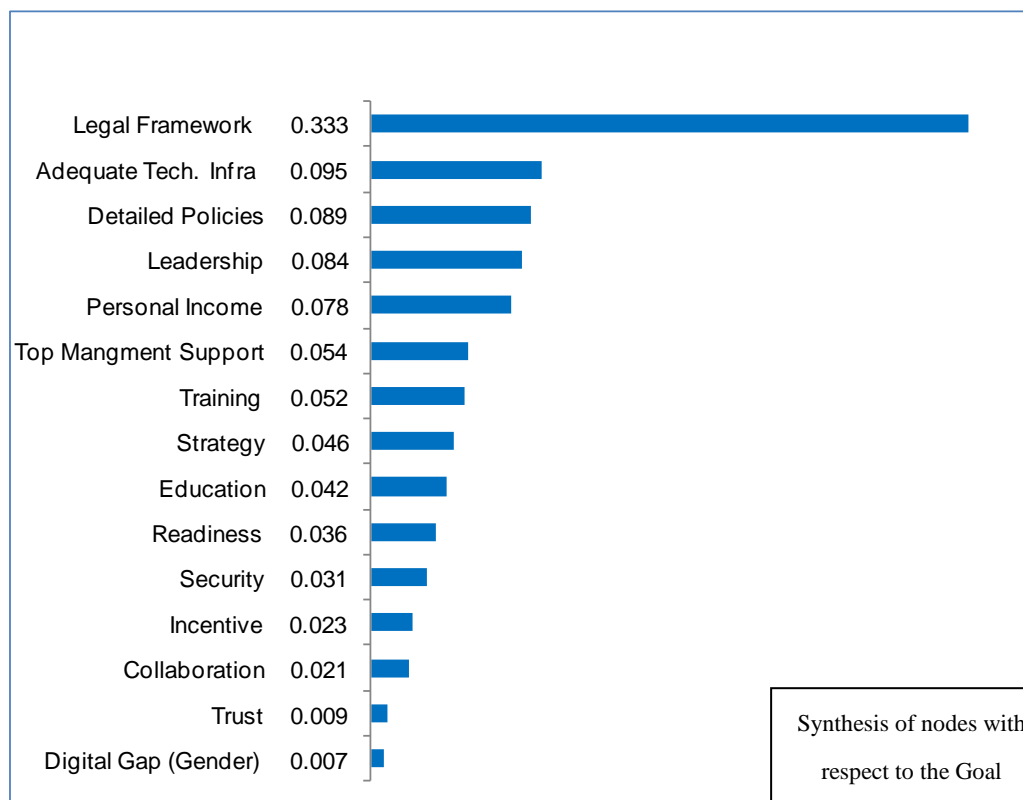
In the hierarchy of 'e-Government success factors that contribute to successful implementation of a robust e-Government system', the nodes are identified factors that must be also prioritized according to e-Government team members and the technical staff's behavior.

In second group, "Legal framework" factor ( $G=0.333$ ) estimated to be the most important factor in nodes ranking even more important than "Adequate Technological Infrastructure" (0.095) which ranked second in the importance of the hierarchal tree. The factor "Detailed Policies" ( $G=0.089$ ) positioned in the third importance level with quit less than "Adequate Technological Infrastructure" factor.

Here, the "Personnel Income" ranked fourth and "Top Management Support" ranked fifth important factor in the success factors hierarchal tree. The order of the importance for the remaining factors is described in Figure 5-4.

**Group 2: Technical staff & e-Gov. project's team: Overall Inconsistency = 0.01**

**Synthesis with respect to the Goal: E-Government success factors**



**Figure 5-4: Second group's (Technical staff & e-Gov. project's team) node prioritization**

**C) Third Group (Top Management & Decision Maker's) Preferences**

*1- Third group's Preferences inside each level:*

The third group “top management and the decision makers” preferences also discussed in the same way of previous two groups. However, the weights for the criterias and levels assigned by this group are presented in Table 5-7.

According to the top management and the decision makers related to e-Government the factors related to the “Governing factors” (G, L= 0.472) are the most important factors in the first level of the success factors. The “Organizational factors” (G, L= 0.345) have the second priority in the first level of the success factors. “External factors” (G, L=0.183) have ranked third priority and given a quite less importance in comparison with the governing and organizational factors in the same level. The overall decision of the three groups for the first level of the decision hierarchal tree can be summarize as all the groups have the same opinions towards the final decision of e-Government implementation as they advise the government of Yemen to start dealing with the factors related to the governing criteria which includes Administrative factors (Leadership, Top Management Support, and clear Strategy) and Legislative factors (existence of strong legal framework, and detailed policies of the related legal and law issues).

## *2- Third Group's (Top Management and Decision Maker's) nodes prioritizations:*

In the “e-Government success factors that contribute to successful implementation of a robust e-Government system” hierarchy, the nodes are identified factors that must be prioritized according to government employees' behavior.

In third group, “Legal framework” factor (G=0.208) estimated to be the most important factor in nodes ranking even quite more important than “Readiness” (G=0.129) which ranked second in the importance of the hierarchal tree. The factor “Detailed Policies” (0.99) positioned in the third importance level with less than “Readiness” factor. In this group's preferences, the “Adequate Technological Infrastructure” ranked fourth important factor in the success factors hierarchal tree.

**Table 5-7: Third group's (Top Management & Decision Maker) Preferences**

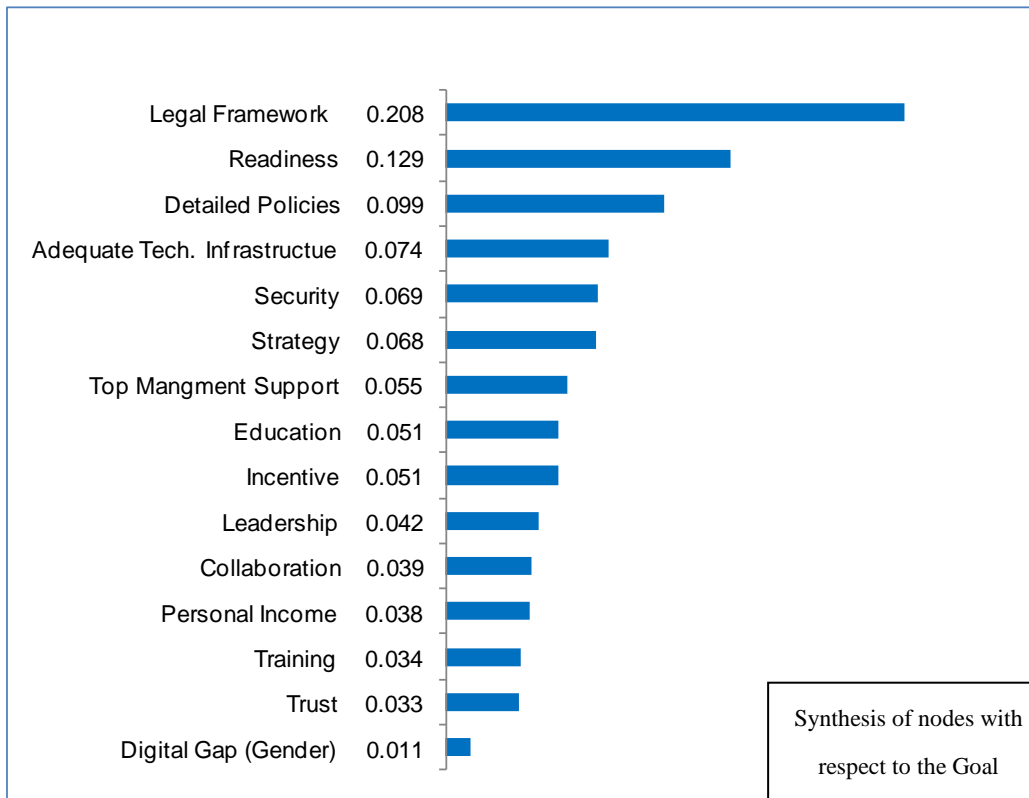
<b>Goal: Success Factors of e-Government implementation in Yemen</b>				
<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Local Importance</b>	<b>Global Importance</b>
<b>Governing (L: 0.472, G:0.472)</b>	Administrative (L: 0.350, G:0.165)	Leadership	0.254	0.042
		Top Management	0.333	0.055
		Support		
		Strategy	0.413	0.068
	Legislative (L: 0.650, G:0.307)	Legal Framework	0.679	0.208
		Detailed Policies	0.321	0.099
<b>Organizational (L: 0.345, G:0.345)</b>	Organizational Structure (L: 0.487, G:0.168)	Collaboration	0.235	0.039
		Readiness	0.7655	0.129
	Technological (L: 0.513, G:0.177)	Adequate		
		Technological	0.419	0.074
		Infrastructure		
		Security	0.392	0.069
<b>External (L: 0.183, G:0.183)</b>	Citizen- Centric (L: 0.516, G:0.094)	Training	0.190	0.034
		Digital Gap	0.116	0.011
		Trust	0.345	0.033
	Economic (L: 0.484, G:0.089)	Education	0.538	0.051
		Incentive	0.574	0.051
		Personal Income	0.426	0.038

//L: indicates to Local Importance and G: indicates to Global Importance



**Group 3: Decision Makers & Gov. Top Managers: Overall Inconsistency = 0.03**

**Synthesis with respect to the Goal: E-Government success factors**




**Figure 5-5: Third group's (Top Management & Decision Makers') node prioritization**

#### **5.4.5 Similarities and dissimilarity perspectives of groups' preferences**

As this study employed three groups of respondents related to e-Government system in Yemen, several differences existing in the results of policy makers' preferences. Several gaps found in the decisions between normal government employees, e-Government team and technical staff, and the top managements and decision makers for the e-Government implementation issues in Yemen. These differences and gaps give an insight that government has to carefully reexamine official's desire and preferences when they implement and develop the e-Government project.

**Table 5.7: Similarities and Dissimilarities of Groups' Preferences**

Group 1: Gov. Employees		Group 2: e.Gov. team & Tech. Staff		Group 3: Gov. Top Mgt. & Decision Makers	
Level 1					
Governing Factors	G=0.594	Governing Factors	G=0.606	Governing Factors	G=0.472
Organizational Factors	G=0.242	Organizational Factors	G=0.236	Organizational Factors	G=0.345
External Factors	G=0.164	External Factors	G=0.158	External Factors	G=0.183
Level 2					
Governing Factors					
Administrative	G=0.344	Legislative	G=0.422	Legislative	G=0.307
Legislative	G=0.250	Administrative	G=0.183	Administrative	G=0.165
Organizational Factors					
Technological	G=0.164	Technological	G=0.179	Technological	G=0.177
Org. Structure	G=0.078	Org. Structure	G=0.058	Org. Structure	G=0.168
External Factors					
Economic	G=0.103	Economic	G=0.100	Citizen-Centric	G=0.094
Citizen-Centric	G=0.061	Citizen-Centric	G=0.058	Economic	G=0.080
Level 3					
Administrative Branch					
Top Mgt. Support	G=0.122	Leadership	G=0.084	Strategy	G=0.068
Strategy	G=0.116	Top Mgt. Support	G=0.054	Top Mgt. Support	G=0.055
Leadership	G=0.106	Strategy	G=0.046	Leadership	G=0.042
Legislative Branch					
Legal Framework	G=0.171	Legal Framework	G=0.333	Legal Framework	G=0.208
Detailed Policies	G=0.079	Detailed Policies	G=0.089	Detailed Policies	G=0.171
Organizational Structure Branch					
Readiness	G=0.056	Readiness	G=0.036	Readiness	G=0.129
Collaboration	G=0.022	Collaboration	G=0.021	Collaboration	G=0.039
					

**Table 5.7: Similarities and Dissimilarities of Groups' Preferences (Cont'd)**

↓					
<b>Technological Branch</b>					
Adequate Tech. Infra.	G=0.073	Adequate Tech. Infra.	G=0.073	Adequate Tech. Infra.	G=0.073
Training	G=0.051	Training	G=0.051	Training	G=0.051
Security	G=0.039	Security	G=0.039	Security	G=0.039
<b>Citizen-Centric Branch</b>					
Education	G=0.037	Education	G=0.042	Education	G=0.051
Trust	G=0.015	Trust	G=0.009	Trust	G=0.033
Digital Gap	G=0.009	Digital Gap	G=0.007	Digital Gap	G=0.011
<b>Economic Branch</b>					
Personal Income	G=0.055	Personal Income	G=0.078	Incentive	G=0.051
Incentive	G=0.047	Incentive	G=0.023	Personal Income	G=0.038

//G: Global Importance// No. of Respondents 115 // Overall Inconsistency is 0.01.

As depicted in the above Table 5.7, the order of the importance for the same factors is perceived from the different groups, government employees, e-Government team and technical staff, top management and decision makers. In the first level of the hierarchy, all groups' preferences are in similarities in order of importance for all the criterias in the same level, governing, organizational, and external factors.

As seen above, there are also similarities in order of the importance within the second and third levels of the e-Government implementation hierarchy with exception of one leave in the second level; and two branches in the third level. In the second level, the leave 'Governing Factors' shows slight dissimilarity from the groups 1, where group 2 and 3 have similarity in the order of importance of the same factors.

Moreover, in the third level, the branch 'Administrative' shows high dissimilarity and variances among the three groups' preferences in which factors related to the

same branch 'Top Management Support' and 'Strategy' are the most important factors in the groups 1 and 3; however, according to e-Government team and technical staff (group 2) the most significant and important factor is 'Leadership'. This indicates the fact that these groups involved for the e-Government implementation decisions do not understand each other due to different knowledge and awareness of the three groups.

In addition, the branch 'Economic' in the third level shows also slight dissimilarity in which the factor 'Personal Income' considered as least important by the third group 'Top Management and Decision Maker', however, the other two groups 'Normal government employees' and 'Technical staff and e-Government team' considered the same factor as the first influential factor in the Economic branch in the e-Government implementation in Yemen hierarchy.

Nevertheless, the government employees, e-Government team and technical staff, top management and decision makers evaluate 'governing factors' as most important in the first level of the hierarchy. These similarities are followed by dissimilarities when it comes for the preferences order inside the branch 'governing factors' in the second level. They also have similarities in the order of the importance for the other factors 'Organizational' and 'External' of the first level and also have the same inside their branches in the second level.

In the third level, as discussed above there is high dissimilarity among the three groups' preferences in 'Administrative' branch; however, all the groups assign similar preferences inside other branches in the same level in which they show similarities in the order of the importance of the 'Legislative factors' where the 'legal frame work' has the first order of the importance followed by the legal 'Detailed policies'.

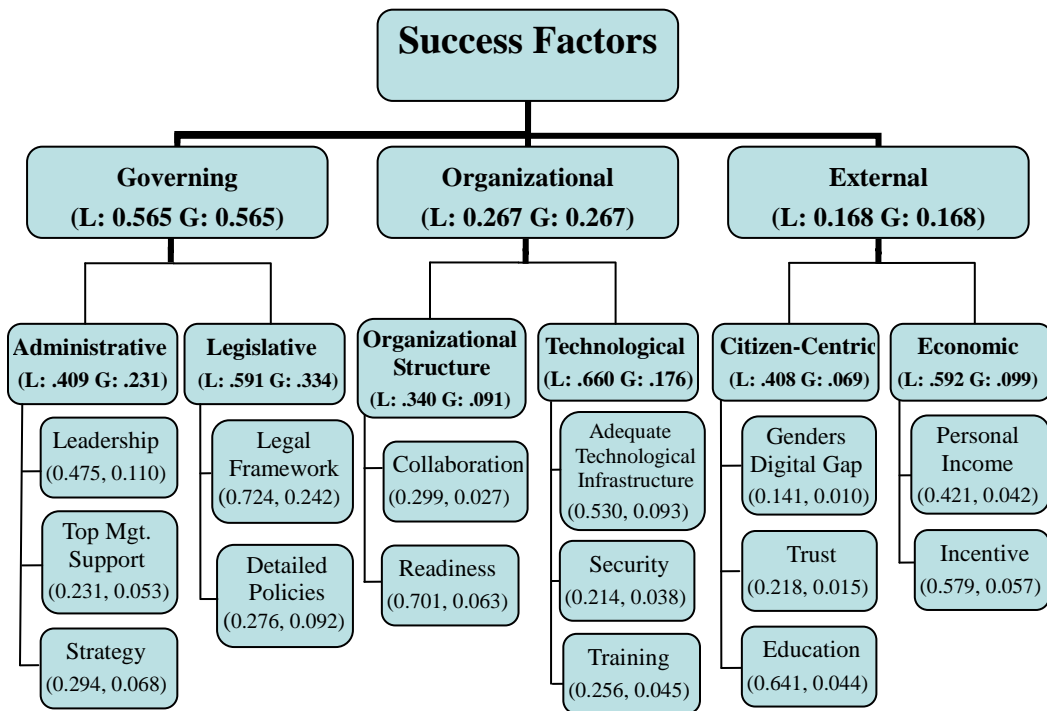
Likewise, all groups have similarities in the order of importance inside the branch 'Technological' where all respondents consider the factor 'Adequate Technological Infrastructure' as the most important factor in the branch followed by 'Training', and 'Security', respectively. In 'Citizen-Centric' branch in the third level as well, all groups estimated that 'Education' is the most important and 'Trust' is more important than the factor 'Digital Gap'.

In general, Yemeni government officers' preferences towards e-Government implementation might be justifiably if we look at the circumstances that exist in the fact which is that, there is a gap of knowledge exist between the three groups. In order to conclude, this study estimated the overall aggregated preferences of three groups of decision maker with the respect to the goal of this study which is a successful e-Government implementation in Yemen as explained in the following sections.

### 5.4.6 Overall Aggregated Preferences Results (Combined ALL Groups):

#### A) Overall Preferences inside each level:

The overall preferences inside each level (branch) are discussed by using the relative local importance of each factor inside the branches of the hierarchical tree as displayed in Figure 5-6.



Note: Parenthesis ( ): the first part L: indicates the Local importance, and the second part G: indicates the Global importance. Overall Inconsistency= 0.01.

**Figure 5-6: All groups' Aggregated Preferences**

According to the aggregated preferences of government employees, e-Government team and technical staff, and top management and the decision makers in the first level of the e-Government success factors hierarchy, the most important factors preferred are the “Governing factors” (G, L= 0.555) taking 56% of importance

in the first level of the e-Government success factors. The “Organizational factors” (G, L= 0.275) have the second priority taking 27% of importance in the first level of the e-Government success factors. “External factors” (G, L=0.169) have ranked third priority taking 17% only and given a quite less importance in comparison with the governing and organizational factors in the same level.

In Governing factors branch, as it is shown in the hierarchal tree as depicted in Figure 5.6., the most important factors affecting the e-Government implementation behavior are the “Legislative factors” (L=0.591 G=0.328), these factors are the most important ones given them the first priority with 59% of importance within the governing factors branch. And the node “Administrative factors” (L=0.409 G=0.277) has given the second ranking by taking 41% of importance within the same branch. Under the node “Legislative factors” the “Legal framework” (L=0.724 G=0.238) has given the first priority taking 72% of importance in the node, followed by the “Detailed Policies” (L=0.276 G=0.090) which has the less importance taking only 28% in the same node. In the next ranked factors within governing factors branch the “Administrative factors”, within this node “Administrative factors”, the “Top Management Support factor” (L=0.360 G=0.082) has the first relative importance taking 36% of importance within the node, next factors in the same node are ordered as: “Leadership” (L=0.333 G=0.055) as second important factor taking 33% and “Strategy” (L=0.309 G=0.070) as third one taking 31% of importance in same node.

In Organizational factors branch, these factors have two nodes: “Technological factors” (L=0.660 G=0.182) which has the first priority taking 66% of importance in the branch, followed by “Organizational Structure” (L=0.340 G=0.094) which has the

less priority taking only 34% within the Organizational factors branch. The first node “Technological factors” has three sub-nodes as the “Adequate Technological Infrastructure” (L=0.479 G=0.087) which has the first priority taking the first important factor by 48% of importance within the “Technological factors” node, followed by “Training” (L=0.266 G=0.048) which goes second important factor taking 27% of importance, while the “Security” (L=0.255 G=0.046) which got the less priority by taking only 25% of importance within the same node. The second ranked factors within the “Organizational factors” branch are the “Organizational Structure” which has two sub-nodes namely; “Readiness” (L=0.701 G=0.066) which has the first priority taking about 70% of importance within this node, and the other 30% of importance is related to “Collaboration” (L=0.299 G=0.028) which has the second priority in the same node.

In “External factors” branch, which has give also the less priority to consider while implementing e-Government system as it has given the same priority by the all groups. However, this attribute branch also has two nodes. This overall aggregation preferences have given the “Economic factors” (L=0.592 G=0.100) which has the first ranking taking 59% of importance within the external factors attribute branch. The second ranked factors in the “External” factors branch are the “Citizen-Centric” (L=0.408 G=0.069) which has the second priority by taking 41% of importance in the same branch.

In the “Economic factors” node the “Personal Income” (L=0.579 G=0.058) has the first priority taking about 58% of importance within the Economic factors node. And the other 42% of importance goes for “Incentive” (L=0.421 G=0.042) which has the second priority in the same node.



Within “Citizen-Centric” node, there are three sub-nodes (subsets); “Education” ( $L=0.641$   $G=0.44$ ) which has the first priority taking 64% of importance in the node. Then “Trust” ( $L=0.218$   $G=0.015$ ) which goes the second important factor with 22% of importance in the same node while the “Digital Gap (Gender)” ( $L=0.141$   $G=0.010$ ) goes third important factor but with less priority taking only 14% of importance in “Citizen-Centric” node.

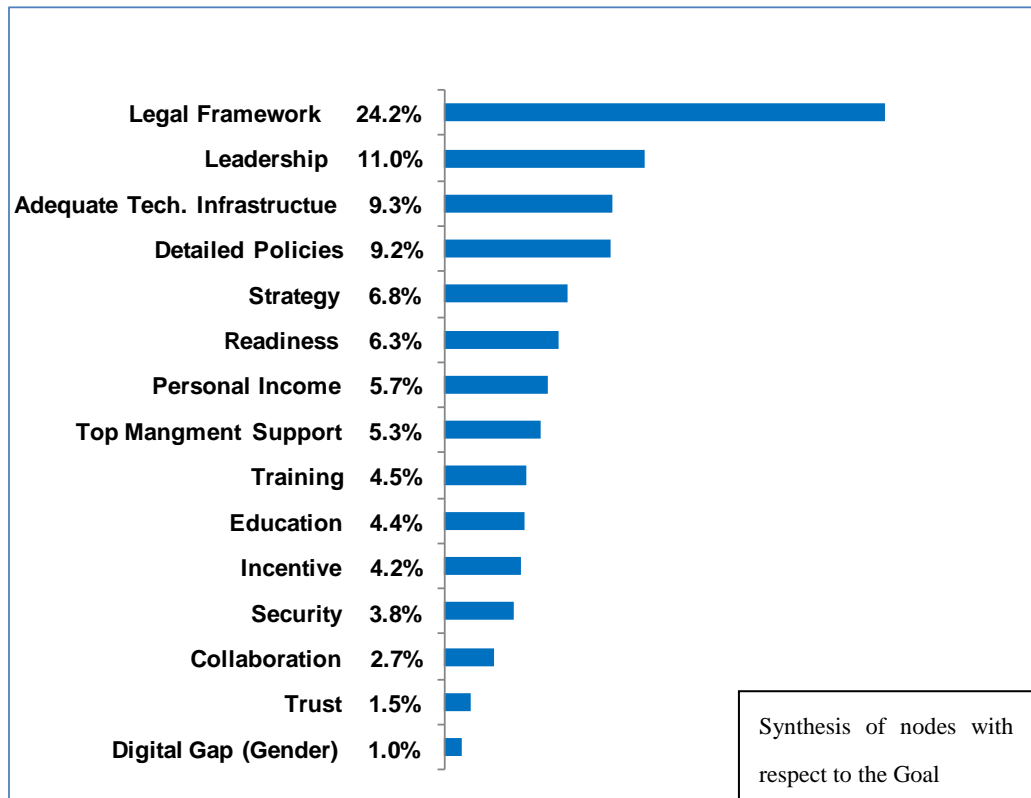
*B) Aggregated Preferences of nodes prioritizations for the three groups:*

In the “e-Government success factors that contribute to successful implementation of a robust e-Government system” hierarchy, the nodes are identified factors that must be prioritized according to government employees’ behavior.

In the overall aggregated preferences, the “Legal framework” factor ( $G=0.238$ ) estimated to be the most important factor taking 24% of importance in the tree ranking even quite more important than “Detailed Policies” ( $G=0.090$ ) which is the second most important factor taking 9% of importance in the tree with little more important than “Adequate Technological Infrastructure” ( $G=0.087$ ) which ranked third in the importance of the hierarchal tree. The factor “Top Management Support” ( $G=0.82$ ) positioned as the forth important factor in the tree with quit less than “Adequate Technological Infrastructure” factor. In this overall’s preferences, the “Leadership” ranked fifth important, “Strategy” ranked sixth factor in the success factors hierarchal tree. The order of the importance in the remaining factors is described in the following figure respectively.

**All groups: Aggregated Preferences (Combined): Overall Inconsistency = 0.01**

**Overall Synthesis with respect to the Goal: E-Government success)**



**Figure 5-7: All groups' nodes prioritization (overall Relative Importance)**

#### **5.4.7 Results and Discussions:**

This section contains the result's analysis and discussion of the findings related to three main factors that contribute to the successful e-Government implementation in Yemen. These factors affecting the e-Government adoption in Yemen were analyzed in previous sections and will be presented factor by factor with their levels of importance. This study has shown that there are several success factors of implementing e-Government system in the metropolitan city "Sana'a"-the capital city of the republic of Yemen from the prospective of the government officials as follows:

➤ **Governing Factors:**

According to the government officials in all groups, the factors related to the 'Governing factors' regarded 56% level of importance which is the highest in the first level of the hierarchy of the success factors that are affecting the e-Government adoption in their agencies. They indicate that legal framework is the most important factor while dealing with the implementations of e-Government projects and it must be established as a proper and strong legal framework for the different operations of e-government because it includes the protection of government data and personnel information. In addition, Yemen government roles at current stage requires to be developed to cover new legal issues and reforms which are major factors for the successful of e-Government implementation in Yemen. However, Basu (2004) emphasized that the success of e-Government implementation and its services in developing countries are highly dependent on government's role in ensuring a proper legal framework for their operation. Establishing protections and legal reforms will be needed to ensure, among other things, the privacy, security and legal recognition of electronic interactions and electronic signatures (Ndou, 2004). That means, for less developed countries like Yemen, the governance initiatives are really critical. It is also found that criteria which are closely related to legislative initiatives like legal framework, detailed legal policies are more critical success factors than others.

However, the results of this study regarding governing policy had shown that all respondents in the three groups considered these governing factors as a highly important to start deal with e-Government implementation. This indicates that, the results of the governing factors questions have shown that all the participated officials answered similarly. In contrast, since the idea of the question was to clarify other

aspects of governing factors which was not involved in the questionnaire, almost all of the respondents did not comment on this question as it was expected from them.

Moreover, the involved governing factors in this study are specifically the Administrative and Legislative factors which have been judged as a highly relative important factors in the second level as the Legislative factors goes first with the highest ranking in the second level under the governing factors node taking 59% of importance, followed by the Administrative factors which ranked the second important factors in the same level taking 41% of the relative importance. As presented in Figure 5-8, the order of the importance in the third level of the hierarchy under the Legislative and Administrative criteria are depicting the highest importance, as discussed above, for the legal framework with 43% of importance in the third level, followed by Leadership which has the second priority taking 20% of the importance, detailed policies with 16%, Strategy with 12 %, and Top Management Support with 9% of the importance in the same level.

However, government employees in Yemen believe that the existence of a strong ‘Leadership’ for the e-Government to make the agenda of implementation and adoption in the reality is an important factor towards the successful implementation of e-Government system in their organizations. This goes in the line with Heeks (2003) who identified lack of leadership as a major challenge for e-Government success in developing countries. Variations in support among leadership are among the critical challenges in developing countries. This challenge stems the fact that, even though leadership in developing countries clearly supports the development of e-Government and ICTs, their understanding of these systems varies significantly (Sang *et al.*, 2009).

### Synthesize with respect to: Governing Factors

(Goal: E-Government success factors > Governing factors L: 0.565)

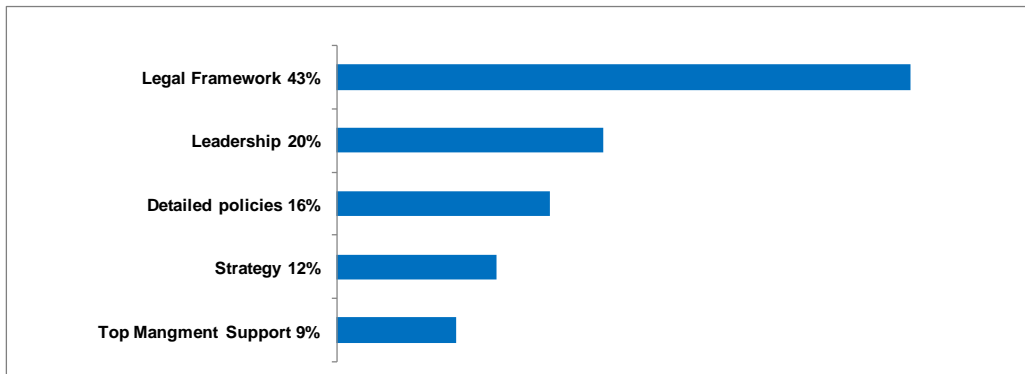


Figure 5-8: Relative importance of Governing Factors

#### ➤ Organizational Factors:

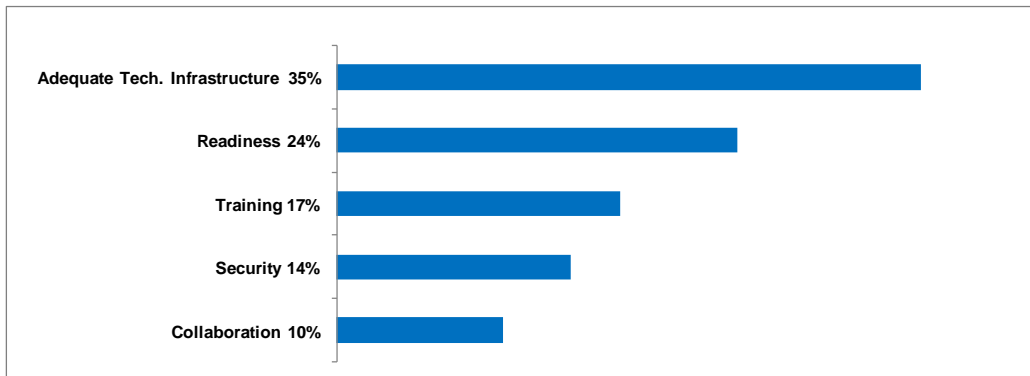
The obtained information and opinions of all policy makers in the all groups considered these factors with second priority or second important with 27% of importance towards the successful implementation of e-Government system in their ministries. The participants' opinion implies that 'Adequate Technological Infrastructure' is also very important factor to enhance the success implementation of e-Government in Yemen. This criteria ranked third important one among the top 3 important factors in the overall hierarchical tree. However, in Yemen and many other developing countries, the poor ICT and telecommunication infrastructure is a major barrier for quality implementation of electronic governance and government services delivery online. The operation of e-governance requires construction of strong and adequate technological infrastructure of telecommunications. However; in most Middle East countries a significant large financial investment is required to develop this infrastructure that would support: communications, electronics, digital content and software services and industries (Bhuiyan, 2011; Alnagi and Hamdan, 2009).

Moreover, the organizational factors consist of the Organizational Structure and Technological factors which have been judged as 66% of importance for the technological factors taking the first priority under organizational factors node, followed by organizational structure factors which has been given 34% of importance in the same node. Figure 5-9 shows the order of the importance in the third level of the hierarchy under the Technological and Organizational Structure where the adequate technological infrastructure is the first important factor with 35% of relative importance, followed by 'Readiness' with 24% relative importance, 'Training' with 17%, 'Security' and 'Collaboration' with 14% and 10%, respectively in the same third level of the hierarchal tree (see Figure 5-9). The respondents' result indicates that they also consider the organizational 'Readiness' is another important factor as the organizational change and innovations have a significant impact on the success of e-Government implementation and adoption in their government agencies. This linked with the study of Alshehri and Drew (2010) who stated that the adoption of e-Government is facing many challenges in terms of the organizational issues which must be considered and treated carefully by any government contemplating its adoption. As a result, governments around the world are introducing innovations in their organizational structure, practices, and capacities, as well as in the way they mobilize, deploy and utilize the human capital and information, technological, and financial resources for service delivery to citizens (UN, 2008).

It is very interesting that government officials regarded micromanagement criteria like collaboration and cooperation among government organizations as not much important. Hence, we conclude that the large scope planning and preparing is much more important in the stage of e-Government implementation in their agencies.

### Synthesize with respect to: Organizational Factors

(Goal: E-Government success factors > Organizational factors L: 0.267)



**Table 5-8: Relative importance of Organizational Factors**

#### ➤ External Factors:

However, the government officials in all groups considered those 'External Factors' as the least priority taking only 17% of importance which is the lowest degree in the first level of the hierarchy of the success factors that affect the e-Government implementation in their organizations. This less priority importance which has been given by the respondents translates the opinion of the government employees as the government should firstly deal with the Governing and Organizational factors then they can interact with the citizens.

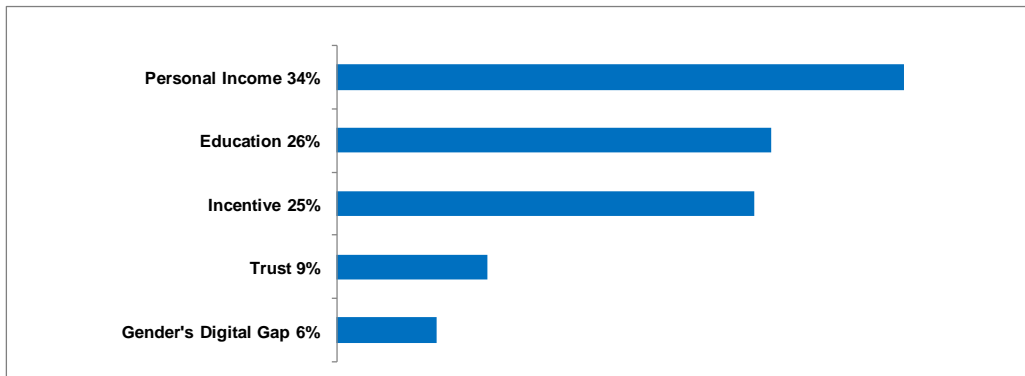
Moreover, these external factors have been judged as 59% of importance for the economic factors taking the first priority under external factors node, followed by citizen-centric factors which has been given 41% of importance in the same node. Figure 5-10 displays the order of the importance in the third level of the hierarchy under the Economic and Citizen-Centric criteria where the 'Personal Income' is the first important factor with 34% of relative importance, followed by 'Education with

26% relative importance, 'Incentive' with 24%, 'Trust' and 'Gender's Digital Gap' with 9% and 6%, respectively in the same third level of the hierarchal tree (see Figure 5-10). This implies that 'Personal Income' is also another important factor that government should consider while implementing the e-Government system in its agencies. This is precisely reflects the fact of the low GDP per capita in Yemen. According to ESCWA (2007), online activities such as scientific research, online shopping and e-commerce and Internet government transactions are either underutilized or virtually not-existent because of the lack of institutional support, Low Gross Product (GDP) per capita, and poor Telecommunication infrastructure. Even though the pricing systems of e-Government services are affordable by individuals with high income, most Yemenis find this cost very expensive given that the General National Income (GNI) per capita in Yemen is only US\$370.

However, for external factors, it is hard to say that citizen-centric factors are just not important to success of e-Government. All of respondents were government officials who are rather free from cultural and social problems. It only can be said that economic factors are more critical than citizen-centric factors as captured from the results of the policy makers' preferences towards the successful implementation of e-Government system in Yemen. In contrast, we can say government employees regarded the economic, and incentives factors with the least important factors for e-Government even they have low income compare with other neighbor countries; but they think that this is not a barrier at all towards the successful implementation of e-Government system in their nation.



**Synthesize with respect to: External Factors**  
**(Goal: E-Government success factors > External factors L: 0.168)**



**Figure 5-9: Relative importance of External Factors**

For the Gender Digital Gap, it has been selected as criteria in the AHP hierarchal tree based on the circumstances of Yemen case. However, the policy makers in government assign a very less priority for this factor. As they believe that the digital divide will not affect the implementation process of e-government system. This factor has been reflected in the policy implications chapter and explained in more details.

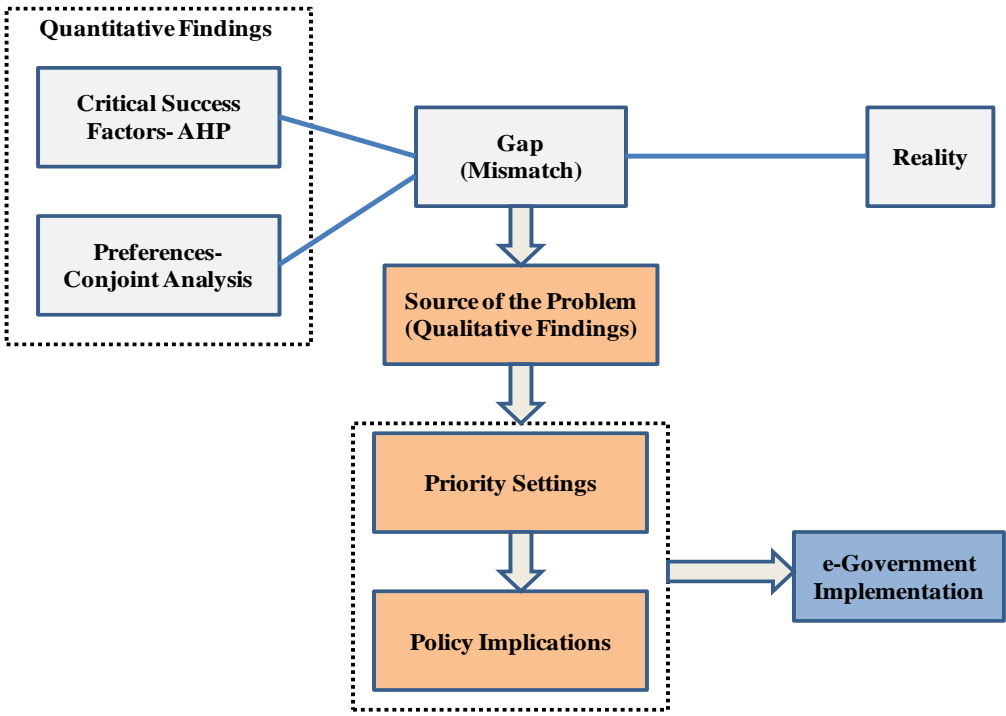
## **Chapter 6 Gap Analysis and Policy Implications**

This chapter provides the gap analysis, key findings, and policy implications of the research. First, the framework for the gap analysis followed by key findings of the quantitative analysis with a direct link to the main findings of both CA and AHP approaches. Following this discussion, the findings of the qualitative analysis are provided to supplement the quantitative results. The gap analysis is addressed to identify reasons of the mismatch between the empirical results of this research and the realities in the Yemen case. The researcher also constructed priority settings for policies based on the quantitative results with the supplement of the qualitative findings. Finally, policy implications for the Yemeni government and policy makers are provided to promote the adoption and implementation of an e-Government system in Yemen.

### **6.1 Framework of the Gap Analysis**

In this section, the framework of the gap analysis is introduced based on the empirical quantitative results and qualitative findings. First, the quantitative findings were summarized and interpreted based on the results of the CA and AHP. The qualitative analysis supplemented the quantitative results of this study. Following the analyses, a gap was found between the empirical findings and e-Government reality in Yemen.

Accordingly, using telephone interviews of surveyed participants, the reasons for the mismatch of each empirical finding were identified. Finally, the priority settings were applied to drive the proper policy implication to help the Yemeni government and policy makers successfully implement e-Government system within it agencies. Figure 6-1 shows the Gap Analysis framework that followed in this study.



**Figure 6-1: Framework of the Gap Analysis**

## **6.2 Summary of the Quantitative Findings**

The estimation results of this study are consistent to an appreciable extent with the empirical analyses of e-Government adoption studies conducted in both developed and developing countries. With regard to the empirical analysis of data and results, the quantitative findings of the study are presented based on the results obtained from the combination of Conjoint Analysis (CA) and Analytical Hierarchy Process (AHP) methodologies.

The findings of the CA methods are based on the rank-ordered mixed logit estimation results and show evidence of the impact of the attributes involved (strategy, legal framework, GEA, Privacy, training and operational cost) in e-Government implementation. The results of AHP also show that several factors significantly affect the implementation of successful e-Government systems. These factors include legal framework, leadership, and adequate technological infrastructure. The following are the findings of both methods.

Based on the quantitative findings of the CA, 99.7% of the respondents preferred a highly secured e-Government system without leakage of any government data or user information. This significance preference shows that almost all government officials were very much concerned with data security concerning how government information and personal data are electronically saved, processed, and transmitted in this electronic system of government. Privacy and security are reoccurring issues in e-commerce and e-Government research and are serious factors in the implementation stage of e-Government in developing countries (Belanger and Hiller, 2006). Similarly, privacy

and security in e-Government systems and services seem to be a significant challenge for the implementation and adoption processes in Yemen as well.

In terms of legal framework, the CA revealed that 79% of respondents preferred strong legal framework for e-Government to ensure the protection of the government's data and users' personal information. Similarly, the final decision of government officials obtained from the AHP showed the highest relative importance for this specific legal framework for e-Government. Processing of e-Government principles and functions requires a range of new rules, policies, laws, and legislative changes to address electronic activities including electronic signatures, electronic archiving, freedom of information, data protection, computer crime, intellectual property rights, and copyright issues (ESCWA, 2007). Therefore, success of e-Government implementation and its services in developing countries is highly dependent on the government's role in ensuring a proper legal framework for operation (Basu, 2004). Accordingly, it is justified that respondents wanted the introduction of a specific and strong legal framework for e-Government in Yemen.

Using the AHP method, the researcher found that leadership ranked among the highest relative important factors to support the development and implementation of e-Government in Yemen. Leadership is a key factor in the adoption and implementation of e-Government in developing countries (Heeks, 2003). Specifically, policy makers in Yemen believed that they need a strong and qualified leader to apply the agenda of e-Government and make it applicable in reality.

Strategy was also a highly important factor for e-Government implementation. Based on the empirical findings of the CA, the majority of respondents preferred long-

term strategy to provide a roadmap of the different stages of e-Government implementation. However, a minority of the respondents preferred short-term strategic planning. These variances show the heterogeneity of responses. Further, officials who preferred a short-term strategy may support the old legacy system that held the perception that once the minister or president changes or is replaced, all previous strategies would be terminated and the new leader would introduce a new strategy. However, e-Government projects are large, costly, and long-term; therefore, they require the establishment of clear, appropriate, and contextually-tailored strategies (Alshehri and Drew, 2010; Heeks, 2003; Hossan *et al.*, 2006; Ndou, 2004).

Concerning adequate technological infrastructure, the AHP revealed that respondents rated this factor of high relative importance among other relative factors in the AHP hierarchical tree. Government officials in Yemen understand very well that the existent technological infrastructure is not appropriate for e-Government and e-services. However, the operation of e-Government requires the construction of a strong technological infrastructure of telecommunications. As a matter of fact, in most Middle East countries, a significant financial investment is required to develop the infrastructure necessary to support communications, electronics, digital content, and software services and industries (Alnagi and Hamdan, 2009; Bhuiyan, 2011).

The empirical findings of the CA also found 55% (majority) of government officials preferred the decentralized GEA, which is the e-Government back office. This means that the e-Government back office should be implemented in each government agency and be linked with the centralized office. However, this requires a large budget to establish infrastructures for these units. In contrast, 45% (minority)

of respondents preferred a centralized GEA. This variance shows the heterogeneity of the preferences. These findings can be interpreted as those who prefer centralized GEA know very well the budget constraints of the government and that the traditional centralized system has been favored for many years in the Yemeni government.

The CA also indicated that 51% of respondents preferred short training periods for IT and e-Government concepts and skills and 49% preferred long training periods. For this factor, there is some variance that reflects the heterogeneity of responses. In addition, the findings of the AHP show less priority for this factor among policy makers, which suggests that government officers do not want to leave their offices for long time for training on e-Government concepts and usage issues. Rather, government officers may prefer shorter trainings such as regular workshops and seminars. However, qualified technical staff and proper IT training are critical success factors to avoid facing obstacles in e-Government adoption (OECD, 2003). Therefore, training of exiting governmental staff members is an important factor to accelerate the adoption and diffusion of any new technology (Alsheri and Drew, 2010).

For operational cost for e-Government (budget), the CA revealed that respondents were sensitivity and indicated uniform preferences. Specifically, respondent understand that e-Government is a large project that requires an available budget for infrastructure and other operational costs.

### **6.3 Qualitative Analysis**

To supplement the empirical findings of this research, qualitative analysis were considered by conducting a telephone survey with some policy makers to learn of the real situation of government agencies and identify reasons for the mismatch between the quantitative findings of this study and reality in the government sector in Yemen.

Extensive research has shown that qualitative research can be used to supplement the analysis of quantitative estimations. For example, a researcher might conduct an experiment (quantitative) and then conduct interviews with participants (qualitative) to learn how they viewed the experiment and learn of the studied actions in reality (Johnson and Onwuegbuzie, 2011).

From this perspective, the current study used the qualitative findings of telephone interviews with policy makers in government to supplement the empirical findings. In doing so, the researcher was able to determine reasons for the gap between the quantitative findings and the realities that exist in government agencies in Yemen.

Accordingly, this study categorized and analyzed both interview results and experiments based on a mixed method approach that incorporated inductive and deductive reasoning (Johnson and Onwuegbuzie, 2011).

A mixed method approach employs a research design that uses quantitative and qualitative data in deferent phases of a research study (Hesse-Biber, 2010). In other words, mixed research mixes quantitative and qualitative approaches in a way that works best for the specific research questions being considered in a particular context. Moreover, mixed method research adopts inductive and deductive reasoning using qualitative and quantitative data to corroborate and complement findings and takes a



balanced approach to research (Johnson and Onwuegbuzie, 2011).

The qualitative data analysis can be explained through an inductive reasoning approach. Inductive reasoning is ‘bottom-up’ approach with a systematic procedure for qualitative data analysis under specific objectives. Conversely, deductive reasoning is a ‘top-down’ approach that occurs when a researcher works from general information to more specific information, thus, narrows the objective while collecting data to test specified hypotheses and link with certain theories (Simon, 1996).

As a starting point, to conduct the qualitative analysis, telephone survey questions were constructed to gather specific information and narrow the objectives. The following discusses the structure used for the qualitative telephone interviews.

### **6.3.1 Structure of Qualitative Analysis**

To conduct a telephone survey, the survey questionnaire must be constructed first. The factors revealed from the survey questions were structured for the telephone interviews. This structure was explained as follows.

#### **➤ Strategy:**

Strategy refers an appropriate and contextual tailored strategy that provides a road map of the different stages of e-Government implementation. The interview questions that addressed this factor were as follows:

1. What type of Strategy has been introduced for e-Government?
2. Do you think the current strategy is enough and appropriate for your government, (Yemen)?

3. In your opinion, what do you think are the reasons behind not introducing a clear long- term strategy for e-Government until now?
4. From your point-of-view, do you think there are any other challenges that prevent the Yemen government from introducing a clear long-term strategic plan for e-Government?

➤ **Legal Framework:**

Legal framework is the established protections and legal reforms that are needed to ensure privacy, security of government and users' data, and legal recognition of electronic interactions and electronic signatures. The interview questions that addressed this factor were as follows:

1. Can you please discuss the current legal provisions (structure) that guide the different processes of e-Government in Yemen?
2. Do you think the current legal framework is enough and appropriate for your government 'Yemen'?
3. In your opinion what do you think are the reasons behind not introducing a strong and specific legal framework for e-Government until now?
4. Do you think there are any other challenges that prevent the government of Yemen from introducing a strong legal framework for e-Government?

➤ **Privacy:**

Privacy refers to the means of securing government data and users' data from threats, hackers, and unauthorized access. Successful implementation of privacy measures lead to security of government or users' information. The interview questions that addressed this factor were as follows:

1. What type of privacy level is used for e-Government in Yemen?
2. Do you think this current level of privacy is secured enough and appropriate for your government, (Yemen)?
3. In your opinion, what do you think are the reasons behind not providing 100% privacy and security for e-Government until now?
4. Are there any other challenges that might prevent the government of Yemen from enhancing highly secured privacy technologies for e-Government?

➤ **Leadership:**

Leadership included skilled e-Government leaders who apply the agenda of e-Government and make it applicable in reality. Leaders provide a positive environment and encourage participation in e-Government implementation and operation. The interview questions that addressed this factor were as follows:

1. What type of leadership has been assigned for e-Government in Yemen?
2. Do you think that the current leadership is appropriate for e-Government?
3. In your opinion what do you think are the reasons behind not assigning a specialist and strong leadership for e-Government until now?
4. Do you think there are any other challenges that prevent the government of Yemen from assigning a strong leadership for e-Government?

➤ **Adequate Technological Infrastructure :**

Adequate Technological Infrastructure means a strong technological and telecommunication infrastructure which is required for the implementation and operation of e-Government and e-services. The interview questions that addressed this factor were as follows:

1. Can you please clarify what type of technological infrastructure has been build for e-Government in Yemen?
2. Do you think that the current infrastructure is enough and adequate for e-Government in Yemen?
3. In your opinion, what are the reasons behind having a poor technological infrastructure until now?
4. Do you think there are any other challenges that prevent the government of Yemen from providing an adequate technological infrastructure, which is an essential requirement for e-Government?

### **6.3.2 Main Qualitative Findings**

The researcher collected qualitative data based on telephone interviews with the policy makers (Appendix C-4) to supplement the quantitative results of this empirical research. The qualitative findings are illustrated in the following section.

For the factor of strategy, e-Government strategy is unclear and very weak. In fact, policy makers declared that they felt that there was no strategy because specialist personnel did not design the existing strategy. A major reason stated for this lack of specialist personnel was because internal barriers in government such as; poor administrative reform, and not choosing the right person in the right place. Another major reason stated by policy makers for the lack of clear and long-term strategy is because of political instability. As such, the government tried to make short-term (two years) strategic planning while the official portal was being published. However, following this period, the government realized that the portal was not

effective and work ceased at the stage of introducing the portal in 2009; they did not go on to the next step.

In terms of legal framework, one policy maker reported that the existing framework is very weak and not favored for e-Government. Another interviewee stated that the e-Government legal framework is very weak because it was not made by the Ministry of Justice, the organization of rules and regulation that produce government acts and has full authority to assign punishment concerning rules and obligations. The qualitative results revealed that this weak legal framework was introduced by an IT staff; however, developing the framework was not their specialty. Of note, under the circumstances of a centralized system of government, every agency wants to do everything without sharing with other agencies; therefore, there is a high rate of conflicting responsibilities.

The leadership of e-Government in Yemen was assigned from a political point-of-view. However, those chosen were not skilled enough and did not give ICT and e-Government high priority in their agendas because of they were unaware of the benefits of e-Government, and lacked a clear vision and objective. Policy makers also admitted that the leadership of e-Government in Yemen was not committed and did not understand that they had to assign a financial budget for e-Government project annually. Rather, these officials thought these types of projects relied on outside subsidiaries or loans; this belief also affects the lack of proper long-term training for its employees. Lack of money for ICT and e-Government is a fact in Yemen. However, it should be noted that the government introduced a new supervisory committee for e-Government in September 2012.

The current ICT infrastructure is poor. However, one interviewee noted that the ICT infrastructure is the backbone of e-Government, the current ICT status in Yemen is not enough to run e-Government system. The main reason for this late of ICT development is political instability; as political parties and leaders are busy exploring ways to increase power. Additionally in 2011, Yemen experienced an instable economy and country security because of the revaluations of Arab spring. After changing the government, it is the hope of the Yemen people to create a new and better Yemeni government.

Another qualitative finding was that, although the ICT infrastructure is poor, it is not a barrier toward e-Government implementation because, at the time of this study, the Ministry of Telecommunication was preparing to adopt the WIMAX technology to pursue e-Government using the internet provided by WIMAX technologies.

Concerning the factor of security, IT security was weak in the government sector; however, was much better in the private sector. Government sector had limited resources and had not realized its responsibility in electronic security and privacy issues. Additionally, the existing security technologies are not appropriate for e-Government applications and services and needed a lot of improvement to provide the minimum security level necessary to protect government and personal data. Further, IT security is weak because of a weak existing ICT infrastructure. In addition to a weak infrastructure, the Yemen people do not trust the government because of the absence of legal policies and guarantee that information and transactions are safe.

Finally, in case of the e-Government back-office (GEA), qualitative findings revealed that no unit of GEA previously existed that was officially responsible for e-Government implementation and operation. However, there was an IT unit in the

Prime Ministers' Office that was responsible for the overall supervision and support in coordinating and cooperating between the relative government agencies. The reality is that, the centralized system had been practiced in the Yemen government for many years; therefore, it is clear that a centralized GEA would be good to start under the circumstances.

In conclusion, there are many international organizations that cooperate with Yemen via consultancy services that help the government uptake the adoption and implementation of e-Government. However, due to the Arab spring in 2011, this cooperation ceased. After changing the entire government, the opportunity for international organizations to be involved in Yemen and provide guidance and consultancy services for e-Government and ICT adoption and diffusion increased. Such involvement also allowed for the transfer of best practices (used worldwide) to Yemen's e-Government system.

## **6.4 Gap Analysis**

Based on the quantitative findings of the CA and AHP and the supplemental qualitative findings, the gap analysis between the empirical results and reality in Yemen for e-Government status offers an means to identify the reasons of the mismatch.

In terms of privacy, the quantitative findings showed that government officials preferred a highly secured e-Government system. However, the current IT security in Yemen is very weak within government agencies. In fact, the existing security and privacy technologies in the government are not appropriate for e-Government

applications and services. Therefore significant improvements are required to reach to the appropriate security level to protect government data and personal information.

Accordingly, there was a clear gap between the empirical results and the reality of privacy status for e-Government and ICT technologies in Yemen. Therefore, the researcher relied on qualitative analysis to support the empirical findings. This was accomplished by conducting a telephone survey with the policy makers to determine reasons why IT security systems have been weak until now. The following details are the reasons of the gap based on the findings of these interviews:

- a. Poor ICT infrastructure, which was also found in the HDI as Yemen ranked 154 out of 187 nations (International Human Development Indicators, 2011).
- b. Lack of government awareness of electronic privacy responsibilities.
- c. Expertise on IT security and privacy issues are deployed in resource-constrained environments among individuals who lacks a sufficient knowledge base in this field. In other words, IT skilled personal, if existent in Yemen, do not have an influence in decision making.
- d. Absence of specific regulatory and legal policies that are required for proper security and privacy protections. The IT policies of Yemen are not yet fully developed. However, when completed will include information security and privacy, ensure equal access to all citizens, and enhance trust between citizens and government.

The empirical findings also showed that respondents preferred a strong legal framework for e-Government to ensure the protection of data. However, the current status of the e-Government legal framework in Yemen is weak in the sense that government officers do not feel that they have a legal framework. Based on the



qualitative findings, the reason of this mismatch is because the current e-Government legal framework has been setup by IT personals in the government who do not have legal awareness or legal competencies and experience. In addition to that, the policy makers did not support the implementation of such legal framework for political reasons in which ministers of different ministries do not want to give up their personal relations with each other for the sake of legal frameworks.

Therefore, it is justified that the respondents (policy makers) want a strong legal framework for e-Government to ensure the protection of government and user data. Hence, this framework is highly needed for the government to start establishing a national strategic planning for the legal issues, and should include acts on electronic interactions and transactions with the government.

For e-Government Leadership, the quantitative results revealed that policy makers in Yemen want strong and qualified leaders for e-Government. However, leadership of e-Government as well as leaders, high-ranking officers, and decision makers in Yemen do not have enough sufficient awareness about the benefits of e-Government and ICT technologies. The lack of leadership is a major challenge for e-Government success in developing countries, and variations in support among leadership are among the critical challenges in those nations (Heeks, 2003).

The reason for the gap between the quantitative results and reality is that the leadership of e-Government in Yemen was assigned from a political point-of-view. However, these leaders are not skilled enough and do not give ICT and e-Government high priority in their agendas because they have not yet realized the benefits adopting ICT and e-Government technologies. As a result, leaders are not capable in

identifying the nature of the ICT future because of an absence of a clear vision and objectives.

For strategy, respondents preferred clear, tailored-made, and long-term strategies to serve as roadmaps for the different stages of e-Government implementation. However, the reality of the Yemen case is that current e-Government strategy is unclear and based on short-term planning. According to the interviews, government officials in Yemen reported that there was no specific strategy for e-Government at all. Again, there was a clear gap between the results and reality.

The reasons for the lack of long-term strategies stem from the belief that if a minister leaves or is replaced, the new minister will change all previous strategies and make other short-term strategies until he finishes his duties. Additionally, there is no special unit or organization that is officially responsible for e-Government implementation projects; this causes conflicts of responsibility among Yemeni government agencies.

In addition to the above reasons, other internal barriers in the Yemeni government include poor administrative reform, not choosing the right person in the right place, and instable politics throughout the country. A clear vision and strategy is needed to assess the current situation. Specifically, discussion makers need to understand the reality on the ground, take an inventory of projects, articulate costs, and understand the impacts and benefits of programs as well as continuously monitor and evaluate the project upgrading (Ndou, 2004).

The empirical result of the AHP showed that policy makers ranked adequate technological infrastructure as one of the most important factors to consider when implementing e-Government in Yemen. However, the qualitative findings revealed

that the current ICT infrastructure in Yemen is poor and inadequate for quality implementation of e-Government. Hossan *et al.* (2006) argued that an inadequate technological infrastructure is the most critical factor that contributes to the failure of e-Government implementation in developing countries.

There is again a mismatch between the quantitative findings and the reality in Yemen. Based on the supplemental qualitative findings, the reason for this gap is because Yemen has gone through different turmoil in nation politics and no political party has given priority or attention to ICT development. Meanwhile, other obstacles that delay the improvement of ICT and e-Government infrastructures in Yemen include poor administrative reform, poor top management support, and electronic cultural barriers. Further, many people in government do not publish information regularly, smoothly, or easily into the e-Government portal.

Based on the quantitative findings of the CA, almost half of the respondents (policy makers) preferred a decentralized GEA, which the other half still preferred a centralized GEA. With the support of the qualitative results, the reality is that the traditional centralized system is favored and organizations systematically work to concentrate authority at the upper levels, hence, it is normal that almost half of the respondents preferred the centralized GEA rather than decentralized. Therefore, for the country's circumstances, a centralized information system in government will be more efficient and effective than the decentralized system.

The quantitative findings showed that half of the respondents wanted short training periods while the other half preferred long periods. The supplemental finding revealed that decision makers prefer shorter trainings because of budget limitations for IT training.

Additionally, at the time of this study, short training periods were enough to diffuse ICT knowledge of ICT, e-Government concepts and practice on the e-Government portal. However, this may or may not fit other government agencies' in developing countries as it is applicable in Yemen's circumstances. Generally, in developing countries, a major challenge of e-Government adoption is the lack of IT skills in public sectors where lack of qualified staff and inappropriate human resources training is problematic (Ndou, 2004; UN E-Government Survey, 2012).

Overall, the main reason why government of Yemen gives little priority for ICT development and e-Government system implementation is because of the economic and political instability in the country due to the revolutions of the 2011 Arab Spring in Middle East. Hence, the government has many priorities including reestablishing water facilities, electricity, transportation, and medical facilities. Considering the need of these facilities, the government considers ICT and e-Government unnecessary at that time, hence, has not given priority to the implementation of ICT and e-Government master plans.

## **6.5 Policy Implications**

The quantitative findings of the CA and AHP drive the policy implications of this research. Accordingly, and with the supplemental qualitative results, the gap analysis assisted in determining the reasons for the mismatch between the empirical findings and realities in Yemen. The priority settings for policies were constructed to derive proper policy implications that help government and policy makers to successfully implement an e-Government system in Yemen.

The priority setting process was considered as an overall success because it fulfilled its political goals. Factors considered crucial for success, based on participants' perceptions, include an economic strategy that addresses existing internal resources allocation, process management characterized by goal orientation and clear leadership, and an elaborate communications strategy integrated early in the process (Waldau *et al.*, 2010).

Implementing and adopting new ICT technologies always exceeds available funding. This deficiency in funding requires policy makers to prioritize needs of those technologies that the government has to start with. Here, the challenge lay in making a fair decision to balance competing needs. The priority setting for the adoption of new technologies was considered one of the most intractable issues in decision making (Saaty, 1990). This factor obligates governments and policy makers to increase the rationality and accountability of priority setting for technology adoption (Lettieri and Masella, 2009).

Accordingly, this study applied the DCM and AHP to select the optimal combination of e-Government implementation success factors within the given budget and develop priority settings to derive proper policy implications that will help government and policy makers successfully implement an e-Government system in Yemen.

The first significant policy implication can be drawn as the factor of privacy must be among the top priorities for implementing e-Government projects. Privacy in this sense will ensure the protection of government and user data and enhance trust between the government and citizen.

The second policy implication is that the government should introduce a strong legal framework specifically for e-Government by consulting specialists to assess the existing rules and legislation, and provide the legal status of electronic interactions and transactions, clarify regulations to enhance and permit electronic content archiving (digitalizing) in government agencies, and assign specific rules and regulations to ensure security and protection of government information and end users' data. Hence; it is highly necessary for the government to begin establishing a national strategic planning for legal issues. Such a plan should include acts on electronic interactions and transactions with the government.

The third policy implication is that the government has to assign a strong and specialist leader, who has an innovative mind, applies the strategies and policies of implementation and makes them applicable in reality, supports implementing strategic planning, and has control of the different e-Government projects in all government agencies. Moreover, the government should consider the leader as a highly important agent for e-Government implementation and policy development who can provide the vision and drive necessary for society in Yemen. Of note, best practices in e-Government leadership have been developed in countries such as Korea, which has given e-Government the highest priority (NIA, 2010).

The fourth policy implication concerns the need for a clear and tailored-made strategy with long-term strategic planning of at least 10-years. This strategy should serve as a fundamental process to roadmap and support the different stages of e-Government implementation and identify policies necessary to support e-Government in the sense that it effectively and efficiently serves the digital government and society.

General aims of such strategy include raising the level of government performance especially providing services to citizen. This roadmap would guide policy makers to their targeted destinations. Additionally, every project or initiative needs to be rooted in a careful, analytical, and dynamic strategy (Ndou, 2004).

The fifth major implication for policy makers in Yemeni government is to provide an adequate technological infrastructure that meets the technology requirements to implement the e-Government system. More precisely, the government must implement an adequate infrastructure, which is needed to build a robust e-Government system through the provision of effective communication systems to transfer data between governmental institutions, individuals, and society as a whole. Here, the responsibility rests on the Ministry of Telecommunications and Information Technology in continually providing and maintaining networks of government institutions because not all e-Government services can be obtained through the current structure; therefore a suitable ICT infrastructure that serves as the backbone of e-Government is required. Therefore, the government should develop a clear vision to enhance networks that interconnect different government agencies. The government must progress this step simultaneously with the improvement of the ICT infrastructure stage and e-Government implementation.

The sixth policy implication concerns the government's ability to handle functions of e-Government using a centralized GEA. Using a centralized GEA will allow the government to operate and maintain the e-Government system and should guide government agencies to start adopting e-Government using their existing IT or internet units or departments rather than investing in building special GEA units for

each ministry and related agency. With budget constraints, this option tends to save the government expenses; reduce the cost of the e-Government infrastructure; and utilize, improve, and promote the existing IT departments and staff. Policy makers should realize that implementing decentralized back offices requires significant funding to develop new infrastructure for GEA units in all agencies.

More specifically, as budget limitations also hinder government agencies, they should use their current IT departments to administer and operate e-Government sites and services without investing money to create special units and infrastructures for e-Government. In this case, a centralized e-Government back office (GEA) must include specific responsibilities and duties, such as supervising and monitoring the performance of all related agencies, and most importantly promoting and supporting the coordination and collaboration of all government entities. However, if adopting a centralized GEA is successful, future expansion to decentralized offices, which require higher budget and investments, would be much easier.

The seventh policy implication is the development of policies to promote short training periods for government employees. Short training periods is important to allow government officers the ability to receive training without having to leave their jobs and responsibilities for long periods. Additionally, the government should offer regular workshops that are composed of all departments of computer and communications within the government sector.

Finally, the government should provide appropriate financial support to cover the technical and programmatic costs experienced within the government sector. Specifically, the government should consider allocating its budget to be more favorable



to the ICT sector and e-Government implementation. Policy makers and government of Yemen should also assign a specific budget for the long-term investment of the different stages of the e-Government project and operational and maintenance costs that will be required after implementation.

The scope of the above mentioned policy implications provided the researcher insight to address an additional policy recommendation for the government and policy makers in Yemen toward a successful e-Government implementation. As this dissertation was concerned with implementing e-Government to deliver government services to citizens, the researcher suggests four additional key components.

First, the government should place effort in implementing, developing, and spreading internet networks (LAN & WAN technologies) in government and educational sectors, and develop public internet access points, which is a basic requirement in building an e-government that provides secure communications between network users. The government should also highly consider internet diffusion in all cities within Yemen especially remote areas with complex geographical regions.

To accomplish its goals, the Yemeni government can take advantage of developed best practices from other countries. Since 2003, the UN has provided comparative assessment reports on e-Government development levels of its 192 member states as a way to facilitate and enhance global cooperation in and through e-Government. For three consecutive years (2010-2012), the international community evaluated Korea's e-Government system as one of the world's best systems (UN E-Government Survey, 2012). In fact, Korea's growing internet users population is an important step

toward the country's e-Government development efforts. Additionally, the diffusion of internet services in Korea is the highest among the top five top nations (Korea, Hong Kong, Netherlands, Denmark, and Canada ) as ranked by the International Telecommunication Union (ITU, 2008).

Second, government educational institutions must empower citizens by providing education on ICT technologies by developing the curricula and educational techniques to be consistent with the digital age. This education also requires increasing the awareness and electronic culture of citizens to achieve their acceptance to use e-Government applications, and to attain justice and equality for all levels of citizens to access public services.

Third, government institutions in Yemen must address various challenging issues and find solutions for obstacles that prevent the adoption of e-Government applications in their agencies. When these obstacles are addressed they should be consolidated with the correct concepts and scientific foundations upon which e-Government is built. Additionally, providing training and equipping specialist in the IT field will be necessary to ensure the progress of implementation of e-Government strategy. Such oversight will also help achieve the required changes in institutions, departments, and re-distribution of tasks and functions. Finally, the government should work to get rid of bureaucracy and complexity of regulatory routines.

Fourth, policy makers in government should eliminate the problem of computer and digital illiteracy throughout the Republic of Yemen before and while implementing the new electronic system of government. Specifically, the government should consider a policy to reduce the digital divide nationwide by

reducing internet charges and offering government services at a lower cost. The digital gap must be narrowed, especially between males and females; therefore, the government should offer both genders equal ICT educational opportunities.

In Yemen and other developing countries in Middle East region, addition to the digital divide that exists between developed and developing nations, there is evidence that the digital divide between male and female has declined (Basu, 2004). The emphasis given to these new data by a number of international organizations led to wide spread coverage in the media and a sense of optimism about the future. Indeed, some researchers have gone so far as to argue that ‘the most stunning feature of this divide is not about how large it is, but how rapidly it is closing (Belanger and Carter, 2006).

For example, the diffusion of the internet in Korea is the highest among the five top nations, as ranked by the ITU, has overcome a great percentage of the digital divide. While the Korean government has invested a lot into creating and providing e-Government services to its citizens, a divide still exists in urban e-Government in South Korea in the use of e-Government services in terms of gender, age, educational level and income (Lee and Cho, 2007), which has been shaped by internal organizational factors of municipalities and external pressure from communities (Lim, 2010).

Mossenburger *et al.* (2003) supported the argument is that, although males and females have different attitudes toward to technology, the surge in the number of females online has eliminated some disparity in access between genders. Belanger and Carter (2006) argued that the gender digital divide should not be a major determinant of e-Government usage.

These arguments justify the results obtained from the AHP estimations as the final decision of government officials toward e-Government adoption in Yemen was assigned a lower priority or lower relative importance for the factor gender digital gap. These government officials felt that even though this gender digital gap exists in Yemen, it is not a barrier toward the implementation and adoption of e-Government. This gender digital gap has been reflected in policy implications, which recommend that the government and policy makers learn from the best practices worldwide (e.g., Korea) by diffusing the Internet services all over the country of Yemen.

Finally, government should involve and activate the role of the private sector in the process of transitioning to a pattern of e-Government. Such involvement would ease the burden on the government, provide well skilled personnel in the field of IT, and raise the level of the public's abilities to working with these new technologies.

Government should also seriously consider enhancing international cooperation. Several international organizations (e.g., ESCWA) cooperate with Yemen by offering consultancy services that have helped the government in the adoption and implementation of e-Government. However, the Arab Spring in 2011 resulted in political instability and this cooperation is no longer active. Therefore, after changing the whole government, there is a better chance for international organizations to become involved in Yemen and provide guidance and consultancy services for e-Government and ICT adoption and diffusion, especially by transferring best practices from other countries such as Korean e-Government.

## **Chapter 7: Overall Conclusions, Limitations, and Future Research**

In Chapter 1, the researcher presented various issues regarding e-Government implementation in Yemen as well as the motivation for conducting this study. In the same chapter, the researcher explained the purpose of the dissertation, research questions, and contribution to the research. In Chapter 2, the researcher reviewed the current status of ICT and e-Government development in Yemen and listed the different e-Government adaptation obstacles that developing countries experience. Chapter 2 also included the main reason of not implementing e-Government Yemen, which was the lack of an appropriate in-depth study that conceptualized government employees' behaviors and opinions toward e-Government implementation in their agencies.

The researcher suggested that involving government officers in the implementation of the e-Government system would significantly reduce resistance to change to this electronic system of government. Thereafter, the researcher conducted a systematic literature review of previous studies and included a discussion on e-Government concepts such as recent definitions, benefits, and applications. Following this discussion, the researcher discussed related studies by investigating e-Government adoption research in developed and developing nations, which included ICT and e-Government studies that used the current research methods.

In developing countries, especially Yemen, promoting the adoption and implementation of an e-Government system is one of the most important and difficult

tasks of the government. In these circumstances, governments of developing countries should have proper policies to enhance the adoption and usage of e-Government. Globally, many general policy frameworks have been developed to enable nations to successfully implement e-Government. However, there is still a critical need for a supply-side approach based on understanding e-Government policy makers' behaviors and preferences, which are critical in the implementation process.

To achieve the aims of this study, the researcher applied the CA with stated preference method based on DCM and AHP based on MCDM. Based on random utility theory, the DCM was applied to describe policy makers' preference toward e-Government adoption and implementation in Yemen. To lay out an informative background for policy making, the researcher incorporated heterogeneity into the discrete model (rank-ordered mixed logit model) by random coefficients and the interaction between e-Government attributes and participants' demographics and characteristics as explained in Chapter 4. The AHP, based on MCDM, was applied to identify and rank factors that strongly influenced the successful adoption of e-Government system in Yemen as depicted in Chapter 5.

The estimation results of the two methods applied in this study (Chapters 4 and 5) were consistent to an appreciable extent with the empirical analysis on e-Government adoption studies conducted in both developed and developing countries. The findings of this study provide evidence on the impact of factors used for both CA and AHP. This research empirically investigated the attributes and factors that are considered to be more important in policy makers' preferences and demonstrated that the order of importance is privacy, legal framework, leadership, strategy, adequate technological

infrastructure, GEA, training and budget. These results have important implications for different levels within the e-Government society to provide better implementation policies.

This study was a mixed research approach as it applied quantitative and qualitative analysis. Chapter 6 illustrated how this study drew the gap analysis and policy implications based on the quantitative results with the supplemental qualitative findings that were obtained by conducting telephone interviews with policy makers in Yemen.

Last but not the least, this chapter provided the overall conclusion of the dissertation. It will also provide the limitations of the study and the recommendations for future research.

Despite of the benefits, this study had limitations, which offer opportunities for future research. First, a small sample size was used because not all government officials were involved in this study; rather, this study was conducted with government employees of 14 ministries in Yemen. Therefore, a small number of respondents and participants were involved in the survey, which limits the scope and coverage of the results. As such, there is a need to involve other ministries and government institutions such as universities, co-operations, etc. to obtain a larger sample size.

Second, this study was confined to a limited geographical area as it used a convenience sample from the capital city of Yemen (Sana'a); therefore, the perceptions of policy makers may differ from those of officials in other cities. Hence, the researcher recommends involving government officials from different cities to gain a better stratified reflection of the government's structure.

Finally, factors that affect the adoption and implementation of e-Government were been investigated; however, additional research is needed to consider other factors that were not included in this research. In addition, this researcher considered the supply side and conducted a survey-based instrument in the government sector. Therefore, future research should consider the demand side by investigating citizens' (end users) behaviors and intentions to use e-Government systems and services to attain more accurate levels of adoption.



# Bibliography

- Al-Hashmi, A., & Darem, A.B. (2009). Understanding Phases of E-Government Project. *Public Administration Review*, pp: 152–157.
- Almazan, S.R., & Gil-Gracia, J.R. (2011). Are government Internet portals evolving towards more interaction, participation, and collaboration? Revisiting the rhetoric of e-Government among municipalities. *Government Information Quarterly*, 29(2), pp: 72–81.
- Al-Nagi, E., & Hamdan, M. (2009). Computerization and e-Government implementation in Jordan: Challenges, obstacles and successes. *Government Information Quarterly*, 26(4), 577-583.
- Alpar, P., & Olbrich, S. (2005). Legal requirements and modelling of processes in e-Government. *Electronic journal of e-Government*, 3(3), 107-116.
- Alsebaeai, M. A. (2012a, January). Success and Failure Factors of e-Government project implementation in Yemen: An explore study. *Proceedings of the 3rd International Conference of Computer Application ICCA, Paper Number: ICCA504*.
- Alsebaeai, M. A., Manseok, J., & Lee, J., (2012, June). Determining Success Factors of e-Government Implementation in Yemen: An Analytical Hierarchy Process Approach. *Paper presented in the 12<sup>th</sup> European Conference of Electronic Government*, 2012, Barcelona, Spain.
- Alshehri, M., & Drew, S. (2010). Challenges of e-Government Services Adoption in

- Saudi Arabia from an e-Ready Citizen Perspective. *World Academy of science, Engineering and Technology* , 66(2010).
- Baltas, G., & Doyle, P. (2001). Random Utility models in marketing research: A survey. *Journal of Business Research*, 51, 115-125.
- Basu, S. (2004). E-Government and developing countries: An overview. *International Review of Law, Computers & Technology*, 18(1), 109–132.
- Belanger, F. & Hiller, J. (2006). A framework for e-Government: privacy implications. *Business Process Management Journal*, 12(1), 48-60.
- Belanger, F., & Carter, L. (2006, January). The Effects of the Digital Divide on E-Government: An Empirical Evaluation. In *System Sciences, 2006. HICSS'06. Proceedings of the 39th Annual Hawaii International Conference on* (Vol. 4, pp. 81c-81c). IEEE.
- Belanger, F., & Carter, L. (2008). Trust and Risk in e-Government adoption. *Journal of Strategic Information Systems*, 17, 165-176.
- Bhuiyan, S. H. (2011). Modernizing Bangladesh public administration through e-governance: Benefits and challenges. *Government Information Quarterly*, 28, 54-65.
- Carter, L. & Belanger, F. (2005). The utilization of e-Government services: Citizen trust, innovation and acceptance factors. *Information Systems Journal*, 15(1), 5–25.
- Chan, C. M. L., & Pan S. L. (2008). User engagement in e-Government systems implementation: A comparative case study of two Singaporean e-Government

- initiatives. *Journal of Strategic Information Systems*, 17, 124-139.
- Chen M. K., & Wang S. C. (2010). The critical factors of success for information service industry in developing international market. *Journal of Expert Systems with Applications*, 37, 694-704.
- Choi, J.Y., Koh, D., & Lee, J. (2008). Ex-ante simulation of mobile TV market based on consumers' preference data. *Technology Forecasting & Social Change*, 75, 1043-1053.
- Contreras F., Hanaki K., Armakin T., & Connors S. (2008). Application of analytical hierarchy process to analyze stakeholders preferences for municipal solid waste management plans, Boston, USA. *Journal of Resources and Conservation*, 52, 979-991.
- Coursey, D., & Norris D. F. (2008). Models of E-Government: Are They Correct?: An Empirical Assessment. *Public Administration Review*, pp: 523–536.
- Crabbe, M., & Vandebroek, M. (2011). Using appropriate prior information to eliminate choice sets with a dominant alternative from D-efficient designs. *Available at SSRN 1846488*.
- Criado, J. I., & Ramilo, M. C. ( 2003). E-Government in practice. An analysis of Web site orientation to the citizens in Spanish municipalities. *The International Journal of Public Sector Management*, 16( 3), 191-218.
- Dada, D. (2005). The Failure of E-Government in Developing Countries: A Literature Review. *The Electronic Journal on Information Systems in Developing Countries*, 26(7), 1-10.

ESCWA. (2007). *National Profile of the information society in the Republic of Yemen*.

United Nation, New York.

ESCWA. (2009). *National Profile of the information society in Yemen*. Economic and Social Commission for western Asia, United Nation, New York.

Euser, A. M., Dekker, F. W., & Cessie, S. (2008). A practical approach to Bland-Altman plots and variation coefficients for log transformed variables. *Journal of clinical epidemiology*, 61(10), 978-982.

Fritz, N. (2010). An Empirical Investigation of Consumer Preferences towards Mobile Broadband. *Master Thesis*. Department of Marketing and Statistics: Aarhus University, Denmark.

Ganapati, S., & Reddick, C. G. (2012). Open e-Government in U.S. state governments: Survey evidence from Chief Information Officers. *Government Information Quarterly*, 29, 115-122.

Gant, J. P. (2008). Electronic Government for Developing Countries. *International Telecommunication Union (ITU)*, Geneva.

Gil-Garcia, J. R., & Helbig, N. (2006). Exploring e-Government benefits and success factors. *Encyclopedia of Digital Government*, 2, 803-811.

Gil-Garcia, J. R., & Pardo, T. (2005). E-Government Success Factors: Mapping Practical Tools to Theoretical Foundations. *Government Information Quarterly*, 22, 187-216.

Goodwin, P., & Wright, G. (2004). *Decision analysis for management judgment*. Wiley.

- Green, P. E., & Rao, V. R. (1971). Conjoint measurement for quantifying judgmental Data. *Journal of Marketing Research*, 8(3), 355-363.
- Green, P. E., & Srinivasan, V. (1990). Conjoint analysis in marketing: new developments with implications for research and practice. *The Journal of Marketing*, 54(4), 3-19.
- Green, P. E., & Wind, Y. (1975). New Way to Measure Consumers' Judgments. *Harvard Business Review*, 53, 107-117.
- Gupta, B., Dasgupta, S., & Gupta A. (2008). Adoption of ICT in government organizations in a developing country: An empirical study. *Journal of Strategic Information Systems*, 17, 140-154.
- Hakim, Z., & Pathak, D.S. (1999). Comparison of Discrete Choice Conjoint And Conditional Preference Modeling. *Journal of Health Economics*, 8, 103-116.
- Hauser, J. R., & Rao, V. R. (2004). Conjoint Analysis, Related Modeling, and Applications. *Advance in Marketing Research: Progress and Prospects*, 141-68.
- HDI. (2011). *International Human Development Indicators*. Available at: <http://hdrstats.undp.org/en/countries/profiles/YEM.html>.
- Heeks, R. (2003). *Most e-Government-for-development projects fail: how can risks be reduce?.* Manchester: Institute for Development Policy and Management, University of Manchester.
- Heeks, R. (2007). Implementing and Managing eGovernment: An International Text. *Enlace*, 4(2).

- Hensher, D. A., & Greene, W. H. (2003). The mixed logit model: the state of practice. *Transportation*, 30(2), 133-176.
- Hensher, D. A., Rose, J. M., & Greene, W. H. (2005). *Applied choice analysis: A primer*. Cambridge University Press.
- Hesse-Biber, S. N. (2010). *Mixed methods research: Merging theory with practice*. Guilford Press.
- Hiller, J. S., & Belanger F., (2001). Privacy Strategies for Electronic Government. *E-Government*, 2001, 173.
- Högberg, M. (2007). *Eco-driving? A discrete choice experiment on valuation of car attributes* (No. 2007:13).
- Hole, A. R., & Kolstad, J. R. (2012). Mixed logit estimation of willingness to pay distributions: a comparison of models in preference and WTP space using data from a health-related choice experiment. *Empirical Economics*, 42(2), 445-469.
- Hossan, C.G., Habib, M.W., & Kushchu, I. (2006). Success and Failure Factors for e-Government projects implementation in developing countries: A study on the perception of government officials of Bangladesh. In *Proceedings of the 2<sup>nd</sup> European Conference on Mobile Government, Mobile Government Consortium International*.
- Howard, K., & Salked, G. (2009). Does attribute framing in discrete choice experiments influence willingness to pay? Results from a discrete choice experiment in screening for colorectal cancer. *Value in Health*, 12(2), 354-363.
- Ida, T., & Sato, M. (2006). Conjoint analysis of consumer preferences for broadband

- services in Japan. *The Kyoto Economic Review*, 75(2), 115–127.
- International Human Development Indicators. *Human Development Index of Yemen*.  
 Available at: <http://hdrstats.undp.org/en/countries/profiles/YEM.html>
- Irani Z., Eliman T., & Jackson P. (2007). Electronic transformation of government in the UK: a research agenda. *European Journal of Information Systems*, 16(4), 327-335.
- Ishizaka, A., & Labib, A. (2011). Review of the main developments in the analytical hierarchy process. *Journal of Expert Systems with Applications*, 38(11), 14336-14345.
- ITU. (2008). *Electronic Government for Developing Countries*. Geneva: International Telecommunication Union (ITU). at: [www.itu.int/ITU-D/cyb/app/e-gov.html](http://www.itu.int/ITU-D/cyb/app/e-gov.html).
- Jeong G. (2008). Development and Application of Choice Models with Simultaneity and Endogeneity. *PhD Dissertation*. Korea: Seoul National University.
- Johnson, R. B., & Onwuegbuzie, A. J. (2011). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33(7), 14-26.
- Kim, H. J., Pan, G., & Pan, S. L. (2007). Managing IT-enabled transformation in the public sector: A case study on e-Government in South Korea. *Government Information Quarterly*, 24(2), 338-352.
- Kim, Y., Lee, J. D., & Koh, D. (2005). Effects of consumer preferences on the convergence of mobile telecommunications devices. *Applied Economics*, 37(7), 817-826.

- Kjaer, T. (2005). *A review of the discrete choice experiment - with emphasis on its application in health care*. Syddansk Universitet.
- Koppelman, F. S., & Bhat, C. (2006). A self instructing course in mode choice modeling: multinomial and nested logit models. *Prepared for US Department of Transportation Federal Transit Administration*.
- Layne, K. & Lee, J. (2001). Developing fully functional E-Government: A four stage model. *Government Information Quarterly*, 18(2), 122–136.
- Lee, J., Kim, Y., Lee, J. D., & Park, Y. (2006). Estimating the extent of potential competition in the Korean mobile telecommunications market: Switching costs and number portability. *International Journal of Industrial Organization*, 24(1), 107-124.
- Lee, S., & Cho, J. (2007). Usability evaluation of Korean e-government portal. *Universal Access in Human-Computer Interaction. Applications and Services*, 64-72.
- Lettieri, E., & Masella, C. (2009). Priority setting for technology adoption at a hospital level: Relevant issues from the literature. *Health policy*, 90(1), 81-88.
- Lim, J. H. (2010). Digital Divides in Urban E-Government in South Korea: Exploring Differences in Municipalities' Use of the Internet for Environmental Governance. *Policy & Internet*, 2(3), 3.
- Long, N. V. (2010). Study on consumer preference for Internet service in rural area of Vietnam. *PhD Dissertation*. Korea: Seoul National University.
- Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). *Stated choice methods: analysis*



*and applications*. Cambridge University Press.

Mangham, L. J., Hanson, K., & McPake, B. (2009). How to do (or not to do) ... Designing a discrete choice experiment for application in a low-income country. *Health Policy and Planning*, 24(2), 151–158.

McFadden, D. & Train, K. (2000). Mixed MNL models for discrete response. *Journal of applied econometrics*, 15(5), 447 - 470.

Moon, M. J. (2002). The Evolution of E-Government among Municipalities: Rhetoric or Reality?. *Public Administration Review*, 62(4), 424-443.

Mossberger, K., Tolbert, C. J., & Stansbury, M. (2003). *Virtual inequality: Beyond the digital divide*. Georgetown University Press.

Ndou, V. (2004). E-Government for Developing Countries: Opportunities and challenges. *The Electronic Journal on Information Systems in Developing Countries*, 18(1), 1-24.

NIA. (2010). Introduction of the Korean e-Government. *National Information Society Agency*, Korea.

NIC, National Information Center. (2005). *E-Government: Yemen's particularities and methodology for achieving ambition*. Paper submitted to Yemen's Shoura council meeting.

OECD (2009). *OECD e-Government Studies: Rethinking e-Government Services: User Centered Approach*. OECD Publications, France, 2009.

OECD. (2003). *OECD e-Government Studies: The e-Government Imperative*. OECD

Publications, France, 2003.

Pirdashti, M., Ghadi, A., Mohammadi, M., & Shojatalab, G. (2009). Multi-criteria decision-making selection model with application to chemical engineering management decisions. *World Academy of Science, Engineering and Technology*, 49, 54-59.

Rakhmanov, E. (2009, November). The barriers affecting E-Government development in Uzbekistan. In *Computer Sciences and Convergence Information Technology, 2009. ICCIT09. Fourth International Conference on* (pp. 1474-1480). IEEE.

Rakhmanov, E. (2009, November). The barriers affecting E-Government development in Uzbekistan. In *Computer Sciences and Convergence Information Technology, 2009. ICCIT09. Fourth International Conference on* (pp. 1474-1480). IEEE.

Resano, H., Sanjuán, A. I., & Albisu L. M. (2012). Consumers' response to the EU Quality policy allowing for heterogeneous preferences. *Food Policy*, 37(4), 335-365.

Rosston, G. L., Savage, S. J., & Waldman, D. M. (2010). Household demand for broadband Internet in 2010. *The BE Journal of Economic Analysis & Policy*, 10(1), 1-43.

Rowley, J. (2011). E-Government stakeholders- Who are they and what do they want?. *International Journal of Information Management*, 31(1), 53-62.

Saaty, T. L. (1977). A scaling method for priorities in hierarchical structures. *Journal of Mathematical Psychology*, 15(3), 234-281.

Saaty, T. L. (1980). The analytic hierarchy process. *New York: McGraw-Hil* 1980.

- Saaty, T. L. (1990). Multicriteria Decision Making: The Analytic Hierarchy Process: Planning, Priority Setting. *Resource Allocation*, 2.
- Saaty, T. L. (1994). Highlights and critical points in the theory and application of the analytical hierarchy process. *European Journal of Operational Research*, 74(3), 426–447.
- Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International Journal of Services Sciences*, 1(1), 83-98.
- Salmeron, J. L., & Herrero, I. (2005). An AHP-based methodology to rank critical success factors of executive information systems. *Computer Standards & Interfaces*, 28(1), 1-12.
- Sang, S., Lee, J.D., & Lee, J. (2009). A study on Contribution Factors and Challenges to the Implementation of E-Government in Cambodia. *Journal of Software*, 4(6), 529-235.
- Sang, S., Lee, J.D., & Lee, J. (2010). E-Government Adoption in Cambodia: A partial Least Squares Approach. *Transforming Government: People, Process and Policy*, 4(2), 138-157
- Savage, S. J., & Waldman, D. M. (2005). Broadband Internet access, awareness, and use: Analysis of United States household data. *Telecommunications Policy*, 29(8), 615-633.
- Savage, S. J., & Waldman, D. M. (2009). Ability, location and household demand for Internet bandwidth. *International Journal of Industrial Organization*, 27(2), 166-174.

- Scarpa, R., Thiene, M., & Train, K. (2008). Utility in WTP space: A tool to address confounding random scale effects in destination choice to the Alps. *American Journal of Agricultural Economics*, 90, no. 4 (2008):994-1010.
- Shahkooh, K.A., Saghafi, F., & Abdollahi, A. (2008, April). A proposed model for e-Government maturity. In *Information and Communication Technologies: From Theory to Application, 2008. ICTTA 2008. 3<sup>rd</sup> International Conference on* (pp. 1-5). IEEE.
- Sharifi, H., & Zarei, B. (2004). An adaptive approach for implementing e-Government in IR Iran. *Journal of Government Information*, 30(5), 600–619.
- Sillano, M., & Ortuzar, J.D. (2005). Willingness-to-pay estimation with mixed logit model: some new evidence. *Journal of Environment and Planning A*, 37(3), 525-550.
- Simon, M. A. (1996). Beyond inductive and deductive reasoning: The search for a sense of knowing. *Educational Studies in mathematics*, 30(2), 197-210.
- Song, H. J. (2002). Prospects and Limitation of the E-Government initiative in Korea. *International Review of Public Administration*, 7(2), 45-53.
- Srinivasan, S., Bhat, C. R., & Holguin-Veras, J. (2006). Empirical Analysis of the impact of security perception on intercity mode choice: A panel rank-ordered mixed logit model. *Transportation Research Record: Journal of the Transportation Research Board*, 1942(-1), 9-15.
- Syamsuddin I. (2011). Information Security Policy Evaluation: A Comparative Study of the AHP methodologies. *PhD Dissertation*. Korea: Seoul National University.

- Thomas, R., & Hardy, C. (2011). Reframing resistance to organizational change. *Scandinavian Journal of Management*, 27(3), 322-331.
- Train, K. E. (2003). *Discrete Choice Method with Simulation*. Cambridge University Press.
- Train, K., & Weeks, M. (2005). Discrete choice models in preference space and willingness-to-pay space. *Applications of simulation methods in environmental and resource economics*, 1-16.
- UN. (2010). *UN E-Government Survey 2010: Leveraging e-Government at a time of financial and economic crisis*. United Nations Department of Economic and Social affair, available at:  
<http://unpan1.un.org/intradoc/groups/public/documents/un/unpan038851.pdf>.
- UN. (2012). *UN E-Government Survey 2012: E-Government for the People*. United Nations Department of Economic and Social affair, available at:  
<http://unpan1.un.org/intradoc/groups/public/documents/un/unpan048065.pdf>
- United Nations (2008). “UN E-Government Survey 2008: From e-Government to Connected Governance”. *United Nations Department of Economic and Social Affairs, Division for Public Administration and Development Management*, at:  
<http://unpan1.un.org/intradoc/groups/public/documents/un/unpan028607.pdf>
- Waldau, S., Lindholm, L., & Wiechel, A. H. (2010). Priority setting in practice: Participants opinions on vertical and horizontal priority setting for reallocation. *Health policy*, 96(3), 245-254.
- Weerakkody, V., El-Haddede, R., Sabol, T., Ghoneim, A., & Dzupka P. (2011).

E-Government implementation strategies in developed and transition economies: A comparative study. *International Journal of Information Management*, 32(1), 66-74.

West, D. M. (2004). E-Government and the Transformation of Service Delivery and Citizen Attitudes. *Public Administration Review*, 64(1), 15-27.

World Bank, Center for Democracy and Technology. (2002). *E-Government Handbook*. Retrieved October 10, 2010, from <http://www.cdt.org/egov/handbook/>.

World Bank. (2009). *World Development Report 2009*. Available at <http://econ.worldbank.org/> (accessed on 15/03/12).

Yemeni e-Government portal project's documentations. (2008) & (2009).

# Appendixes

## Appendix A- Official Letter for conducting the survey

الرقم: ٥٥٤/٥٥٤  
التاريخ: ١٣/٧/١٤٣٥  
الموافق: .....

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

الجمهورية اليمنية  
رئاسة مجلس الوزراء

الأخوة، الأخوات / الوزراء المحترمين

بعد التحية،،،

نود الإحاطة بأن المهندس/ مهدي عبدالله السباعي يقوم بتحضير  
الدكتوراه في مجال الحكومة الإلكترونية بدولة كوريا.

وعليه: يرجى التكرم بالتوجيه للمختصين لديكم بتعبئة الاستبيان  
الخاص بدراسته.

ولكم الشكر،،،

عبد الحافظ ناجي السامه  
أمين عام مجلس الوزراء



### Translation:

To All Respected Ministers

After greetings,,,

We would like to notify you that Mr. Mahdi Abdullah Alsebaei is researching on electronic government field in South Korea.

Therefore, kindly guide your specialist in your ministries to fulfill the attached questionnaire for his study.

Thanking You,,,,,

Abdull Hafiz Alsamah

General Secretary of Yemeni Cabinet

(Sign, PMO stamp).

## Appendix B- Survey Questionnaires

### B1. Questionnaire in Arabic



كلية الهندسة  
جامعة سويل الوطنية  
سور، كوربا الجنوبية



الجمهورية اليمنية  
رئاسة الوزراء  
الأمانة العامة

بالتعاون مع البرنامج الدولي للسياسة المعلوماتية بجامعة سويل الوطنية بـ كوربا الجنوبية، لدينا بحث حول دراسة اعتماد وتحسين عوامل نجاح تطبيق نظام الحكومة الإلكترونية في اليمن بواسطة التحليل المشترك ومفهوم التحليل الهرمي لصنع القرار الذي يقلل سرعة الإنجاز ورفع ثقافة الأداء. تأتي هذه الدراسة مترجمة مع تطبيق الجمهورية اليمنية لروية المجتمع الرقمي بما فيه من مشاريع للحكومة الإلكترونية.

كما تعلمون بأن الحكومة اليمنية نشرت موقعها الرسمي على الأنترنت وصفحتها الرئيسية [www.yemen.gov.ye](http://www.yemen.gov.ye).

وقد تم تقديم بعض المعلومات المفيدة من خلال مواقع الوزارات والجهات الحكومية المرتبطة بالبوابة، وهناك إمكانية لتوفير الخدمات الحكومية من خلال البوابة، فبدلاً من أن يكون المواطن بحاجة لزيارة مكتب الحكومة للحصول على أي خدمات حكومية، فإنهم يمكن أن يحصلوا على تلك الخدمات عبر البوابة الحكومية الإلكترونية وبواسطة الأنترنت، ونحن هنا نتحدث عن الخدمات التطبيقية التي يمكن تمكينها عبر المواقع الحكومية باستخدام شبكة الأنترنت. لذلك هناك حاجة إليها من أجل التنفيذ والتطبيق الناجح للحكومة الإلكترونية.

نرجوا بذل القليل من الوقت للمشاركة من خلال إجابة هذا الاستبيان. وجهات نظركم تمثل وجهة نظر حول فوائد وعوامل نجاح تنفيذ وتطبيق نظام الحكومة الإلكترونية في الجمهورية اليمنية.

هذا الاستبيان هو جزء مهم لتحديد العوامل المؤدية لنجاح تطبيق نظام الحكومة الإلكترونية في الجمهورية اليمنية".

كل إجاباتكم لهذا الاستبيان ستكون سرية للغاية ولن تستخدم إلا لغرض هذه الدراسة.

يحتوي هذا الاستبيان على ثلاثة أجزاء:

1. الجزء الأول يحتوي على إختيارات متفاوتة المراتب بحيث تقسم وتغطي هذه الخيارات على 4 مجموعات إختيار. كل مجموعة لديها 4 حزم نظم بدائل مختلفة من الصفات لسبعة عوامل مؤثرة على إنشاء الحكومة الإلكترونية في اليمن والمذكورة في أعلى الجدول لكل مجموعة إختيار. الرجاء تحديد إختيارك اعتماداً على الترتيب الآتي: رقم 1 للخيار الأكثر أفضلية (أو أهمية)، رقم 2 للخيار الأقل أفضلية من رقم 1، رقم 3 للخيار الأقل أفضلية من رقمي 1 و 2، وبالمثل رقم 4 للخيار الأقل أفضلية من البقية. قبل إختيار المجموعات، (الرجاء الأخذ بعين الاعتبار مفاهيم العوامل والصفات الخاصة بها الموضحة في الصفحة التالية).
2. الجزء الثاني يحتوي على إختيارات مقارنة (مفاضلة) بحيث تقسم وتغطي في أربع مستويات مختلفة، كل مستوى يحتوي على بعض الصفات للعوامل المؤثرة لتطبيق ناجح لنظام حكومة إلكتروني قوي في اليمن. قبل ترقيم العوامل، (الرجاء الإطلاع على مفاهيم العوامل والصفات الخاصة بها الموضحة في بداية صفحة الجزء الثاني).
3. الجزء الثالث يحتوي على أسئلة عامة عن استخدام موقع بوابة الحكومة اليمنية على الأنترنت، وعنا معلومات ديموغرافية عن المشاركين بهذا الاستبيان.

مع جزيل الشكر لوقتكم الثمين، والمشاركة الفعالة!



## الجزء الأول: إستبيان الخيارات المتفاوتة:

### ملاحظة هامة!

الرجاء تخصيص قليل من الوقت لقراءة الجدول التالي لفهم معاني العوامل والمستويات والشرح الخاص بها وذلك قبل الإجابة على الأسئلة في الصفحات التي تلي هذه الصفحة.

الوصف	العوامل	المستويات أو الصفات	الشرح
الإداري	1. الإستراتيجية (تخطيط مزمين لإستراتيجية ورؤيا واضحة)	10 سنوات	يجب على الحكومة عمل إستراتيجية ورؤيا واضحة طويلة المدى لتحديد ورسم طريق أهداف إنشاء الحكومة الإلكترونية ولفترة مستقبلية 10 عشر سنوات
		5 سنوات	يجب على الحكومة عمل إستراتيجية ورؤيا واضحة طويلة المدى لتحديد ورسم طريق أهداف إنشاء الحكومة الإلكترونية ولفترة مستقبلية 5 خمس سنوات
		2 سنتين	يجب على الحكومة عمل إستراتيجية ورؤيا واضحة قصيرة المدى لتحديد ورسم طريق أهداف إنشاء الحكومة الإلكترونية ولفترة مستقبلية سنتين 2
القانوني	2. إطار قانوني متاسب	قوي	وجود قانون حكومي وإطار قانوني خاص لإنشاء الحكومة الإلكترونية بدعم ويضمن تعميم استخدام النظام بمختلف الجهات الحكومية وكذا يساعد على إنشاء خطة وطنية رئيسية للحكومة الإلكترونية مما يجعل الموظفين والمواطنين التعامل مع النظام كحقيقة في الواقع
		ضعيف	وجود قانون حكومي وإطار قانوني خاص لإنشاء الحكومة الإلكترونية ولكن لا يضمن تعميم استخدام النظام من قبل الموظفين أو المواطنين
التنظيمي والرقابي	3. مكتب الإدارة الإلكترونية للحكومة	مركزي	إنشاء وحدة خاصة بالإدارة الإلكترونية للحكومة في رئاسة الوزراء فقط للمراقبة والإشراف على تشغيل ودعم جميع مراحل المشروع ويعمل على التعاون والتنسيق مع كل الجهات.
		لامركزي	إنشاء وحدة خاصة بالإدارة الإلكترونية للحكومة في رئاسة الوزراء كسيرفر (خادم) وكذا إنشائها في كل الجهات الحكومية مما يجعل كل الجهات تشارك فعليا في تشغيل النظام بشكل متكافئ مع ان تكون كل الجهات مرتبطة بوحدة رقابة وحدة رئاسة الوزراء.
الإجتماعي (اللغوي)	4. لغات بوابة الحكومة الإلكترونية	فقط اللغة العربية	بوابة الحكومة اليمنية يجب ان تكون فقط باللغة العربية ولا أهمية لوجود للغة الانجليزية مما يمنع المعاملات الدولية
		اللغة العربية والإنجليزية	بل يجب ان تكون بوابة الحكومة اليمنية بالعربية والإنجليزية تحسبا لمعاملات وخدمات دولية مستقبلية
التكنولوجي (التقني)	5. مستوى الامن والحماية (حماية بيانات الحكومة والمستخدمين)	100%	في هذا المستوى لا يوجد أي إعتقاد بسرّب أي معلومات (حكومية أو شخصية)
		98%	قد يوجد 2% إحتمالية تسرب أي معلومات (حكومية أو شخصية)
		95%	قد يوجد نسبة 5% إحتمالية تسرب أي معلومات (حكومية أو شخصية)
	6. التدريب	1 أشهر	على الحكومة تدريب موظفيها لمدة شهر واحد على المهارات المطلوبة لتطبيق نظام الحكومة الإلكترونية
		3 أشهر	بل يجب على الحكومة تدريب موظفيها لمدة 3 أشهر على تلك المهارات
المالي	7. الميزانية المالية (التشغيلية) (تقريبية للتكلفة التشغيلية لنظام الحكومة ولا تشمل أي مبالغ للبنية التحتية)	20 مليون دولار	هذا المبلغ يمثل 0.5% من الموازنه العامه بإقتراض كانت 4 مليار دولار
		30 مليون دولار	هذا المبلغ يمثل 0.75% من الموازنه العامه بإقتراض كانت 4 مليار دولار
		40 مليون دولار	هذا المبلغ يمثل 1% من الموازنه العامه بإقتراض كانت 4 مليار دولار

الرجاء ترقيم الحزم في المربعات الخالية المتواجدة أسفل الجداول (اختياراتك) بناءً على ترتيب الأفضلية الآتي: رقم 1 للخيار الأكثر أفضلية (أو أهمية)، رقم 2 للخيار الأقل أفضلية من رقم 1، رقم 3 للخيار الأقل أفضلية من رقمي 1 و 2، وبالمثل رقم 4 للخيار الأقل أفضلية من البقية.

#### Choice set-A

العوامل	الحزمة الأولى A1	الحزمة الأولى A2	الحزمة الأولى A3	الحزمة الأولى A4
إستراتيجية ورؤيا	5 سنوات	10 سنوات	10 سنوات	2 سنتان
إطار قانوني مناسب	ضعيف	ضعيف	قوي	ضعيف
مكتب الإدارة الإلكترونية للحكومة	لامركزي	لامركزي	مركزي	مركزي
لغات موقع بوابة الحكومة	العربية والإنجليزية	العربية فقط	العربية فقط	العربية فقط
(مستوى أمن وحماية المعلومات أو البيانات)	100%	95%	98%	100%
التدريب	1 شهر	1 شهر	3 أشهر	3 أشهر
الميزانية المالية التشغيلية	30 مليون دولار	20 مليون دولار	30 مليون دولار	40 مليون دولار
إختياراتك	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

الرجاء التحديد بعمل دائرة على الحزمة الأكثر تفضيلاً من مجموعة الخيارات A

A1

A2

A3

A4

#### Choice set-B

العوامل	الحزمة الثانية B1	الحزمة الثانية B2	الحزمة الثانية B3	الحزمة الثانية B4
إستراتيجية ورؤيا	10 سنوات	2 سنتان	10 سنوات	5 سنوات
إطار قانوني مناسب	قوي	قوي	ضعيف	قوي
مكتب الإدارة الإلكترونية للحكومة	مركزي	لامركزي	لامركزي	مركزي
لغات موقع بوابة الحكومة	العربية والإنجليزية	العربية والإنجليزية	العربية والإنجليزية	العربية فقط
(مستوى أمن وحماية المعلومات أو البيانات)	100%	100%	95%	95%
التدريب	1 شهر	1 شهر	3 أشهر	1 شهر
الميزانية المالية التشغيلية	20 مليون دولار	20 مليون دولار	20 مليون دولار	40 مليون دولار
إختياراتك	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

الرجاء التحديد بعمل دائرة على الحزمة الأكثر تفضيلاً من مجموعة الخيارات B

B1

B2

B3

B4

### Choice set-C

العوامل	الحزمة الثالثة C1	الحزمة الثالثة C2	الحزمة الثالثة C3	الحزمة الثالثة C4
إستراتيجية ورؤيا	10 سنوات	10 سنوات	5 سنوات	2 سنتان
إطار قانوني مناسب	قوي	ضعيف	ضعيف	ضعيف
مكتب الإدارة الإلكترونية للحكومة	لامركزي	مركزي	مركزي	مركزي
لغات موقع بوابة الحكومة	العربية والإنجليزية	العربية والإنجليزية	العربية والإنجليزية	العربية فقط
(مستوى أمن وحماية المعلومات أو البيانات)	%98	%100	%98	%98
التدريب	3 أشهر	1 شهر	3 أشهر	1 شهر
الميزانية المالية التشغيلية	40 مليون دولار	40 مليون دولار	20 مليون دولار	20 مليون دولار
إختياراتك	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

الرجاء التحديد بعمل دائرة على الحزمة الأكثر تفضيلاً من مجموعة الخيارات C

C1

C2

C3

C4

### Choice set-D

العوامل	الحزمة الرابعة D1	الحزمة الرابعة D2	الحزمة الرابعة D3	الحزمة الرابعة D4
إستراتيجية ورؤيا	5 سنوات	10 سنوات	10 سنوات	2 سنتان
إطار قانوني مناسب	قوي	ضعيف	قوي	قوي
مكتب الإدارة الإلكترونية للحكومة	لامركزي	مركزي	لامركزي	مركزي
لغات موقع بوابة الحكومة	العربية فقط	العربية فقط	العربية فقط	العربية والإنجليزية
(مستوى أمن وحماية المعلومات أو البيانات)	%100	%100	%100	%95
التدريب	3 أشهر	3 أشهر	1 شهر	3 أشهر
الميزانية المالية التشغيلية	20 مليون دولار	30 مليون دولار	20 مليون دولار	30 مليون دولار
إختياراتك	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D1

D2

D3

D4

A

B

C

D

الرجاء التحديد بعمل دائرة على الحزمة الأكثر تفضيلاً من مجموعة D

والآن الرجاء التحديد بعمل دائرة على المجموعة الرئيسية الأكثر تفضيلاً لديك

## الجزء الثاني: إستبيان إختيارات المقارنة (المفاضلة):

(الرجاء تخصيص قليل من الوقت لقراءة الجدول التالي لفهم معني العوامل والمستويات والشرح الخاص بها وذلك قبل الإجابة على الأسئلة في الصفحات التي تلي هذه الصفحة).

**الهدف: عوامل النجاح التي تسهم في تنفيذ ونجاح نظام الحكومة الإلكترونية في اليمن بشكل قوي وعملي.**

العوامل الحكومية		العوامل التنظيمية (المؤسسية)		العوامل الخارجية	
العوامل الحكومية تعتمد على اعتماد صانعي القرار لأساسيات الحكومة الإلكترونية وذلك سيساعد على نشر برنامج الحكومة الالكترونية في مختلف الجهات ذات العلاقة.		في مجال الحكومة الإلكترونية هناك حاجة كبير لتطوير أو هيكلة الجهات الحكومية بما يتلائم مع التكنولوجيا المتنوعة والتي تعتبر عنصر أساس للحكومة الإلكترونية.		العوامل المتعلقة بالوضع الاقتصادي للبلاد وكذا المرتكزة على نشر التوعية الرقمية للمواطنين، هذه العوامل ليست بحكومية أو مؤسسية ولا تكنولوجية.	
<b>العوامل القانونية</b>	العوامل المتعلقة بوجود قوانين مناسبة تكفل جميع الحقوق عند التعامل الإلكتروني مع الحكومة.	<b>العوامل الإدارية</b>	العوامل المتعلقة بالجانب الإداري والتنظيمي والرقابي وعمل طرق نماذج لأعمال جميع المراحل المختلفة لإنشاء نظام الحكومة الإلكترونية	<b>العوامل الاقتصادية</b>	البيئة الاقتصادية للدولة قد تؤثر على نتيجة اعتماد نظام الحكومة الإلكترونية من قبل الجهات الحكومية المعنية.
<b>السياسات التفصيلية</b>	مبادئ تشغيل وظائف الحكومة الإلكترونية تتطلب مجموعة من القواعد الجديدة، والقوانين والسياسات المتعلقة بحرية المعلومات وحماية البيانات، وكذا قضايا حقوق الملكية الفكرية وحقوق التأليف والنشر وحقوق جرائم الكمبيوتر.	<b>قيادة المشروع</b>	تنفيذ وتطبيق نظام الحكومة الإلكترونية يحتاج الى زعيم (قائد) للمشروع بمفهوم رقي يستطيع وضع النظام الإلكتروني على جدول الأعمال الواقعية وتكوين ربط النظام في إطار برنامج الإصلاح الإداري.	<b>العوامل المرتكزة على المواطنين</b>	عند التعامل مع الحكومة الإلكترونية، يُنظر للمواطنين كملاء للخدمة، لذلك التحور على المواطنين أمر بالغ الأهمية في كل مراحل تنفيذ مشروع الحكومة الإلكترونية وخاصة المتعلقة بإدارة العلاقات مع العملاء.
<b>إطار قانوني ملائم</b>	نجاح تهيئة الحومة الإلكترونية وتنفيذ خدماتها يعتمد اعتماداً كبيراً على دور الحكومة في ضمان وجود إطار قانوني مناسب لتشغيلها وإستخدامها من قبل الموظفين والمواطنين.	<b>دعم الإدارات العليا</b>	من أجل تحقيق نجاح تنفيذ مشاريع الحكومة الإلكترونية في مختلف المؤسسات العامة (الحكومية) لابد من إقرارها من الإدارة العليا. فهذا حاجة قوية لدعم قوي من الإدارة العليا لجميع مراحل التنفيذ.	<b>الحائز</b>	هناك طرق عدة لتشجيع المواطنين على استخدام الخدمات الحكومية الإلكترونية، مثلاً "لا توجد رسوم خدمة إذا تم الحصول عليها من بوابة الحكومة الكترونياً عبر الإنترنت على سبيل المثال شهادة الميلاد..... الخ".
<b>الإستراتيجية (الرؤيا)</b>	وجود إستراتيجية ملائمة ورؤيا واضحة تهدف لرسم جدول أعمال المراحل المختلفة لتنفيذ مشروع نظام الحكومة الإلكترونية في اليمن.	<b>الأمن والحماية</b>	من أهم العوامل في تنفيذ الحكومة الإلكترونية هو تأمين وحماية معلومات وبيانات الحكومة وكذا بيانات المستخدمين الشخصية من تهديدات المتسللين (الهاكرز) ومنع الغير مصرح لهم الإستخدام غياب هذه الحماية يؤدي إلى تسريب معلومات الحكومة أو تسريب بيانات المستخدم.	<b>الدخل الفردي</b>	على الرغم من أن تسعيرة خدمات الحكومة الإلكترونية سهل ومغقول لذوي الدخل المناسب والمرتفع، إلا أنه ينبغي للحكومة أن تستهدف دعم ذوي الدخل المحدود الذين لا يستطيعون تحمل تكاليف الوصول على أجهزة كمبيوتر أو لا يستطيعون استخدام الإنترنت الذي هو مطلب الحيوي لإستخدام خدمات الحكومة الإلكترونية.
<b>التدريب (الكادر الوظيفي)</b>	المهارات الفنية والتقنية مطلوبة لتصميم وتشغيل وصيانة وكذا إدارة العمليات والوظائف الالكترونية والتحكم بالمستخدمين وغيرها.	<b>الجاهزية</b>	الاستعداد أو الجاهزية في الحكومة الإلكترونية تشير الى مبادرات الحكومة بتكليف الجهات المنسبة لتأسيس نظم ومبادئ الحكومة الإلكترونية وتوفير الوسائل الممكنة لتوعية الأفراد بفوائد وأهمية الحكومة الإلكترونية. مع أخذ بعين الإعتبار جاهزية البنية التحتية التكنولوجية.	<b>الثقة</b>	العديد من المواطنين لا يتقنون استخدام الحكومة الإلكترونية خاصة وأن هناك تاريخ عدم الاستقرار السياسي ووجود الفساد على نطاق واسع، وعليه يجب على الحكومة بناء جسر الثقة للمواطنين والفنية والتكنولوجية لتؤكد من أن الجمهور وأصحاب المصلحة متفاعلون مع نظام الحكومة الإلكتروني.
				<b>التعليم</b>	تعليم المواطنين ومحو أمية الكمبيوتر والمعلوماتية من أهم عناصر نجاح الحكومة الإلكترونية في اليمن.

الرجاء البدء بتعبئة مابين الأقواس ( ) أولاً والتي تعني الأهمية النسبية للعوامل بحسب وجهة نظركم، ومن ثم ترقيم أو إعطاء مرتبة لأحد عوامل المقارنة بتظليل الرقم أو تلوينه أو عمل خط تحت الرقم المرغوب، وذلك على النحو الآتي: رقم 1 متساوي، رقم 2،3 أهمية بنسبة بسيطة، رقم 4،5 أهمية بنسبة متوسطة، رقم 6،7 أهمية بنسبة عظمى، رقم 8،9 أهمية بنسبة مطلقة).

### Level 1 Pairwise Comparison

### المستوى الأول: المقارنة المزدوجة

ماهي أهم العوامل الرئيسية التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

الأهمية النسبية: ( ) < ( )

العوامل الحكومية	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	العوامل التنظيمية (المؤسسية)
العوامل الحكومية	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	العوامل الخارجية
العوامل التنظيمية (المؤسسية)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	العوامل الخارجية

(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

العوامل الحكومية: تعني العوامل الإدارية والقانونية.

العوامل التنظيمية (المؤسسية): تعني الجاهزية، البنية التحتية، تدريب الموظفين.

العوامل الخارجية: العوامل المرتكزة على المواطنين والعوامل الاقتصادية.

### Level 2 Pairwise Comparison

### المستوى الثاني: المقارنة المزدوجة

ماهي أهم العوامل الحكومية التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

الأهمية النسبية: ( ) < ( )

العوامل الإدارية	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	العوامل القانونية
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(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

العوامل القانونية: وجود قوانين وظوابط خاصة، وجود إطار قانوني.

العوامل الإدارية: وجود جداول الأعمال، الملائمة، التحري من التكاليف وإدارة الميزانية.

ماهي أهم العوامل التنظيمية (المؤسسية) التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

الأهمية النسبية: ( ) < ( )

العوامل التكنولوجية	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	الهيكل التنظيمية
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(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

العوامل التكنولوجية: وجود بنية تحتية رقمية مناسبة.

العوامل الإدارية: التغيير الإداري الذي يلائم متطلبات الحكومة الإلكترونية.

ماهي أهم العوامل الخارجية التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

الأهمية النسبية: ( ) < ( )

العوامل الاقتصادية	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	العوامل المرتكزة على المواطنين
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(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

العوامل الاقتصادية: يجب على الحكومة ان تعمل حافز مناسب لتشجيع استخدام الحكومة الإلكترونية، وكذا العمل على رفع مستوى الدخل. العوامل المرتكزة على المواطنين: حل مشكلة الفجوة الرقمية بين الجنسين، إنشاء جسر الثقة بين الحكومة والمواطنين، تطوير التعليم.

### Level 3 Pairwise Comparison

### المستوى الثالث: المقارنة المزدوجة

ماهي أهم العوامل الإدارية التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

الأهمية النسبية: ( ) < ( ) < ( )

دعم الإدارات العليا	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	قيادة المشروع
الإستراتيجية	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	قيادة المشروع
الإستراتيجية	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	دعم الإدارات العليا

(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

دعم الإدارات العليا: هناك حاجة قوية لدعم قوي من الإدارة العليا لجميع مراحل التنفيذ.

قيادة المشروع: قائد مشروع الحكومة الإلكترونية يحظى بمفهوم رقمي يستطيع وضع النظام الإلكتروني جدول الأعمال الواقعية الاستراتيجية وجود إستراتيجية ملائمة ورؤيا واضحة تهدف لرسم جدول أعمال المراحل المختلفة لتنفيذ المشروع.

ماهي أهم العوامل القانونية التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

الأهمية النسبية: ( ) < ( )										( )																										
الإطار القانوني										9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	السياسات التفصيلية									

(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

الإطار القانوني: ضمان وجود إطار قانوني مناسب يحوي كل مايتعلق بالتعامل الإلكتروني.  
السياسات التفصيلية: حقوق الملكية الفكرية وحقوق التأليف والنشر وعقوبات جرائم الكمبيوتر.

ماهي أهم عوامل الهيكلية التنظيمية التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

الأهمية النسبية: ( ) < ( )																
الجاهزية																
9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9
التعاون والتواصل																

(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

الجاهزية: مبادرات الحكومة بتكليف الجهات المناسبة لتأسيس نظم ومبادئ الحكومة الإلكترونية وجاهزية البنية التحتية  
التعاون والتواصل: التعاون بين الجهات الحكومية على المستويين المحلي والوطني ومشاركة المعلومات والأفكا

ماهي أهم العوامل التكنولوجية التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

الأهمية النسبية: ) < ( ) < ( ) < (																	
الأمّن والحماية																	
بنية تحتية تكنولوجية مناسبة	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9
التدريب (للكادر الوظيفي)																	
بنية تحتية تكنولوجية مناسبة	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9
التدريب (للكادر الوظيفي)																	
الأمّن والحماية	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9

(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

الأمن والحماية تأمين وحماية معلومات وبيانات الحكومة وكذا بيانات المستخدمين الشخصية من تهديدات المتسللين (الهاكرز).  
البنية التحتية التكنولوجية المناسبة: والتي تشمل نظام الحوسبة، نظام بنية الاتصالات وسياسات تكنولوجيا المعلومات وما إلى ذلك.

التدريب (الكوادر الوظيفية): للحصول على المهارات الفنية والتقنية المطلوبة لتصميم وتشغيل وصيانة وإدارة العمليات والوظائف الإلكترونية وغيرها.

ماهي أهم العوامل المرتكزة على المواطنين التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

( ) < ( ) < ( ) الأهمية النسبية: ( )

الثقة	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	الفجوة الرقمية (الجنسين)
التعليم	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	الفجوة الرقمية (الجنسين)
التعليم	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	الثقة

(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

الثقة: يجب على الحكومة بناء جسر الثقة للمواطنين بتوعيتهم وتوفير كل الجوانب القانونية والفنية والتكنولوجية.

الفجوة الرقمية (الجنسين): تحقيق المساواة بين الرجل والمرأة لتمكين المرأة بالخوض في مجال تقنية المعلومات والاتصالات بشكل أوسع.

التعليم: على الحكومة تطوير التعليم العام للمواطنين والعمل على محو أمية الكمبيوتر والمعلوماتية.

ماهي أهم العوامل الإقتصادية التي تسهم لنجاح تنفيذ نظام حكومة إلكترونية قوي في اليمن؟

( ) < ( ) الأهمية النسبية: ( )

الدخل الفردي	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	الحافز
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(1) أهمية متساوية، (3) أهمية أكبر نسبياً، (5) أهمية أكبر، (7) أهمية أكبر بكثير، (9) أهمية قصوى مطلقة.

الدخل الفردي: على الحكومة أن تستهدف دعم ذوي الدخل المحدود الذين لا يستطيعون تحمل تكاليف الحصول على أجهزة كمبيوتر استخدام الإنترنت.

الحافز: لتشجيع المواطنين على استخدام الخدمات الحكومية الإلكترونية، مثلاً خدمات حكومية مجانية إذا تم الحصول عليه من موقع بوابة الحكومة.



### ثالثاً: 1. إستبيان عن إستخدام بوابة الحكومة الإلكترونية اليمنية

أين تستخدم الإنترنت عند تصفحك لموقع بوابة الحكومة أو مواقع حكومية أخرى؟ (يمكن الاختيار المتعدد)

1. ☐ في المنزل ☐ في المكتب (العمل) ☐ في مقهى إنترنت ☐ أخرى، حدد .....

كم الوقت الذي تقضيه لتصفح الموقع في الإستخدام الواحد؟

2. ☐ أقل من 10 دقائق ☐ نصف ساعه ☐ ساعة واحدة ☐ أكثر من ساعة واحدة

هل وجدت موقع بوابة الحكومة لايعمل؟

3. ☐ أبداً ☐ أحياناً (مرتين أو 3 مرات) ☐ عدة مرات (أكثر من ثلاث مرات) ☐ أخرى، حدد .....

4. سبب إستخدامك لمواقع بوابة الحكومة اليمنية على شبكة الإنترنت هو: (الرجاء تحديد كل ماتستخدمه/ أو تنوي لإستخدامه)

☐ الخدمات الحكومية ☐ بيانات عن الجهات الحكومية ☐ أخبار الحكومة ☐ الإيميل الحكومي (الرسمي)

☐ للتجارة الإلكترونية ☐ لتسديد الفواتير (كهرباء، ماء، هاتف) ☐ للتعليم ☐ أخرى، إذكرها .....

من مفهومك الشخصي، هل تعتقد بأن مشاريع الحومة الإلكترونية في الجمهورية اليمنية ستكون ناجحه؟

5. ☐ نعم ستكون ناجحه ☐ لا ستكون فاشله ، حدد لماذا؟ .....

6. إذا تعتقد بأن هناك عوامل أخرى دون المذكورة في الإستبيان يجب أخذها بعين الإعتبار، الرجاء ذكرها:

### ثالثاً: 2. إستبيان عن البيانات الديموقرافية (الشخصيه): (الرجاء وضع علامة صح في المربع الصحيح او المناسب)

1. الجنس؟

☐ ذكر ☐ أنثى

2. العمر؟

☐ 18-25 عام ☐ 26-40 عام ☐ 41-60 عام ☐ أكبر من 60 عام

3. المستوى التعليمي:

☐ دكتوراه ☐ ماجستير ☐ بكالوريس ☐ ثانويه عامه ☐ أخرى، حدد .....

4. المهنة / المسمى الوظيفي:

☐ وكيل وزارة ☐ مدير عام ☐ مدير إداره ☐ أخصائي كمبيوتر ☐ أخرى، حدد .....

5. إذا كنت قد عملت أو تعمل في مجال الحكومة الإلكترونية، فماهي فترة عملك في ذلك المجال؟

☐ سنة واحدة ☐ 3 سنوات ☐ 5 سنوات ☐ 8 سنوات ☐ أخرى، حدد .....

شكراً لحسن تعاونكم.

## Appendix B- Survey Questionnaires

### B2. Questionnaire in English



Seoul National University  
College of Engineering  
Seoul, South Korea



Republic of Yemen  
Prime-Minister's Office  
General Secretary

#### Survey on E-government adoption in the Republic of Yemen

With cooperation with International IT Policy Program at Seoul National University in Seoul, South Korea, we have a research about the area of e-government adoption in Yemen. Therefore, we would like to know your opinions on e-government implementation in Yemen, as this e-government system will be provided by the Yemeni government to its employees and citizens.

As you may be aware that Yemen has its official government portal at its homepage ([www.yemen.gov.ye](http://www.yemen.gov.ye)) and has been providing some useful information through the website, there is a possibility of the extension of government services through the site, instead of citizens need to visit the government office to obtain any municipal service, they can get it online. By online, we mean services applied and delivered via the government sites using the Internet. Therefore, it is needed for a successful implementation of e-government.

We hope that you will be able to spare a little time to help by responding to this survey. Your views will represent the view about the benefits and success factors of implementing e-government system in Yemen.

All your response to this survey will be **highly confidential**.

If you have any comments, suggestions or questions about this survey, kindly contact the researcher at: +8210 57577548 or by email at [mahdiyemen80@temep.snu.ac.kr](mailto:mahdiyemen80@temep.snu.ac.kr).

This survey questionnaire has three parts.

**Part A:** contains rank-ordered choice questionnaire in which 4 choice sets are given. Each choice set has 4 packages comprising different alternatives of 7 attributes that mentioned in the top of each table for the e-government implementation in Yemen. Please rank your choice in order – 1 for the most preferred, 2 for less preferred than 1, 3 for less preferred than 1 and 2, similarly 4 for the least preferred. Before ranking the packages, please consider the attributes and their levels as explained in the beginning of part 2.

**Part B:** contains the pair-wise comparison questionnaire in which 4 levels are given. Each level has some criterias all will be provided in individual tables to rank the success factors that contribute to implement a robust e-government system in Yemen. Please start filling the Relative importance parenthesis according to your preference, then rank your choice in order: - 1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9: Absolutely Important. Before ranking, please refer to the descriptions of the levels and criterias as explained in the beginning of part 2.

**Part C:** consists of questions on e-government portal access and your general demographic information.

Thank you very much for your cooperation!

## Part A: Rank-ordered choice questionnaire

**Important Notice!:** Please spend a few minutes to understand the attributes and their levels with their descriptions in this box carefully before answering the questions in the following pages.

Attributes	Levels	Description
<b>Strategy</b> (Strategy Planning period)	10 years	Long term Strategy Planning; the government must have a clear Long term Strategic planning which is the road map to lead government organizations for the different stages of e-government implementation for <b>10 years</b> period.
	5 years	Midterm strategy planning; shows that the government has a clear strategy toward achievement of the e-government goals for implementation of <b>5 years</b> period.
	2 years	Short term Strategic planning; is a tool for organizing the present stages and producers to implement the e-government system. This short term planning is the road map for <b>2 years</b> .
<b>Legal Framework</b> “is a legal Information System on the level of national legislation within the country”.	Strong	Government’s regulation that support mandatory use of e-government system, this will ensure that the national e-government master plan should be implemented, monitored and regulated, thus this will result rich e-government system and services ensuring that citizens and organizations can claim e-government as a matter of fact.
	Weak	Government has roles and regulations for the e-government system but there is <b>no enforcement</b> to use the system and its services. Therefore government employees and citizens will not consider it as an essential.
<b>Government Electronic Admin office (GEA)</b> GEA enhances the e-government in policy making in general, and in practice, as a tool for coordinating various sections of the government.	Centralized	Centralized GEA is established in the Prime Minister’s office to operate, monitor and support e-government functions, reducing the variation and duplication in e-government systems. With centralized systems, the web portal, or a “one-stop-shop,” functions as a fully integrated, user-friendly system.
	Decentralized	Decentralized GEA is established in each government agency, allowing the individual agency more control over e-government administration and content. The decentralized GEA is also linked to and monitored by the central GEA.
<b>Portal Language</b>	Only Arabic	The portal of e-government websites should be only in Arabic language but there is no English (international) version, which will be a barrier in any international transactions.
	Arabic and English	The portal of e-government websites should be available in Arabic and English languages; so that there will not be any barriers for international and local transactions.
<b>Level of Privacy</b> Protecting the government’s information and user’s personal data from leakage by unauthorized access/hackers.	100%	At this level, no leakage of information is observed (for both the government and the user)
	98%	At this level, there is a rare chance of information leakage.
	95%	At this level, there is more chance (say 5 percent) of information leakage.
<b>Training</b> “Technical staff”	1month	Only one month training is required.
	3 months	Three months training is required.
<b>Cost</b> (Estimated Operational cost OPEX, No investment cost is involved)	20 million\$	This amount represents <b>0.5%</b> of the whole government budget which is 4 billion US dollars.
	30 million\$	This amount represents <b>0.75%</b> of the whole government budget which is 4 billion US dollars.
	40 million\$	This amount represents <b>1%</b> of the whole government budget which is 4 billion US dollars.
		These amounts means the estimated operational cost needed to be available annually for operational of the e-government system (i.e., maintenance and for administration of the portal, maintenance all the equipments and devices, communication and operational services, portal staff payments, and Technical support and consultancy, etc).

**“Please rank your choice in order – 1 for the most preferred, 2 for less preferred than 1, 3 for less preferred than 1 and 2, similarly 4 for the least**

#### Choice set-A

Attributes	Package A1	Package A2	Package A3	Package A4
Strategy	5 years	10 years	10 years	2 years
Legal framework	Weak	Weak	Strong	Weak
GEA	Decentralized	Decentralized	Centralized	Centralized
Portal Language	Arabic and English	Arabic only	Arabic only	Arabic only
Level of Privacy	100%	95%	98%	100%
Training	1 month	1 month	3 month	3 months
Cost (OPEX)	30 million USD	20 million USD	30 million USD	40 million USD
Your ranking	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

- Please tick the most preferred package in Choice Set –A

☐ A1

☐ A2

☐ A3

☐ A4

#### Choice set-B

Attributes	Package A1	Package A2	Package A3	Package A4
Strategy	10 years	2 years	10 years	5 years
Legal framework	Strong	Strong	Weak	Strong
GEA	Centralized	Decentralized	Decentralized	Centralized
Portal Language	Arabic and English	Arabic and English	Arabic and English	Arabic only
Level of Privacy	100%	100%	95%	95%
Training	1 month	1 month	3 months	1 month
Cost (OPEX)	20 million USD	20 million USD	20 million USD	40 million USD
Your ranking	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

- Please tick the most preferred package in Choice Set –B

☐ B1

☐ B2

☐ B3

☐ B4

### Choice set-C

Attributes	Package A1	Package A2	Package A3	Package A4
Strategy	10 years	10 years	5 years	2 years
Legal framework	Strong	Weak	Weak	Weak
GEA	Decentralized	Centralized	Centralized	Centralized
Portal Language	Arabic and English	Arabic and English	Arabic and English	Arabic only
Level of Privacy	98%	100%	98%	98%
Training	3 months	1 month	3 months	1 month
Cost (OPEX)	40 million USD	40 million USD	20 million USD	20 million USD
Your ranking	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

- Please tick the most preferred package in Choice Set –C

C1

C2

C3

C4

### Choice set-D

Attributes	Package A1	Package A2	Package A3	Package A4
Strategy	10 years	2 years	10 years	5 years
Legal framework	Strong	Strong	Weak	Strong
GEA	Centralized	Decentralized	Decentralized	Centralized
Portal Language	Arabic and English	Arabic and English	Arabic and English	Arabic only
Level of Privacy	100%	100%	95%	95%
Training	1 month	1 month	3 months	1 month
Cost (OPEX)	20 million USD	20 million USD	20 million USD	40 million USD
Your ranking	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

- Please tick the most preferred package in Choice Set –D

D1

D2

D3

D4

➤ Now Please mention the best opinion, according to your preference, from among the ones you have indicated as the most preferred in each choice set (A, B, C, or D)

## Part B- Pair-wise Comparison questionnaire

Please spend a few minutes to understand the criteria and their levels with their descriptions in this Table before answering the questions in the following pages.

<b>The Goal: Success Factors:</b> factors that contribute to the success implementation of a robust e-government system in Yemen					
<b>Governing</b> Governing factors influence people's decisions to adopt e-government initiatives and furthermore can assist or limit the public sector's effort to diffuse e-government initiatives.		<b>Organizational</b> Within the field of e-government, there is a great need to develop a more comprehensive body of knowledge on the structure of the many and varied organizations that constitute e-government.		<b>External</b> Factors that are not governmental, organizational, and not technological.	
<b>Administrative</b> Factors related to lack of appropriate business models, justification of costs, availability and allocation of skilled personnel leader and the need for structural reforms and clear vision.	<b>Legislative</b> Factors related to the existence of appropriate laws, regulations, directives that allow or facilitate the deployment of electronic government and services.	<b>Organizational Structure</b> Within the field of e-government, there is a great need to develop a more comprehensive body of knowledge on the structure of the many and varied organizations that constitute e-government.	<b>Technological</b> Associated with the availability of suitable tools, standards, and infrastructure to develop, deploy, and use electronic government systems and services which enables government agencies to participate in the adoption of e-government	<b>Citizen- Centric</b> In e-government, citizens are seen as parallel to customers. Therefore, Citizen Centric is crucial in any e-government implementation stage related to customer relationship management.	<b>Economic</b> The economic environment in which government organizations operate may affect the results of adopting the e-government system.
<b>Leadership</b> E-government implementation needs a leader who can put e-government onto the agenda, set it within a broader reform agenda, and who can make it happen.	<b>Detailed Policies</b> Processing of e-Government principles and functions requires a range of new rules, policies, laws, and freedom of information, data protection, computer crime, intellectual property rights and copyright issues.	<b>Collaboration</b> Collaboration between agencies at local, regional and national levels is one of the major elements for accomplishing e-government implementation stage.	<b>Adequate Technological infrastructure</b> Adequate technological infrastructure includes computerization system, telecom policies, ICT policies etc. ICT infrastructure is recognized to be one of the main challenges for e-Government implementation stage.	<b>Digital gap (Gender)</b> Developing countries did not achieve gender equality and empowerment. An example in the area of ICT, the typical Yemeni Internet users of males around 86% to 14 % of females.	<b>Incentive</b> A way to encourage the citizen to use e-government services. No service fee if it the service obtained online i.e., birth certificate,
<b>Top Management Support</b> In order to achieve a successful project implementation in public agencies it has to be endorsed by top management. Strong support from top management is strongly needed for the implementation stage.	<b>Legal Framework</b> The success of e-Government implementation and its services are highly dependent on government's role in ensuring a proper legal framework for their operation.	<b>Readiness</b> Readiness in e-government refers to communicating e-government initiatives to the appropriate stakeholders and providing the means for individuals to realize projected e-government benefits.	<b>Security</b> One of the important factors in e-government implementation is securing the government's information and user's personal data from threats, hackers, and from unauthorized access. Absence of them leads to the expectation of leaking the government's or user's information.	<b>Trust</b> Many citizens distrust the government, especially where there has been a history of political instability and large-scale corruption. To ensure that the public and stakeholders will be partners in the e-government effort, it is important for the government to try to build Trust Bridge to the citizens.	<b>Personal Income</b> Even though the pricing of e-government services is affordable easily for the people with high income. Government should consider and target the low income people who cannot afford to own computers or using Internet which are the vital requirement for E-government access.
<b>Strategy</b> Clear and tailored Strategy aims to road map the different stages of the e-government system implementation.			<b>Training</b> Technical skills are required for installation, maintenance, designing and, for using and managing online processes, functions and users.	<b>Education</b> Education of citizens, especially in information and computing technology, is proposed as the most important factor affecting e-Government adoption in Yemen.	

The following an example of the wanted answer which is highlighted with a color or you can just underline the numbers:

**Example: What is the more important success factors that contribute to the success implementation of a robust e-government in Yemen?**

Relative Importance: (Digital gap (Gender)) > (Education) > (Trust)

Digital gap (Gender)	9	8	<u>7</u>	6	5	<u>4</u>	3	2	<u>1</u>	2	3	4	5	6	7	8	9	Trust
Digital gap (Gender)	9	8	7	6	<u>5</u>	4	<u>3</u>	2	<u>1</u>	2	3	4	5	6	7	8	9	Education
Trust	9	8	7	6	5	4	3	2	<u>1</u>	2	<u>3</u>	4	5	6	7	8	9	Education

( ) To be filled before Ranking the Numbers.

1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9: Absolutely Important

### Level 1 Pair-wise Comparison

**What is the more important success factors that contribute to the success implementation of a robust e-Government in Yemen?**

Relative Importance: ( ) > ( ) > ( )

Governing	9	8	7	6	5	4	3	2	<u>1</u>	2	3	4	5	6	7	8	9	Organizational
Governing	9	8	7	6	5	4	3	2	<u>1</u>	2	3	4	5	6	7	8	9	External
Organizational	9	8	7	6	5	4	3	2	<u>1</u>	2	3	4	5	6	7	8	9	External

1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9: Absolutely Important

Governing: Administrative and legal factors

Organizational: Readiness and Technical staff

External: Citizen centric and Economic factors

### Level 2 Pair-wise Comparison

**What is the more important "Governing factors" that contribute to the success implementation of a robust e-government in Yemen?**

Relative Importance: ( ) > ( )

Administrative	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Legislative
----------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	-------------

1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9: Absolutely Important

Administrative: appropriate business models, justification of costs

Legislative: appropriate laws, regulations

**What is the more important "Organizational factors" that contribute to the success implementation of a robust e-Government in Yemen?**

Relative Importance: ( ) > ( )

Organizational Structure	9	8	7	6	5	4	3	2	<b>1</b>	2	3	4	5	6	7	8	9	Technological
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1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9: Absolutely Important

Organizational Structure: Change to accommodate new e-government system

### Technological: Good ICT Infrastructure

**What is the more important "External factors" that contribute to the success implementation of a robust e-Government in Yemen?**

Relative Importance: ( ) > ( )

Citizen Centric	9	8	7	6	5	4	3	2	<b>1</b>	2	3	4	5	6	7	8	9	Economic
-----------------	---	---	---	---	---	---	---	---	----------	---	---	---	---	---	---	---	---	----------

1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9: Absolutely Important

Citizen Centric: Gender digital gap, Trust, Education

Economic: Government should make incentives to use e-government, and improve the personnel income.



### Level 3 Pair-wise Comparison

#### What is the more important "Administrative factors" that contribute to the success implementation of a robust e-Government in Yemen?

Relative Importance: (                      ) > (                      ) > (                      )

Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Top Management Support
Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Strategy
Top Management Support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Strategy

1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9:

Absolutely Important

Leadership: strong leader who can put e-government onto the agenda

Top Management Support: clear responsibilities, consideration of risk, good monitoring and control

Strategy: clear strategy to road map the different stages of e-government.

#### What is the more important "Legislative factors" that contribute to the success implementation of a robust e-Government in Yemen?

Relative Importance: (                      ) > (                      )

Detailed Policies	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Legal Framework
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1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9:

Absolutely Important

Detailed Policies: Range of new rules, policies, laws and legislative changes.

Legal Framework: legal recognition of electronic interactions.

#### What is the more important "Organizational Structure factors" that contribute to the success implementation of a robust e-government in Yemen?

Relative Importance: (                      ) > (                      )

Collaboration	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Readiness
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1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9:

Absolutely Important

Collaboration: cooperation among government agencies

Readiness: communicating e-government initiatives

**What is the more important "Technological factors" that contribute to the success implementation of a robust e-Government in Yemen?**

Relative Importance: ( ) > ( ) > ( )

Adequate Technological Infrastructure	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Security
Adequate Technological Infrastructure	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Training (Tech. Stuff)
Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Training (Tech. Stuff)

1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9:

Absolutely Important

Adequate Technological Infrastructure: computerization system, telecom policies, ICT Infrastructure.

Security: expectation of leaking the government's or user's information.

Training (Technical Stuff): ICT skills and training in the public sector.

**What is the more important "Citizen Centric factors" that contribute to the success implementation of a robust e-government in Yemen?**

Relative Importance: ( ) > ( ) > ( )

Digital Gap (Gender)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Trust
Digital Gap (Gender)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Education
Trust	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Education

1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9:

Absolutely Important

Digital Gap (Gender): gender equality and empowerment.

Trust: Citizens trust the government.

Education: ICT training and diffusion among citizens and employees.

**What is the more important "Economic factors" that contribute to the success implementation of a robust e-government in Yemen?**

Relative Importance: ( ) > ( )

Incentive	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Personal Income
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1: Equal, 3: Slightly more Important, 5: More Important, 7: Much More Important, 9:

Absolutely Important

Incentive: A way to encourage the citizen and employees to use e-government system and services.

Personal Income: Low Gross Product (GDP) per capita

### Part C-1 E-government portal access

1. Where do you access the Yemen e-government portal? (Choose more than one option if applicable).  
☐ At home      ☐ at office      ☐ at Internet café      ☐ others, specify.....
2. How long do you browse the Yemen e-government portal at one access?  
☐ Less than 10 minutes      ☐ half an hour      ☐ one hour      ☐ > one hour
3. How often do you find the government portal not opening?  
☐ Never      ☐ Sometimes (one or two times)      ☐ Many times (> 3 times)
4. What do you **mainly** use e-government portal sites for? (please tick as many as you use/would use it for):  
☐ Official E-mail      ☐ Government News      ☐ Governmental information  
☐ Government (public) services      ☐ Education  
☐ Product/service information      ☐ E-business      ☐ Others (specify).....
5. In your opinion, do you think the e-government in Yemen is going to be successful?  
☐ Yes      ☐ No  
If “NO”,  
Why? .....  
.....  
.....  
.....
6. If you feel there are other factors, which were not used in this survey and are pertinent to Yemen’s case, please feel free to list them and indicate why they are relevant?  
.....  
.....  
.....

**Part: C-2 (Respondent Demographic and background information)**

(Please check (√) for the correct answer.)

1. What is your gender?

☐ Male ☐ Female

2. How old are you?

☐ 18-25 ☐ 26-40 ☐ 41-60 ☐ > 60

3. What education level do you have?

☐ Literate ☐ High school ☐ Diploma

☐ Bachelor ☐ Master ☐ Doctorate

4. What is your Profession?

☐ General Manager ☐ Admin. Manager ☐ Department Manager

☐ IT specialist ☐ other, specify: .....

5. How many years have you been working in e-government sector?

☐ One year ☐ Three years ☐ Five years ☐ Eight years

☐ Other, Specify: .....

**Thank you very much for your time, patience and contribution!**

## Appendix C

### C1.The generated choice cards

Card	Strategy	Legal Frame	GEA	Portal Language	Privacy	Training	Cost (OPEX)
1	5 years	Weak	Decentralized	Ar & En	100%	1 month	30 m USD
2	10 years	Weak	Decentralized	Arabic	95%	1 month	20 m USD
3	10 years	Strong	Centralized	Arabic	98%	3 months	30 m USD
4	2 years	Weak	Centralized	Arabic	100%	3 months	40 m USD
5	10 years	Strong	Centralized	Ar & En	100%	1 month	20 m USD
6	2 years	Strong	Decentralized	Ar & En	100%	1 month	20 m USD
7	10 years	Weak	Decentralized	Ar & En	95%	3 months	20 m USD
8	5 years	Strong	Centralized	Arabic	95%	1 month	40 m USD
9	10 years	Strong	Decentralized	Ar & En	98%	3 months	40 m USD
10	10 years	Weak	Centralized	Ar & En	100%	1 month	40 m USD
11	5 years	Weak	Centralized	Ar & En	98%	3 months	20 m USD
12	2 years	Weak	Centralized	Arabic	98%	1 month	20 m USD
13	5 years	Strong	Decentralized	Arabic	100%	3 months	20 m USD
14	10 years	Weak	Centralized	Arabic	100%	3 months	30 m USD
15	10 years	Strong	Decentralized	Arabic	100%	1 months	20 m USD
16	2 years	Strong	Centralized	Ar & En	95%	3 months	30 m USD

Note: /Ar= Arabic Language, En= English Language/ m USD= Millions United States Dollars.

## C2. AHP Inconsistency of each respondent (Total 65 respondents)

S/N	Group 1: Gov. Employees		Group 2: e.Gov. team & Tech. Staff		Group 3: Gov. Top Mgt. & Decision Makers	
	Respondent no.	Inconsistency	Respondent no.	Inconsistency	Respondent no.	Inconsistency
1	P5	0.18	P2	0.07	P3	0.09
2	P6	0.00	P3	0.09	P5	0.17
3	P7	0.13	P4	0.10	P6	0.14
4	P8	0.17	P5	0.04	P7	0.19
5	P9	0.08	P6	0.16	P8	0.19
6	P10	0.17	P7	0.16	P12	0.08
7	P11	0.11	P9	0.17	P13	0.16
8	P12	0.17	P10	0.10	P14	0.18
9	P13	0.10	P11	0.14	P15	0.17
10	P14	0.18	P12	0.07	P16	0.19
11	P16	0.06	P13	0.19	P18	0.08
12	P17	0.11	P14	0.17	P19	0.16
13	P18	0.06	P15	0.12	P20	0.13
14	P19	0.19	P16	0.07	P22	0.18
15	P20	0.11	P17	0.12	P24	0.19
16	P21	0.08	P18	0.15	P25	0.16
17	P22	0.19	P19	0.19	P26	0.12
18	P23	0.14	P20	0.05	P27	0.14
19	P24	0.18	P21	0.19		
20	P25	0.08	P22	0.08		
21	P26	0.02	P25	0.15		
22	P27	0.17	P26	0.12		
23	P28	0.11	P27	0.07		
24			P28	0.00		

**C3. Overall Relative Importance w. r. t. Goal: the priority of each criteria**

	<b>Level 1 Criteria</b>	
	Governing	55.5%
	Organizational	27.5%
	External	16.9%
<b>Category</b>	<b>Level 2 Criteria</b>	
Governing Factors	Legislative	32.8%
	Administrative	22.7%
Organizational Factors	Technological	18.2%
	Organizational Structure	10%
External Factors	Economic	9.4%
	Citizen-Centric	6.9%
	<b>Level 3 Criteria</b>	
Governing Factor	Legal framework	24.2%
Governing Factor	Leadership	11.0%
Organizational Factor	Adequate Tech. Infrastructure	9.3%
Governing Factor	Detailed Policies	9.2%
Governing Factor	Strategy	6.8%
Governing Factor	Readiness	6.3%
Organizational Factor	Personal Income	5.7%
External Factor	Top Mgt. Support	5.3%
Organizational Factor	Training	4.5%
Organizational Factor	Education	4.2%
External Factor	Incentive	4.2%
External Factor	Security	3.8%
Organizational Factor	Collaboration	2.7%
External Factor	Trust	1.5%
External Factor	Digital Gap (Gender)	1.0%

## **C4. Details of the Qualitative Findings**

### **❖ Telephone Interviews Details:**

#### **➤ Interviewees:**

##### **1. General Manager of IT Planning- Prime Minister Office**

Eng. Shehab Alshaderi

##### **2. E-government Team Leader- Prime Minister Office**

Eng. Eyhab Albana

##### **3. IT Planning and Studies- Ministry of Telecomm and IT**

Eng. Ali Yahya Honaina



## Abstract in Korean

### 전자정부 도입에 대한 정책입안자 선호도의 실증적 분석

- 이산선택모형과 계층화분석법을 이용하여 -

#### 요약

지난 수 년 동안 인터넷 및 네트워크 기술 영역은 크게 확장되어 각 선진국 및 개발도상국의 관심을 끌고 있다. 특히 개발도상국들의 정부 조직은 기술적 진보로 인해 세계가 급속도로 변화하고 있다는 점을 깨닫게 되었다. 이러한 인식은 개발도상국들에게 그들의 조직 개편에 있어 신기술 활성화 추구하고 강력한 비전을 끌어내고 있다. 그러므로 정부는 정보 경제 및 사회경제적 이익 촉진을 위한 국가 전략과 정책 개발 및 수립이 필요하다. 이를 통해 그들은 더욱 효율적인 조직 운영 방식 개혁, 생산성 및 투명성 제고를 이룰 수 있다. 이 점에서 전자정부 체계의 도입은 그러한 목표를 달성하는 데 필수적이다.

정부 부처간 혁신 과정은 여전히 수많은 개발도상국 정부들에 있어 커다란 난관이다. 예멘은 새로운 전자 정부 체계를 공공 기관 전반에 걸쳐 도입하고자 노력하고 있는 제 3세계 국가이다. 그러나 타 개발도상국들의 예에서 확인할 수 있듯이, 예멘 역시 몇 가지 이유로 인해 수많은 실패를 겪어야만 했다. 그 중 가장 커다란 장애 요인은 바로 정부 부처에서 일하는 직원들의 심한 반발이었다. 이러한 점에서 볼 때, 본 연구의 목표는 전자 정부 체계의 도입에 대한 다양한 정부 직원(일반 근로자, 기술직, 정책 입안자) 계층별 선호도 및 견해를 조사하는 데 있다고 할 수 있다. 예멘에 대한 특정 실증적 분석을 바탕으로 한 전자

정부 도입 촉진이라는 측면에서, 관련 정책 권고안들은 이 점에 주안을 두고 도출하였다.

지금까지 본 연구 분야에 관한 한, 현재까지 실험적 단계나 그 어떠한 종류의 연구 활동도 이루어진 바가 없다. 그런 점에 착안한 본 연구는 개발도상국들의 전자 정부에 관한 연구에 관심을 가진 정부와 정책 전문 결정권자들에게 유용한 통찰력을 제공해 줄 것이다. 본 연구는 정량적 방법과 정성적 방법을 모두 이용하고 두 가지 분석법들을 적용함으로써 그 목표를 달성할 것이다.

첫 번째 방식은 컨조인트 분석(CA: Conjoint Analysis)과 함께 이산 선택 모형(DCM) 및 임의 효용 이론(RUT: Random Utility Theory)에 기반한 순위정렬 혼합로짓모형을 이용한 분석이다. 16가지의 대안들에 대한 선택은, 전자 정부 도입 및 추진에 관계된 팀 구성원들 및 정책 입안자들을 포함한 전체 정부 직원들 중에서 표본을 선정하여 실시한 공식적 설문 조사를 통해 전자 정부 도입 및 추진에 대한 선호도 및 효용성 변화를 나타내는 데 이용되었다. 두 번째 방법론은 다기준 의사 결정론(MCDM: Multi-Criteria Decision Method)을 기초로 하는 계층화 분석법(AHP: Analytical Hierarchy Process)이며, 이는 예멘에서 안정적인 전자 정부 추진의 성공 요인들의 순위를 매기는 데 대한 정부 관료들의 견해를 살펴보는 데 활용했다.

또한, 정책 설정을 위해 본 연구는 임의 계수를 가정하여 이질성 요소를 혼합로짓 모형에 포함시켰으며, 식별된 전자 정부 속성과 인구 통계학 및 응답자 특성 사이의 상호작용 역시 모형에 고려하였다.

컨조인트 분석 연구에 관련된 속성들은 전자 정부 계획 기간, 법적 틀, 정부 전자 관리국(GEA), 포털 사이트의 사용 언어, 보안성의 대체 속성으로서 사생활 보호, 교육, 그리고 전자 정부 체계 운영에 소요되는 연간 예산으로서의 운영

비용 등의 요소로 이루어진다. 이와 더불어 계층화 분석을 위해 시험을 거친 요인들에는 지배적 요인(행정적 및 법적 요소를 포함), 조직적 요인(조직 구조 및 기술적 요인을 포함), 그리고 외부적 요인(시민 중심적 및 경제적 요인을 포함) 등이 있다.

컨조인트 분석 연구 결과에 의하면, 정부의 사생활 보호 및 개인 정보 정책은 명백히 선호도 구조에 가장 큰 영향을 미치고 있는 것으로 드러났으며, 두 번째로 전자 정부 추진에 관한 강력한 법적 틀이 뒤따랐다. 그러나, 정책 입안자들이 현장에서 경험하는 비용 민감도에 대한 증거도 나타났다. 전자 정부 정책 관철을 위해 정부 관료들은 이러한 이슈를 전자적 책임 정책들을 통해 드러내어야 한다. 덧붙여, 응답자들은 전자 정부 체계에 관한 한, 세분화된 추진 단계를 개괄한 투명성과 짜임새를 갖춘 장기 정책의 추진을 원하는 것으로 나타났다.

게다가 AHP 분석 결과를 통해 응답자들은 지배적 요인들, 이를테면 법적 틀, 리더십, 그리고 적절한 기술적 제반 환경 등의 요인들이 상대적으로 높은 중요성을 띄고 있다고 판단하였으며, 그 중에서도 법적 틀이라는 점에 최우선 순위를 부여하고 있는 것으로 드러났다. 이러한 결과는 컨조인트 분석 측정에서 얻은 결과를 재확인 시켜준다. 현 정부 부처 내에서 전자 정부 추진 및 도입 의제를 현실화 시킬 수 있는 전자 정부의 리더십이 두 번째의 우선 순위를 차지하였다.

본 연구 결과를 통해 밝혀낸 사실들은 예멘의 전자 정부 정책 추진을 촉진하는 정책을 입안하는 데 필요한 본질적인 결과들이며, 여기에는 그러한 체계를 현 정부 기관들에 도입하고, 사용자 접근을 보장하는 환경을 조성하고 현실화시키며, 신뢰성 있고 빠른 온라인 서비스를 시민들에게 제공함으로써 전자 정부의 의지를 강화시킨다는 과제도 포함된다.

CA 및 AHP 작업을 통한 정량적 결과를 바탕으로, 본 연구는 정량적 연구 방식을, 예멘 정부 내의 정책 입안자들을 인터뷰함으로써 얻어진 실증적 결과를 보완하는 데 적용하였다. 그 다음으로 격차 분석(Gap Analysis)을 수행하고, 예멘에서의 연구 인식 및 현실성 간의 불일치 원인을 규명하기 위해 각 정책들에 대해 우선 순위를 설정하는 작업을 실시했다.

궁극적으로 본 연구를 통해 개발도상국 정부 관료들에 의한 전자 정부 도입에 대한 공급 중심의 분석의 필요성을 보증하여, 결과적으로 전자 정부 도입 사례의 증가 및 이러한 정부의 전자 체계화 이행에 따른 저항감을 상쇄시켜줄 것을 기대하는 바이다.

핵심어: AHP, 컨조인트 분석(conjoint analysis), 이산 선택 모형(discrete choice method), 예멘의 전자 정부 도입, 혼합 로짓, 진술 선호, 지불 용의.

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