Development and validation of a framework for e-government readiness measurement

by

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DECLARATION

I, Seena Joseph declare that this dissertation is a representation of my own work both in conception and execution. This work has not been submitted in any form for another degree at any university or institution of higher learning. All information cited from published or unpublished works have been acknowledged.

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Approved for final submission

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ABSTRACT

This study reports on the design of a framework for measuring e-government readiness. Particular attention is paid to providing a measurement framework that is feasible for municipalities and supports their efforts to utilize e-government for the benefit of the society and the economy. The evaluation of e-government readiness for municipalities can provide a useful barometer to measure the critical needs of citizens. In addition, it can be useful for improving the effectiveness of government services and could assist information communication technology industry to access information for implementing efficient infrastructures to support the delivery of e-services. The model of e-government readiness measurement as reported in this dissertation is based on heterogeneous factors of supporting e-services, individual citizens, technological infrastructure, government and supporting industry. The readiness measurement process utilized data obtained from a survey of 219 government employees from 4 municipalities in Eastern Cape Province of South Africa. The partial least square method was used to determine the relationship between the measured factors. The study results revealed the measurement factors to be significant determinants of municipality e-government readiness with an overall goodness of fit performance of 0.81 and predictive power of 0.68.

In addition, a response based segmentation approach of finite mixture partial least squares is applied to uncover unobserved heterogeneity in government employees. The study findings show that the main difference characterising the two uncovered segments of population heterogeneity lies in the internet accessibility using computers. The impact of government readiness and technology readiness on predicting e-government readiness is stronger for the first segment than for the second segment. The segment specific analysis clearly shows that the impact of factors that influence the readiness of e-government can differ vastly, depending on the background of participants. The study findings generally provide a foundation for policymakers and technology practitioners who are interested in propagating e-government readiness awareness across the country. In addition, factors that determine the e-government readiness could provide new insights for future studies on e-municipality service improvement evaluations.

Chapter 1: Introduction

The task of reinventing government has been a primary theme since the 1990s, with governments all over the world trying to improve the systems of public service delivery. The accelerated growth of Information Communication Technology (ICT) systems have assisted the reinvention of governments and equipped them to provide the requirements of a diverse society (Heeks, 2006). The revolution of ICT has changed the way in which governments around the world interact with their citizens, business, government agencies and employees. Government services can be managed and offered through a variety of different forms of ICT platforms and applications. In other words, the information age has redefined the basic principles and changed the institutions and the mechanisms of service delivery forever (Heeks, 2002). The phenomenon of electronic government (henceforth called e-government) is derived from the desire for efficient service delivery. The perception of e-government can be described as an interactive system of communication and synchronization between government and its people, its business units and other governmental entities through ICT platforms and applications. E-government is predicated on providing the potentials of ICT to supply improved government services to citizens, businesses, suppliers and public organisations (Sayin and Okurson, 2013). These services are delivered at, municipal, provincial and national levels. Beyond service delivery, e-government offers additional channels of communication amongst governments, businesses and citizens separately or collectively (Grant and Chau, 2005).

Since the late 1990s, all levels of government around the world have been developing e-government systems (Torres *et al.*, 2005). Public service delivery occurs at all levels of government, but citizen-oriented services are mainly supplied by municipalities (Bernhard, 2014). Municipalities are the vital entities in local government and are the closest governmental structure to the citizens. The majority of e-government services are progressively executed at the municipal level rather than national. The introduction of electronic systems in administrative and organisational aspects of municipal work is imperative for the effective and efficient service delivery (Sayin and Okurson, 2013). Due to the inherent complexity of governance, be it at municipality or at national levels, initiatives

often need to be collaborative in nature. E-government is able to bring together diverse units of government, the private sector, non-government organisation and citizens as key stakeholders (Potnis, 2010). Due to lack of personnel, technical and organisational capacities, many municipalities in South Africa are unable to make a full commitment to develop a set of comprehensive strategies and plans to attain an advanced level of e-government.

A more realistic e-government strategy that supports public administration reform and sustainable national development requires a comprehensive analysis of conditions, opportunities and perils of the existing environment. This analysis is generally achieved through a focused evaluation of e-government readiness (Ojo *et al.,* 2005). E-government readiness comprises all prerequisites necessary to implement e-government (Kachwamba and Hussein, 2009). E-government readiness measurement is a foundation for implementing effective e-government plans that supply significant knowledge and information sources for policy and decision making (Rorissa *et al.,* 2011; Dzhusupova *et al.,* 2010).

In order to improve the efficiency of e-government practices, municipalities need to move towards an advanced level of e-government development requiring a measurement of available resources for this purpose (Löfstedt, 2007). E-government readiness measurement can help a municipality to measure its strengths and weaknesses in terms of implementing e-government policy. The knowledge arising from this exercise regarding the local context, the existing environment, opportunities and challenges for a given municipality can enable it to develop a more realistic e-government strategy (Dzhusupova *et al.,* 2010). In short, it is of great importance to establish a useful and a feasible framework for readiness measurement of e-government.

E-government research has increasingly attracted attention at national or international government level, but there is relatively little systematic research undertaken at the municipal level (Deakin *et al.,* 2010). Although a number of e-government readiness measurement tools and methods exist with various indicators, most studies indicate they are generally used for benchmarking countries and heavily focus on electronic service delivery through the internet and on national indicators of ICT development (Ojo *et al.,* 2005). Some studies take a simplistic view of government websites and services and draw sweeping conclusions about their performance (Yuan *et al.,* 2012; Jansen *et al.,* 2010).

Measurement at the municipal level of governance and complete inclusion of heterogeneous factors into measurement that determine e-government readiness are omitted in the majority of existing studies. Moreover, existing e-government readiness framework studies rarely report on the effect and treatment of heterogeneity caused by unobserved or latent factors, despite a number of studies reporting on the application of structural equation modelling (SEM) in technology based e-government readiness measurement frameworks. The aim of this study is to fill this gap in the literature by providing a general framework for e-government readiness evaluation for municipalities. This dissertation therefore, reports on the development of framework to measure e-government readiness and validated for the case of municipal government.

In order to develop and validate an e-government readiness measurement framework for this study, a series of steps were taken. The first step of the methodology was the systematic review and scoping of the relevant literature to identify the critical factors affecting the readiness of e-government. In the second step, an e-government readiness framework was developed through encompassing all the identified factors that were validated using data collected from government employees. This study then executed a partial least squares (PLS) algorithm to verify the viability of the suggested framework in terms of the identified factors (individual citizen readiness, supporting e-services, technology infrastructure, supporting industry readiness, and government readiness). Finally, a finite mixture partial least squares (FIMIX-PLS) algorithm was used to address the problem of unobserved heterogeneity in government employees when measuring e-government readiness.

1.1 Research Problem

E-government readiness measurement is an important stage in developing efficient e-government strategies that provide vital information source for facilitating optimal resource allocation (Dzhusupova *et al.*, 2010). The majority of e-government studies to-date has focused on central government initiatives and national benchmarking with relatively little systematic research having been carried out at the municipal level, even though this is often the main point of contact for the service delivery and national programmes (Deakins *et al.*,

2010). E-government developments in most municipalities are still principally non-interactive and non-deliberative (Torres *et al.,* 2005).

Successful implementation of e-government demands a common measure to measure the preparedness of government towards making the transformation to e-government (Ayanso *et al.,* 2011). This transformation comprises a set of technology mediated processes that improve both the delivery of public services and the broader interactions between citizens, businesses and governments (Torres *et al.,* 2005). Thus, e-government readiness measurement needs to measure available electronic services, citizen readiness, infrastructure readiness, private sector development and business processes (Ahmed and Hussein, 2006). However, existing studies on e-government readiness frameworks do not adequately focus on all prerequisites for e-government readiness, focussing rather on specific homogeneous factors such as cultural factors (Sabri *et al.,* 2012; Khalil, 2011), web services (Yuan *et al.,* 2012) and government e-services (Koh *et al.,* 2008). These frameworks are not directly focusing on all factors that are affecting the holistic transformation of a government organisation as a result of ICT adoption (Azab *et al.,* 2009).

Moreover, e-government is not a simple online information provisioning (Tavana *et al.,* 2013). Therefore e-government readiness frameworks with homogeneous factors only are inappropriate to effectively measure the state of e-government more adequately. It is also worth noting that e-government readiness measurement models developed by international and corporate organisation such as the United Nations Department of Economics and Social Affairs (UNDESA), Brown University and Accenture are suitable for national benchmarking and certain studies are conceptual models, but without the support of empirical tests (Sabri *et al.,* 2012; Alghamdi *et al.,* 2011).

The e-government readiness measurement at the municipal level of governance, complete inclusion of heterogeneous factors and diversity in structural techniques used are not incorporated in the majority of existing studies. Very few existing e-government readiness framework studies report on the effect and treatment of heterogeneity caused by unobserved or latent factors, even though a number of studies have reported on the application of structural equation modeling (SEM) in technology based e-government readiness measurement frameworks (Yunis and Sun, 2009; Grigorovici *et al.,* 2004). The concept of heterogeneity in this study refers to two aspects, factor heterogeneity and population

heterogeneity. The set of heterogeneous factors yields a non uniform structural measurement model, but in a heterogeneous population, data come from several a priori identified groups of respondents who differ in their factor structure (Ansari *et al*., 2002). The treatment of heterogeneity is crucial in structural equation modelling, for instance Ansari *et al*. (2002) found that ignoring the treatment of heterogeneity can guide to sign reversals of factor covariances, inflation of factor variances and under appreciation of uncertainty in parameter estimates. In their study, they use a Bayesian approach to account for factor heterogeneity, but a confirmatory factor analysis (such as partial least squares, PLS) is widely used by researchers to model structural relationships between heterogeneous factors. The use of factor mixture (such as Finite Mixture partial least squares, FIMIX-PLS) models have been investigated by researchers to treat population heterogeneity. The factor mixture models are a combination of latent class and common factor models to explore unobserved population heterogeneity (Lubke and Muthén 2005).

A comprehensive review of the literature has led the researcher to raise the following research questions that were investigated in this study:

1. What heterogeneous factors can be used to measure the readiness status of e-government?
2. Which conceptual framework includes heterogeneous factors in measuring e-government readiness status at municipal level?
3. Is there any heterogeneity in user perception of e-government readiness and if there is, which factors best characterise the different segments of government employees perception of e-government readiness?

1.2 Research aim and objectives

The preparedness of government, especially at lower levels, such as a municipal to make the transformation to e-government is affected by a set of divergent factors (Ayanso *et al.* 2011; Ahmed and Hussein, 2006). The principal aim of this research study is to develop and validate a framework for e-government readiness measurement that includes heterogeneous factors. In order to accomplish this research aim, the following are the objectives of the study at hand:

1. To identify the specific heterogeneous factors having a significant effect on e-government readiness status.
2. To develop and validate a framework that includes heterogeneous factors for e-government readiness measurement at municipal level.
3. To uncover unobserved heterogeneity in government employees in validating a framework for e-government readiness measurement.

1.3 Overview of research methodology

The methodology of this study consisted of three consecutive phases leading to the achievement of the objectives of this research:

Phase 1 addressed Objective 1. This phase established the research background by means of a scoping review. The initial conceptual framework was developed according to the findings from the scoping review.

Phase 2 addressed Objective 2. In order to validate the developed framework, a survey was conducted in all three categories (metropolitan, district and local) of municipalities in Eastern Cape Province of South Africa. Data were collected through a survey of administrative municipality employees using convenience sampling. The data set generated from the survey was analysed using the structural equation modeling (SEM) technique of partial least squares (PLS) statistical analysis.

Phase 3 addressed Objective 3. Finite mixture partial least squares (FIMIX-PLS) was used to detect homogenous government employee segments. This in turn helped to uncover the heterogeneity in user perception of e-government readiness and to find factors that best characterise the different segments of government employees perception of e-government readiness.

1.4 Significance of the study

This study is of significance in the domain of e-government readiness as it extends the knowledge base that presently exists in this field. The concept of e-government is not about technology, but rather one of society, citizens, business and politics. It is an important theme for researchers, professionals, politicians, policy and decision makers. In previous e-government readiness studies, much of the research focused on the features of government

websites and online services (Yuan *et al.*, 2012; Zheng and Jiang, 2011; Jansen *et al.*, 2010). The researcher refers to such studies as focusing on homogeneous factors because the measurements are focused on a particular domain of technology such as government websites or online services. This study takes a holistic view by addressing the heterogeneous factors that can lead governments towards a successful readiness for the implementation of effective and efficient e-government systems. In this model, the focus is not on a particular technology, but on diverse aspects, such as people, technology, services, governments and industries.

The findings of this study provide a foundation for policymakers and practitioners interested in propagating e-government readiness awareness across the country. The analysis and findings of this research study are expected to provide valuable information and guidelines for decision makers at both the national and municipal government level, guiding them toward decisions that will enhance their environments and prepare municipalities for the process of change. In addition, factors that determine the e-government readiness could provide ideas for future studies on e-municipality service improvement evaluations.

1.5 Contribution of the study

The e-government readiness framework proposed in this study aims to measure e-government readiness at municipal level. This research attempts to add significantly to knowledge and practice of e-government, especially at the municipal level by shedding more light on various factors that have been identified in the literature as having an effect on e-government readiness. Specifically, the contributions of this study to the body of knowledge and to practice are enunciated as follows:

a. Systematic identification of the critical factors that can affect an e-government readiness at all levels of governments.
b. The development of a framework based on five heterogeneous factors (individual citizen readiness, government readiness, supporting industry readiness, technology readiness and supporting e-services) that affect the readiness of e-government.
c. The empirical effects of the establishment that these five factors can have an e-government readiness.

d. The empirical study of heterogeneity treatment in e-government readiness survey data generated from government employees.

The study proposes a framework for e-government readiness measurement that can help municipal governments in the decision making process for planning and implementing effective e-government. The empirical evaluation of the effect of suggested factors on the methodology and findings from this study can be easily generalised to provincial and national levels of governments. The factors impacting the readiness of e-government identified in this study can be used in targeting the readiness of provincial and national level of governments.

1.6 Dissertation outline

This study presents a detailed examination of the subject background, research methodology, data analysis, findings and discussion of the critical factors of e-government readiness measurement. The content of the chapters of the dissertation is summarized as follows.

Chapter 1: Introduction

An overview of the research with a clear statement of: the research problem, aim, objectives and research questions. The chapter highlights the significance of the research, contribution and structure of the study.

Chapter 2: Literature Review

The literature review discussed the overview of e-government in terms of concepts, definitions and perspectives. This chapter includes a comprehensive review of the existing literature and lays the theoretical foundation for the research objectives and the research model of this study. The literature reviewed in this chapter is an effort to understand the depth knowledge of current e-government readiness frameworks and the critical factor variables affecting the readiness of e-government.

Chapter 3: Research Methodology

The methodology adopted for the execution of the current research is presented in this chapter and includes a detailed account of all the steps carried out to achieve the objectives of this study. It discusses the survey method, the instrumentation employed in data collection and the partial least squares (PLS) analytic modeling technique used for data analysis. The FIMIX-PLS approach to evaluating PLS results by addressing the problem of unobserved heterogeneity is also discussed.

Chapter 4: Empirical Results

This chapter describes the survey study and statistical analysis of the data collected. The results of the data analysis using the PLS analytic modeling technique to validate the e-government readiness framework are discussed. The FIMIX-PLS results which capture the unobserved heterogeneity in PLS path modeling are also discussed.

Chapter 5: Summary, Recommendations and Conclusion

This chapter presents a summary of the entire study, including the developed framework and the identified critical factors as well as the contribution of the study to knowledge in research and practice. In addition, the chapter presents the limitations of the study and suggest possible recommendations for future research with potential for practical and academic development of the framework.

1.7 Summary

This chapter highlights the main points of the problem being addressed leading to the research questions. The aim and objectives capable of answering the research questions were presented. The research methodology used to attain these objectives was introduced with an explanation of the overall research process. This chapter also highlights the significance of this research. In the next chapter, a more-in-depth review of the current state of e-government, e-readiness and e-government readiness measurement frameworks will be undertaken to pinpoint their inadequacy in solving the research problem.

Chapter 2: Literature Review

This chapter intends to highlight the main theoretical concepts in the literature related to this topic, providing an insight into the research domain. It starts by introducing a clear view of e-government concepts and its key characteristics, including definitions, concepts and perspectives. In addition, the chapter discusses several measurement models of e-government readiness with a view to their suitability as frameworks for measuring e-government readiness. E-readiness measurement models are first investigated, followed by other tools developed specifically for measuring e-government readiness.

2.1 Overview of e-government

E-government is a channel for governments to use advanced technologies to provide citizen with convenient access to government information and services, to enhance the quality of services and to serve greater opportunities for participation in democratic institutions and processes (Löfstedt, 2007). There exist a variety of definitions and overviews of e-government. The following sections narrate the general overview of e-government.

2.1.1 Definition of e-government

World Bank (2011a) defined e-government as the use of ICT to enhance efficiency, effectiveness, transparency and accountability of government. E-government is a multidimensional and multidisciplinary field (Jaeger and Thompson, 2003). Due to the existence of different e-government implementation approaches, it is becoming increasingly difficult to set a common definition (Roy, 2003). There exist a number of different definitions of e-government in the literature, ranging from being too narrow and specific to being extremely general and broad, reflecting different meanings and definitions to different people.

Narrow e-government definitions focus only on using ICT, particularly the internet (Turban *et al.*, 2002) whereas broader definitions consider ICT as a means toward better government practices (OECD, 2003). E-government can also be viewed from different perspectives such as citizen, technical, political and governmental. Thus, it is more suitable to define e-government based on the different perspectives of its stakeholders. Table 2-1 lists some of the e-government definitions grouped according to different perspectives.

Table 2.1 E-government definitions

Perspective	Definition
Government	E-government refers to the use of ICT to enhance efficiency, effectiveness, transparency and accountability of government (World Bank, 2011a). E-government is the use of ICT in all aspects of the actions of a government organisation (Koh and Prybutok, 2003). E-government is the use of ICT to facilitate more efficient, cost effective and participatory government, which facilitates improved government services, allows better public access to information, and makes government more responsible to the citizens (Rahman, 2007).
Technical	E-government refers to the use of ICT such as Wide Area Networks, the internet and mobile computing by government agencies (World Bank, 2011b). E-government is the deployment of technology to facilitate access to and delivery of public services to employees, citizen and business partners (Yunis and Sun, 2009). E-government refers to the use of ICT, and particularly the internet, as a tool to attain an enhanced government (OECD, 2003).
Citizen	Delivery of government information and services to citizen through the internet 24 hours a day, seven days per week (Reddick, 2004).

While definitions of e-government by different perspective may vary widely, there is a common theme. The above mentioned definitions of e-government all incorporate the use of ICT, improved and efficient public services and government technologies. E-government involves using information technology, especially the internet, to improve the delivery of government services to citizens, businesses, and other government agencies. These definitions shed light on the fact that e-government is more than a web presence of government information, forms and public services, rather it is a catalyst that has the potential to facilitate change, simplify processes, and induce high levels of efficiency and effectiveness (Yunis and Sun, 2009).

2.1.2 E-government domains

E-government involves various activities and stakeholders and also serves different groups of people, sectors and organisation in a variety of domains. The distinct domains for e-government interactions are Government to Citizen (G2C), Government to Business (G2B), Government to Government (G2G) and Government to Employees (G2E) (Jie, 2009) as shown in Figure 2.1.

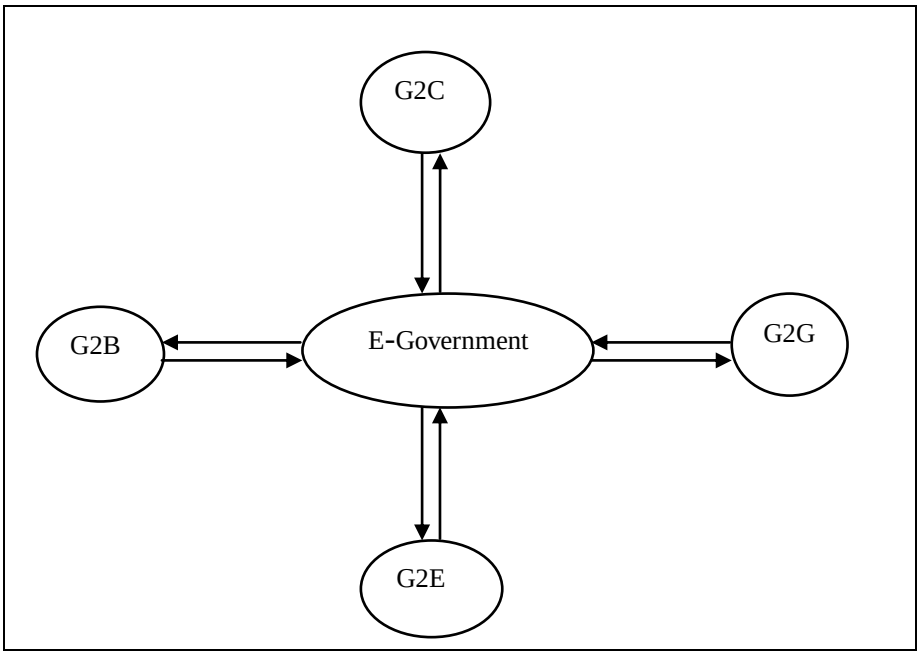

Figure 2.1 Domain of e-government interactions (Source: Jie, 2009)

The concept of G2C describes information distribution to the people and essential services such as license renewals, ordering of birth/death/marriage certificates and filing of income taxes, as well as people's support for such services include education, medical care and libraries (Jie, 2009). G2B creates an enabling environment to exchange services between government and the business entities, including distribution of policies, rules and regulations (Mutula and Mostert, 2010; Torres *et al.*, 2005). The services offered through G2B include transactions to assist the development of business, specifically in small and medium enterprises (SME). G2G interactions take place at the municipal or provincial level and at the international level (international relations and diplomacy) (Torres *et al.*, 2005). This involves the transactions between national and municipal governments, and between various departments and agencies. G2E includes G2C interactions as well as specialized

services that cover only government employees as a prerequisite for human resource training and development to improve the day-to-day services to citizens (Jie, 2009).

2.1.3 E-government objectives, benefits and challenges

2.1.3.1 Objectives of e-government

The goal of e-government is to make the government and its policies more efficient, providing citizens with fast and better access to public infrastructure and the ability to use services in a more personal and cost-effective approach (Heeks, 2006). E-government administration can also be modernised and simultaneously encourage economic policy agenda (OECD, 2003). E-government can diminish the distance between citizen and government and also strengthen democracy (Macintosh *et al.,* 2003).

2.1.3.2 Benefits of e-government

The benefits of using e-government have been addressed in literature, as can be seen in Table 2.2.

Table 2.2 E-government benefits

E-government benefit	**Source**
Support of good governance	Torres *et al.,* 2006.
Cost savings and efficiency gain	Sabri *et al.,* 2012; Jaeger *et al.,* 2010.
Enhanced delivery of services to businesses and customers	Sabri *et al.,* 2012; West, 2007.
Cost reduction in the transfer of information and online transactions	Dada, 2006.
Transparency, anti-corruption, accountability, increased capacity and improved network infrastructure of government, improved quality decision making	Sabri *et al.,* 2012; Jaeger *et al.,* 2010.

2.1.3.3 Challenges of e-government

However, the digitalisation of government services is paramount to all current governments and various resources are set aside for its implementation, which still faces considerable challenges as it proceeds to develop (Jaeger and Thompson, 2003). Furuholt and Wahid (2008) categorised these challenges into three groups: management, infrastructure and human factors as illustrated in Table 2.3.

Table 2.3 E-government challenges

Category	Challenges
Management	How to motivate and train the workforce are major challenges to the success of e-government initiatives. Therefore, the current legislators must ensure that the laws and regulations are simplified to recognise e-government services to enhance social values (Almarabeh and AbuAli, 2010).
Infrastructure	The implementation of e-government initiatives have struggled due to the lack of essential infrastructure to take benefit of new technologies and communication tools (Almarabeh and AbuAli, 2010).
Human factors	The awareness of citizen about e-government services is critical to the success of e-government initiatives. Human resources must be organised and managed with e-government goals in mind. (Almarabeh and AbuAli, 2010).

The management category deals with strategic issues, management change, political leadership, institutionalization and continuous observing and measurement of the projects. Infrastructure involves ICT infrastructure, legislation and financial resources. Human factors comprise competence and skills, training and trust.

Despite the benefits and some initial success, failure rates are quite high in the majority of e-government initiatives (Furuholt and Wahid, 2008). Knowledge about the current realities ("where it is now") is an important starting point for successful e-government initiatives because deciding where to go, one must first know where it is now. According to Kachwamba and Hussein (2009), "e-government readiness" comprises all prerequisites necessary to implement e-government. E-government readiness measurement evaluates how ready a country, a city or a particular government agency is to develop e-government and it predominantly measure the extent to which governments are equipped to deliver various governmental services online and utilize ICT for the internal functioning of government

(Ahmed and Hussein, 2006). E-government readiness measurement has been formulated as a yardstick that allows nations to measure their status relative to others trying to implement electronic governance (Ojo *et al.,* 2005).

Rahman (2007), stated that "To comply with e-governance, one must first be 'e-Ready' and e-readiness is the capability to use ICT to build up one's economy and to promote one's welfare." Ojo *et al.* (2005), state that e-readiness measures the extent to which a society is prepared to reap the opportunities for ICT. E-readiness forms an important starting point when considering the implementation of e-government. Therefore the next section will provide a clear overview of e-readiness.

2.2 E-readiness, E-government readiness and e-government readiness measurement models

To put ICT to effective use, a country must be "E-ready" in terms of: infrastructure; accessibility of ICT to the population at large; appropriate legal and regulatory framework on ICT use (Grigorovici *et al.,* 2004). E-readiness is defined as the ability of an economy to use ICT to shift the traditional business into the new economy (Bui *et al.,* 2003). Further, e-readiness is defined as the degree to which a community is prepared to participate in the networked world (Vaezi and Bimar, 2009).

E-readiness measurement offers policy and decision makers with a detailed scorecard of their economic competitiveness relative to their international counterparts and allows policy analysts to pinpoint areas of strength and weakness, thus providing a balanced perspective in guiding a country through the digital transformation (Bui *et al.*, 2003).

Several e-government readiness measurement models have been implemented over decades by different international and corporate organisation. A comparative analysis of selected e-readiness measurement models is presented in Azab *et al.,* 2009 including those developed by the Centre for International Development Harvard University and IBM (CID), the Centre for International development and Conflict Management (CIDCM), the International Telecommunication Union (ITU), the World Bank-Knowledge Assessment Methodology (KAM), the World Economic Forum, Infodev, the U.S Agency for International

Development (USAID) and the World Information Technology and Services Alliances (WITSA). Information Technology (IT) infrastructure, human resources, policies and regulations, environment and e-government are the main components identified by these e-readiness measurement models to measure the e-readiness. E-readiness tools such as CIDCM, ITU and WITSA do not include e-government in their measurement, rather giving importance to IT infrastructure and human resources. CID, KAM, NRI and USAID include e-government in their e-readiness measurement by measuring availability and number of e-services and promotions and usage of ICT by the public sector but do not consider all aspects affecting e-government readiness.

Current e-readiness measurement models do not undertake in-depth research concerning e-government, ignoring significant elements such as culture and acceptance of technology by public officials (Dada, 2006), quality of ICT in government, and strategic alignment (Azab *et al.*, 2009). According to Bannister (2004) e-readiness tools are over simplified measurements and do not reflect a veritable e-government status. E-readiness measurement models mainly gauge e-service accessibility, ICT support and usage and are inadequate to measure e-government readiness (Azab *et al.*, 2009). This enlightens Jansen's (2005) recommendation to focus on the factors most particular to e-government to measure e-government readiness.

Before introducing an e-government strategy, it is vital to check whether the system has been planned properly based on the reality on the ground. That is whether the nation is capable of adapting e-government; whether the municipal government is competent enough to execute e-government promotion; whether the citizen are capable enough to adjust to the changed environment (Rahman, 2007). E-government readiness measurement helps a government to measure its stages of readiness, identify its gaps, and then redesign its government strategy. The measurement is especially relevant for government at the preliminary or intermediate stage of e-government development (Zheng and Jiang, 2011).

Readiness of e-government is not restricted to government bodies so it is significant to measure society, frameworks of government institutions, human resources, inter-departmental relationship, national infrastructure, education and any of the issues that are related to e-government (Ahmed and Hussein, 2006). There has been considerable effort

from international and regional institutes, as well as by individual scholars and researchers, to develop e-government readiness models and frameworks.

2.2.1 E-government readiness measurement models

Several studies have contributed to identify critical variables for measuring e-government readiness. Thus, the following sections illustrate some of these measurement models of e-government readiness developed by academics as a procedure to guide the selection of the research model for this study.

2.2.1.1 E-government readiness model – conceptual framework

Ahmed and Hussein (2006) proposed six significant factors in the success of e-government initiatives and which consequently increase the e-government readiness level of a country. These factors are: government organisational readiness, governance and leadership readiness, customer readiness, competency readiness, technology readiness and legal readiness (Table 2.4). The study concludes that the implementation of this conceptual framework ensures that e-government initiatives would not face any major legal obstacles and guarantees the success of e-government initiatives and in so doing increases the e-government readiness level of a country.

Table 2.4 – E-government readiness measurement model – Conceptual Framework

E-government readiness	Organisational readiness
	Governance and leadership readiness
	Customer readiness
	Competency readiness
	Technology readiness
	Legal readiness

2.2.1.2 E-government readiness model

Rahman (2007) proposed a model of e-government readiness which focuses on e-society and e-economy to measure the readiness of e-government in terms of its impact on society and government. According to this model, e-government readiness is a function of government, entrepreneurs, development partners, civil society and citizen readiness. The author formulates an e-government readiness formula as follows:

E-government readiness = $\sum \phi_1 + \phi_2 + \phi_3 + \phi_4 + \phi_5 + \cdots + \phi_n$ where:

- ϕ_1 is associated with readiness of government in the context of policies, acts, regulations and laws
- ϕ_2 is associated with readiness of business sectors, such as electronic signature, electronic transactions, e-commerce, small and medium enterprise development
- ϕ_3 is associated readiness of partners (stakeholder partnership, funding, long term vision)
- ϕ_4 is associated with readiness of civil society (participation, grassroots empowerment, human resource development (HRD))
- ϕ_5 is associated with readiness of citizen (social, economy, culture, attitude, civic knowledge, HRD), and
- ϕ_n is associated with other observable and non-observable factors.

However, this formula is not formulated numerically and requires further research to be validated and to be tested empirically.

2.2.1.3 Three-Ring e-government readiness model

Koh *et al.* (2008) proposed the Three-Ring Model (Figure 2.2) and internet integration strategy framework for e-government readiness. This e-government readiness instrument measures the issues at three levels: strategic, system and data. The aim of the study was to measure the readiness of the organisation, its workers, and technology to achieve an effective implementation of e-government. The analysis of the survey results indicates that a two level e-government readiness model is more suitable than a three-level model.

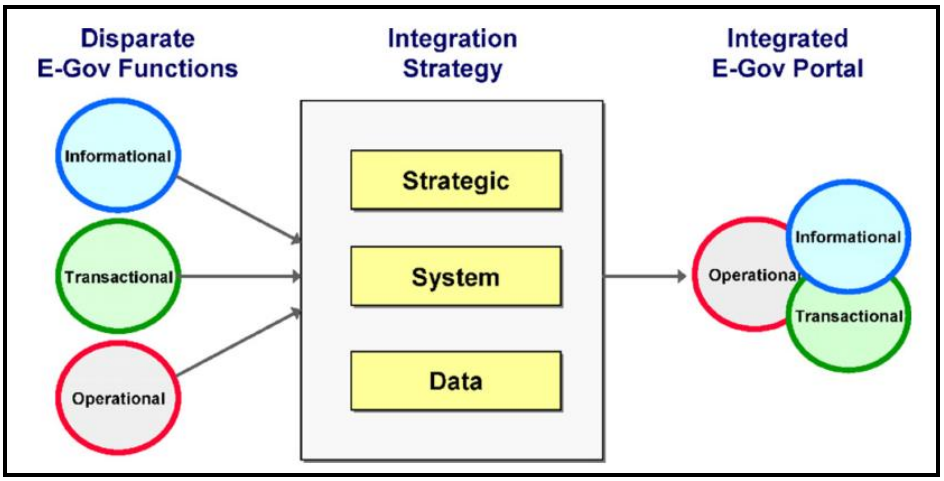

Figure 2.2 Three-Ring e-government readiness model (Koh *et al.*, 2008)

2.2.1.4 Comprehensive e-government readiness model

Yunis and Sun (2009) developed a model (Figure 2.3) for e-government readiness that comprises three major parts: country profile characteristics (Human Capital Index (HCI), Growth Competitive Index (GCI), Information Technology (IT) development index, e-government antecedents (web measure, infrastructure, e-participation, PC and internet index and human capital index) and e-government readiness measurement. Based on secondary data derived from UNPAN and the World Bank, the study presents a comprehensive model and empirically investigates the role that social, technological and economic factors play in the enhancement of countries' e-government readiness. The study shows that, except for the e-participation index, all other factors are significant determinants of e-government readiness.

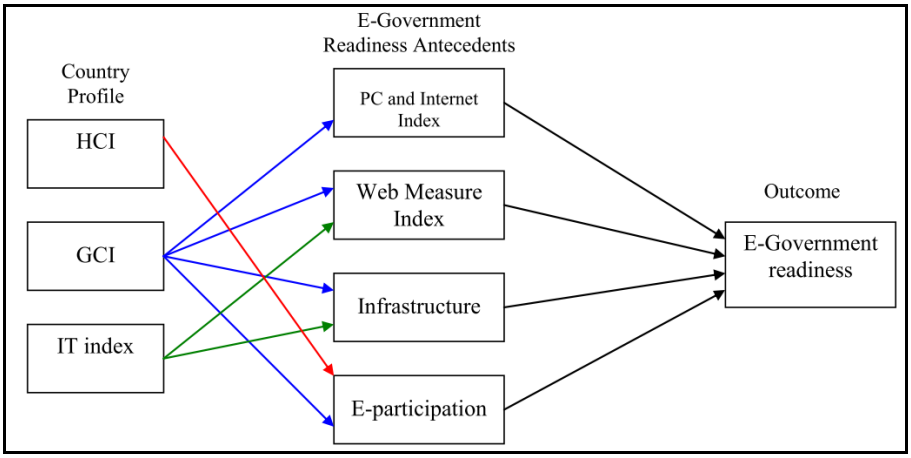

Figure 2.3 E-government readiness model (Yunis and Sun, 2009)

2.2.1.5 E-government readiness model with internal factors

Azab *et al*. (2009) proposed an e-government readiness framework (Figure 2.4) that adopts a four-phase model of e-government that categorises e-government into four dimensions such as strategy, processes, technology and people. The framework covers only the internal factors (strategy, processes, technology and people) that affect e-government readiness. The findings of the study were based on a case study research strategy with qualitative and quantitative data collection. Results indicate that all proposed internal factors directly affect the readiness of e-government.

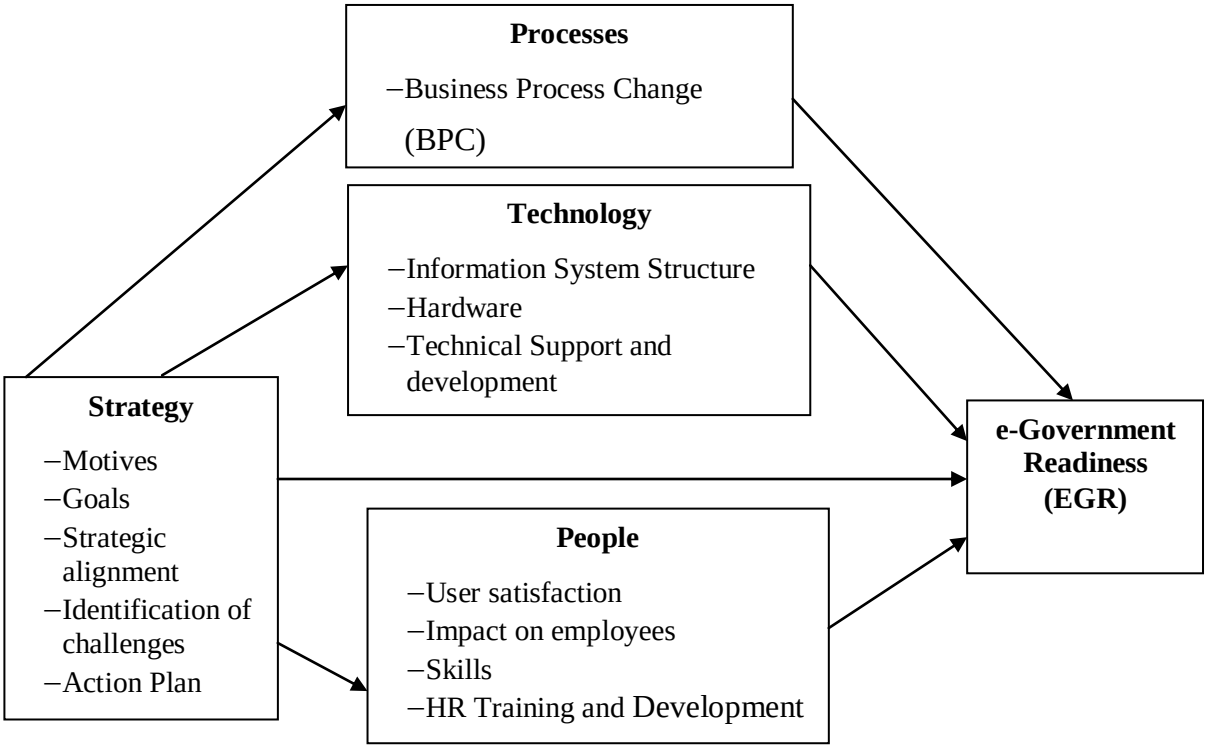

Figure 2.4 E-government readiness framework – internal factors (Azab *et al.*, 2009)

2.2.1.6 E-government readiness model – cultural factors

Khalil (2011) developed an e-government readiness model (Figure 2.5) which explores the national cultural values and practices to e-government readiness measures, namely: power distance, future orientation, assertiveness, gender differentiation, performance orientation, human orientation, uncertainty avoidance, in-group collectivism and institutional collectivism. Gross domestic product (GDP) is added as a control variable. The study utilized the reported survey from UNDESA (2008) for the findings. This study showed that

cultural values have significant effect on predicting e-government readiness than cultural practices and GDP is an important determinant of e-government readiness.

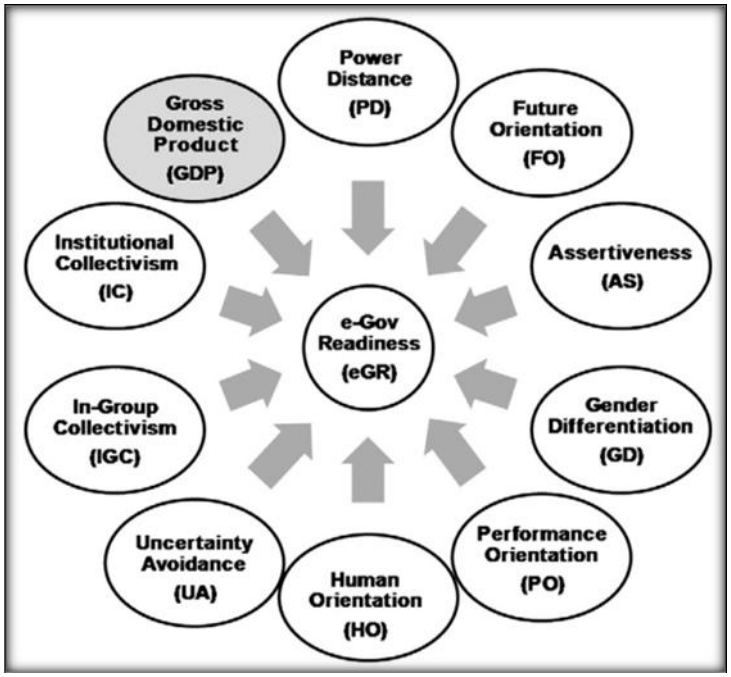

Figure 2.5 E-government readiness model – National cultural values and practice (Khalil, 2011)

2.2.1.7 E-government readiness model – bottom-up approach

The e-government readiness model developed by Zheng and Jiang (2011) used a bottom-up approach to identify the factors for e-government. The framework includes two major building blocks, namely, external environment e-readiness indicators and internal government e-readiness indicators (Table 2.5).

Table 2.5 E-government readiness model – Bottom up approach (Zheng and Jiang, 2011)

External environment readiness	Social ICT infrastructure
	Social and human environment
Internal Government readiness	Managerial framework
	Leadership
	Investment
	Work force capability
	Internal IT infrastructure
	Information safety
	Legal and regulatory environment regarding information

External environment readiness comprises social ICT infrastructure and the social and human environment. Internal government readiness is composed of managerial framework, leadership, investment, workforce capability, internal IT infrastructure, information safety, and legal and regulatory environment. Both qualitative and quantitative methods were used to analyse the data and the study found that the indicators developed from a location specific context may not be generalizable to different conditions.

2.2.1.8 Conceptual e-government readiness framework

The conceptual e-government readiness framework (Figure 2.6) presented by Alghamdi *et al.* (2011) contributes an organisational perspective to the measurement of ICT readiness for e-government. The proposed framework contains seven dimensions of ICT readiness of government organisation, including e-government strategy, user access, e-government programs, ICT architecture, business processes and information systems, ICT infrastructure and human resources. This study is an essential conceptual step in discovering significant factors in an organisational perspective.

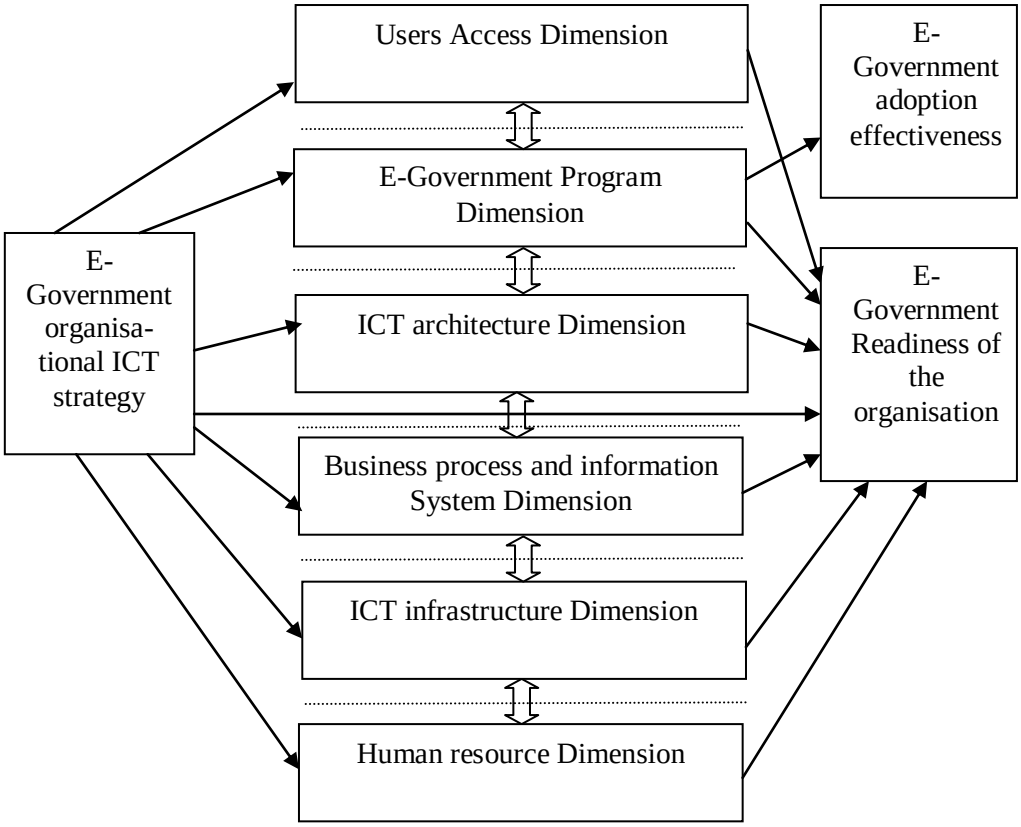

Figure 2.6 E-government readiness framework – organisational ICT readiness (Alghamdi *et al.*, 2011)

2.2.1.9 A cultural e-government readiness model

Cultural factors were the main focus of the e-government readiness framework (Figure 2.7) developed by Sabri *et al*. (2012). The basic building blocks of this e-government readiness model are: government, people and agencies. This study found from systematic review of literature that cultural factors of government, people and agencies are more significant than technological factors for the successful execution of e-government systems.

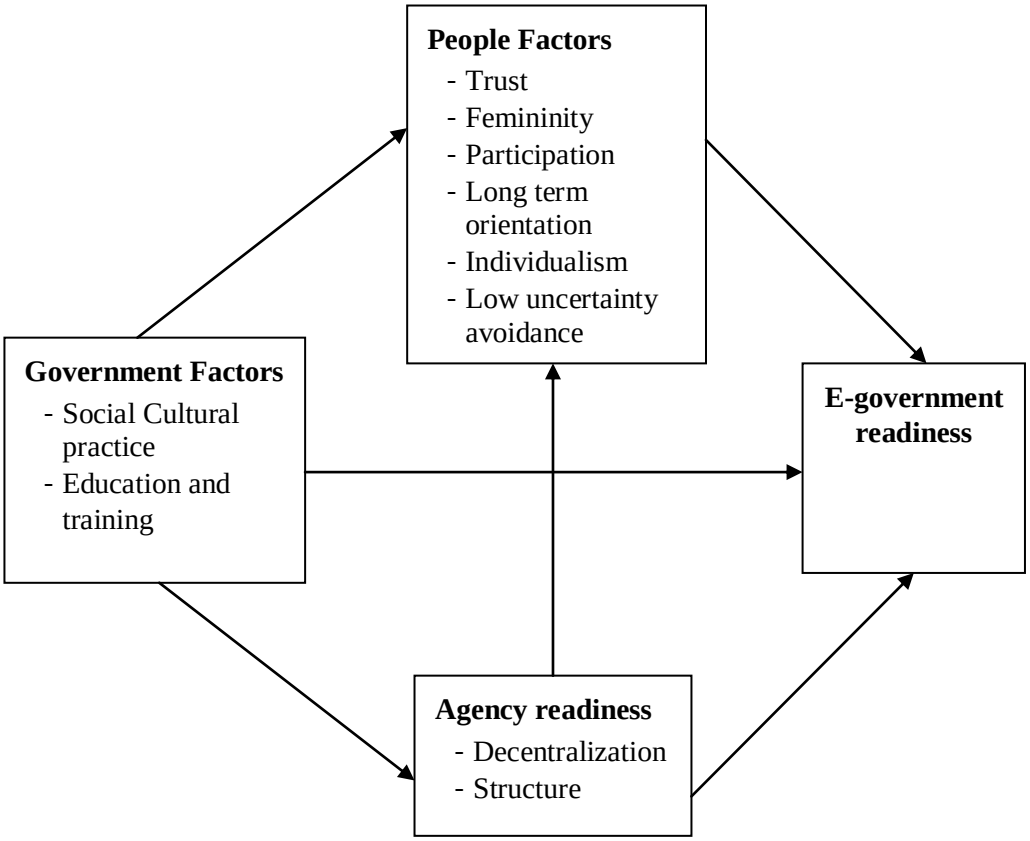

Figure 2.7 E-government readiness framework with cultural factors (Sabri *et al.*, 2012*)*

2.2.1.10 E-government readiness model – information system perspective

Shin-Ping Liu (2012) proposed two models which measure the ability of Information System Assessment (ISA), Information Technology Governance (ITG), and Organisation Information System Alignment (IS-ALIGN) to measure e-government readiness. The main objective of this study was to develop efficient tools that could be used to determine e-government readiness from an organisation-wide and Information System (IS) perspective with a focus on embracing IT. The findings of the study were based on an online survey and lead to the proposal of the two models as shown in Figure 2.8 and Figure 2.9.

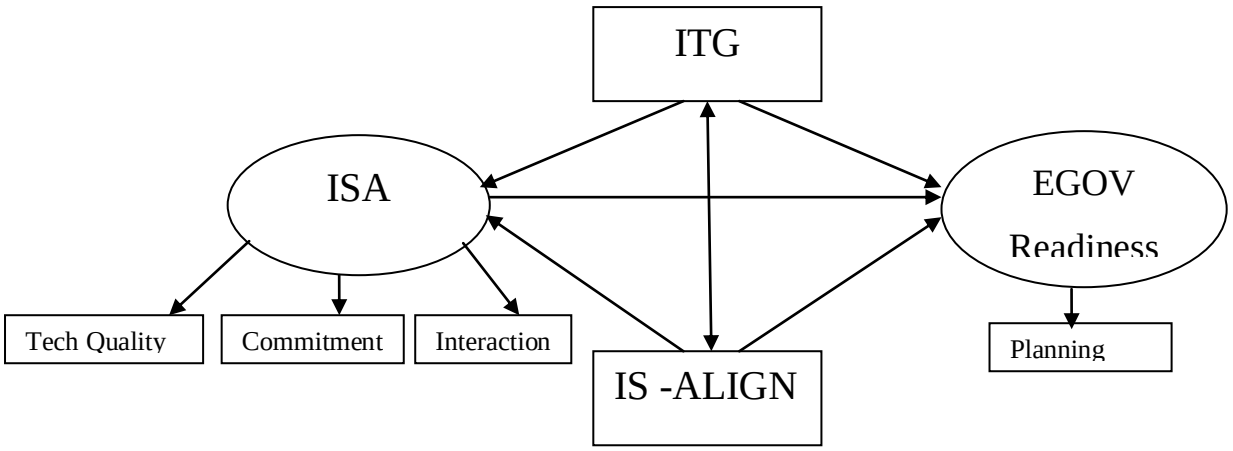

Figure 2.8 Model I of E-government Readiness (Shin-Ping Liu, 2012)

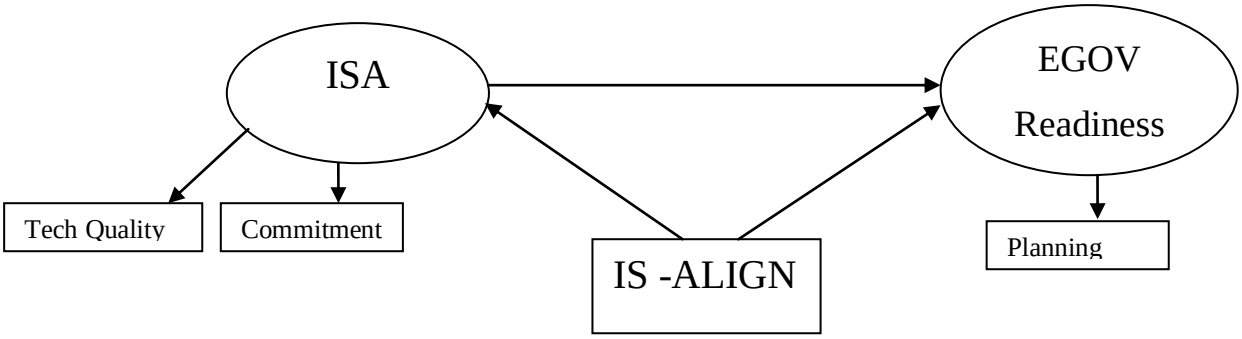

Figure 2.9 Model II of E-government Readiness (Shin-Ping Liu, 2012)

In Model I, the relationship between ITG and ISA was not supported, so the modified model (II) investigated the relationships among the three instruments ISA, IS-ALIGN and EGOV. The study revealed that the commitment of the staff to support user involvement and participation in information system development are crucial to measure the readiness of e-government. The relationship between ISA and interaction was not supported in Model II.

2.2.1.11 E-government readiness model GPPA

Yuan *et al*. (2012) developed a Government Portal Performance Architecture (GPPA) (Figure 2.10) based on the theory of web quality evaluation and contemporary public administration principals to measure e-government readiness in China. The measurement criteria focussed on the government portal website in terms of its content, function and

construction. The result of the empirical study revealed that the effectiveness of e-government readiness affects the performance of government portals.

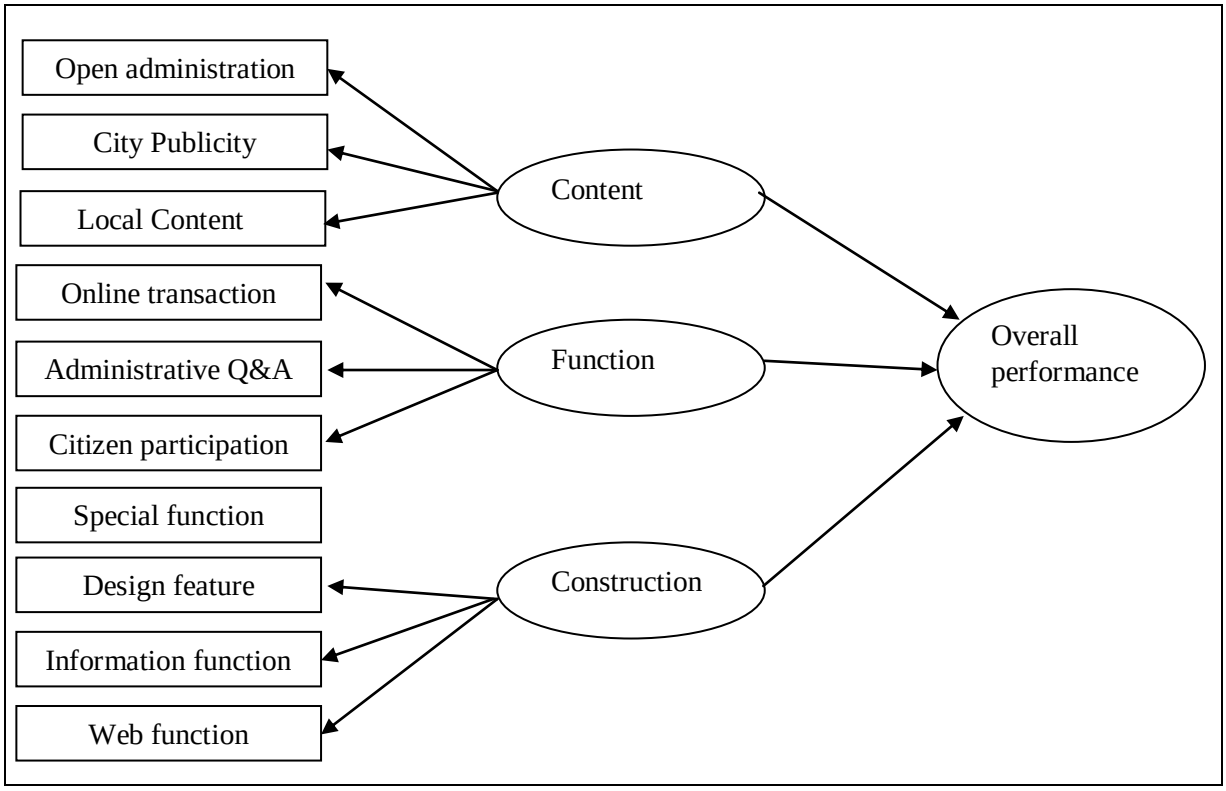

Figure 2.10 E-government readiness model (GPPA) (Yuan *et al.*, 2012)

Table 2.6 shows a summary of e-government readiness models discussed above.

Table 2.6 Summary of e-government readiness models

Frame-work	Focus	Purpose	Major factors	Findings
Ahmed and Hussein (2006)	Government 0rganisations	Decision support for planning and intervention	• Organisational readiness • Leadership and governance readiness • Customer readiness • Competency readiness • Technology readiness • Legal readiness	This is a conceptual framework and all the proposed factors can be utilises as a general procedure for e-government initiatives in government organisation

Rahman (2007)	Government organisations	Benchmarking	• Government readiness • Business sectors readiness; • Stakeholders readiness; • Society's readiness • Citizen readiness	This mathematical model of e-government readiness is the function of government, infrastructure, human resource development along with other identified factors
Koh *et al.* (2008)	Government organisations	Decision support for planning and intervention.	• Internal and external e-government functions in 3 categories (informational, transactional and operational); • E-services transformation at 3 levels (strategic, system and data)	Survey suggests that the two level e-government readiness model is more suitable than 3 level e-government readiness model
Yunis and Sun (2009)	Global level (Countries)	Decision support for planning and intervention	• Infrastructure • IT accessibility • Web measure • E-participation • Information technology development • Growth competitiveness • Human capital	The study uses secondary data UNPAN (2004, 2005 and 2008) and World Bank, States that all factors except e-participation are the significant determinants of e-government readiness
Azab *et al.*(2009)	Government organisations	Decision support for planning and intervention	• Technology • Business process • Strategy • People	Analysis of the case study reveals that all these factors are better predictors of e-government
Khalil (2011)	National level	Decision support for planning and intervention.	• Cultural values • Cultural practise	This study uses secondary data (UNDESA, 2008) for the finding of the results. It shows that cultural values are more significant than cultural practice in predicting e-government readiness.

Zheng and Jiang (2011)	Local government	Decision support for planning and intervention.	• External environment readiness (social ICT infrastructure, social and human environment) • Internal government readiness (managerial framework, leadership, investment, workforce capability, internal IT infrastructure, Information safety, legal and regulatory environment regarding information)	The study used the quantitative and qualitative data for the findings. The study indicates that the framework developed using a bottom-up approach is a useful and flexible to a specific local government.
Alghamdi *et al.*, (2011)	Government organisations	Decision support for planning and intervention	• E-government strategy • Use access • E-government program • ICT architecture • Business process and Information system • ICT infrastructure • Human resources	This conceptual framework states that the challenge related to inefficient e-government planning in the public sector will be minimised through the better understanding of these proposed readiness factors of e-government.

Sabri *et al.* (2012)	Government level	Decision support for planning and intervention.	• People cultural factors (Trust, Femininity, Participation, Long term orientation, Individualism, Low uncertainty avoidance) • Agency cultural factors (Decentralization, Structure) • Government cultural factors (Social, Cultural Practice, Education and Training)	The conceptual framework based on the literature review indicates that government, people and cultural factors of business agencies are more important than technological factors to implement e-government system successfully
Shin-Ping Liu (2012)	Government organisation	Decision support for planning and intervention	• Information System Assessment • Information Technology governance • Information system alignment • Government readiness	The result of the questionnaire based survey reveals that all factors are the predictors of e-government readiness.
Yuan *et al.*, (2012)	Country level	Decision support for planning and intervention	• Government portal websites in terms of content, function and construction	The findings of the empirical study reveals that the performance of government web portals reflects the effectiveness of e-government readiness

2.2.2 E-government readiness frameworks developed by national and corporate organisations

Several surveys have been undertaken by different international and corporate organisation on e-government readiness. Notable amongst them are United Nations Department of Economic and Social Affairs (UNDESA), Centre for Public Policy of the Brown University (CPP-BU), Accenture, Waseda and United Nations University (UNU). All these organisations except UNU have consistently carried out annual benchmark surveys for the

past few years. This section presents these five well known readiness measurement frameworks for e-government and which are available in the public domain.

2.2.2.1 UNDESA E-government readiness framework

The UNDESA is one of the main surveyors of the global state of e-government since 2001. Surveys published in 2001, 2003, 2005, 2008, 2010 and 2012 benchmark all 192 UN member countries (UNDESA, 2012; UNDESA, 2008). Human capacity development, online presence and telecommunication infrastructure are the major measures of this framework. The main purpose of the UNDESA framework is to offer governments with a measurement tool that exhibits their areas of strength and weakness, within the e-government domain.

2.2.2.2. Brown University global e-government

The Centre for Public Policy of the Brown University (CPP-BU) started the survey of national government portals in 2001. The major measures used in this framework include features that are related to online information, electronic services, privacy and security, disability access, foreign language access, advertisement, user fees and public outreach (West, 2008; West, 2007; West, 2006). These surveys only measure a set of features or items of government websites and discuss the development of these features.

2.2.2.3 Accenture e-government leadership

Accenture has been carrying out e-government surveys since 2000. This framework considers service maturity, customer service maturity and citizen voice as the major measures (Accenture 2003; Accenture, 2008). Service maturity is measured by the breadth and depth of e-service delivery. Customer service maturity is evaluated based on the level of support of customer relationship management provided to users. Citizen voice quantifies and incorporates the perceptions of the citizen. While UNDESA and CPP-BU measure e-government in over 190 countries, Accenture measured 20 countries in 2000 and 22 from then onwards. Focus on customer service and incorporation of demand side feedback differentiates the Accenture e-government measurement.

2.2.2.4 WASEDA University e-government ranking

WASEDA university e-government ranking started in 2005. The ranking started in 23 countries in 2005 and reached 55 in 2013 (WASEDA University, 2013). Besides evaluating a country's ICT infrastructure and online applications, WASEDA University ranking system addresses important issues related to back office strategic management, e-government promotion, presence of a Chief Information Officer (CIO) and home page characteristics; but does not cover all e-administration.

2.2.2.5 UNU e-readiness measurement for e-government

The main objective of the United Nations University (UNU) e-readiness measurement was to determine the state of readiness for e-government in selected agencies of the Macao Special Administrative Region (SAR) government. Organisation structure, services, technical and non-technical resources and e-government is the main measures of this framework (Ojo *et al.*, 2007). While all other e-government readiness measurement frameworks measure at the national level, the UNU e-readiness measurement at the agency level and is mainly designed to support strategic e-government planning across the entire e-government circle.

Table 2.7 presents the comparative analysis between the organisation e-government readiness measurement frameworks discussed above.

Table 2.7 E-government readiness measurement framework: comparison (Source: Ojo *et al.*, 2008)

Framework	Purpose	Tools	Measurement
UNDESA	National benchmarking	Survey	Web measure index; Telecom infrastructure index; Human capital index
CPP-BU Global e-government	National Benchmarking	Survey	Online information; Electronic services; Privacy and Security; Disability access; Foreign language access; Ads, User and Premium fees; Public outreach

Accenture	Country ranking based on citizen perception	Survey	Service maturity; Customer service maturity
Waseda University e-government ranking	National benchmarking	Survey	Network preparedness; Management optimization; Online system and application; Homepage feature
UNU e-readiness measurement	Strategic e-government planning – agency level	Survey	Organisation structure; Services; Resources –hardware, software, network, telecom, human and financial; E-government-websites; Challenges and perception

2.3 Main factors used in e-government readiness research

Following a literature review specifically on e-government readiness measurement, this study found that researchers have not yet agreed on a standard framework, but the main factors identified in most of the studies are: citizen readiness, technology readiness, government readiness, business sector readiness and e-services. Table 2.8 shows each factor along with the study that uses it.

Table 2.8 Factors affecting e-government readiness

Factor	Description	Source
Citizen readiness	Readiness of the common citizen to utilise ICT	UNDESA (2012, 2010, 2008); Alghamdi *et al.*, 2011; Zheng and Jiang, 2011; Yunis and Sun, 2009; Azab *et al.*, 2009; Accenture (2008, 2003); Rahman, 2007; Ahmed and Hussein, 2006.
Technology readiness	Technology readiness entails all the necessary technology resources including hardware, software, communication and network infrastructure, internet penetration, and technology services across organisation which provide a foundation for e-government applications and services	WASEDA , 2013; Shin-Ping Liu, 2012; UNDESA (2012, 2008); Alghamdi *et al.*, 2011; Zheng and Jiang, 2011; Yunis and Sun, 2009; Azab *et al.*, 2009; UNU (Ojo *et al.*, 2007); Ahmed and Hussein, 2006.

Government readiness	Government readiness is the preparedness of government to integrate and coordinate data for the smooth interaction among the various e-services and applications	Shin-Ping Liu, 2012; Alghamdi *et al.,* 2011; Zheng and Jiang, 2011; Azab *et al.,* 2009; ; Koh *et al.,* 2008; Rahman, 2007; Ahmed and Hussein, 2006; UNU (Ojo *et al.,* 2007).
Business sector readiness	Readiness of industrialist to take part in and acquire benefit from ICT	Alghamdi *et al.,* 2011; Azab *et al.,* 2009; Rahman, 2007; UNU (Ojo *et al.,* 2007); Ahmed and Hussein, 2006;
E-services	E-services are the all interactive services that are delivered on the internet using highly developed telecommunication technologies, information and multimedia technologies	WASEDA , 2013; Shin-Ping Liu, 2012; Yuan *et al.,*, 2012; UNDESA (2012, 2008); Yunis and Sun, 2009; Koh *et al.,* 2008; West (2008, 2007, 2006); Accenture (2008, 2003); UNU (Ojo *et al.,* 2007)

2.4 Critique of e-government readiness measurement models

Tables 2.6 and 2.7 show the details of e-government readiness measurement models developed by individual scholar/researchers and governmental/world organisation respectively. A summary of the existing models is as follows:

- These e-government readiness measurement frameworks mainly serve two purposes that is international benchmarking and decision support for planning and intervention.
- Existing studies consider resources such as technological, human, financial and legal to influence e-government readiness.
- Even though diversified approaches and factors are considered in each model based on their objectives and priorities, most of the studies are concerned with, and provide, conceptual models (Sabri *et al.,* 2012; Alghamdi *et al.,* 2012; Rahman, 2007; Ahmed and Hussein, 2006).
- The extant studies that investigate e-government readiness empirically, focus on factors that relate to culture (Khalil, 2011), information systems (Shin-Ping Liu,

2012), internal factors (Azab *et al.,* 2009) web services (Yuan *et al.,* 2012) and government and e-services (Koh *et al.,* 2008).

- The models developed by national organisations are well known and are available in the public domain. It is noticeable that these e-government readiness measurement frameworks generally aim to benchmark countries and focus heavily on electronic service delivery through the internet and on national indicators of ICT development.
- In contrast, the UNU e-government readiness measurement framework presents a complete picture of agencies' readiness for e-government, prepared at the central agency level, which can eventually lead policy and strategy development at this level.
- Except for the models developed by Azab *et al.* (2009) and Koh *et al.* (2008), all these models do not investigate e-government readiness from the viewpoint of government employees – how they perceive e-government and to what extent they are aware of all features related to the viability of e-government systems. This population could provide the best sample to recognize the most significant factors affecting e-government readiness since government employees are one of the major stakeholders and are aware of most of the organisation's functions and activities.
- The majority of studies (table 2.6) focused on measurement at government organisational level or national Remarkably little attention has been paid to measuring e-government at municipal level (Yuan *et al.*, 2012; Koh *et al.*, 2008).
- Moreover, in the e-government readiness measurement framework, very few studies have reported about the effect and treatment of heterogeneity caused by unobserved factors or items, even though a number of studies have reported on the application of SEM in technology e-readiness measurement frameworks (Azab *et al.,* 2009; Yunis and Sun, 2009).

Despite the fact that there are many frameworks and models developed to address the factors of e-government readiness measurement, remarkably little attention has been paid to measuring e-government that considers heterogeneous factors at municipal level. This lead to develop and validate a framework for e-government readiness measurement that includes heterogeneous factors. It is noticeable that specific e-government services are progressively being implemented at the municipal level rather than national level. This highlights the

importance of having an e-government readiness measurement framework which includes heterogeneous factors at the municipal level.

2.5 Summary

This chapter provided the foundation for this research study and introduced previous work on measurement related to e-government readiness by individual scholars/researchers and also by national organisation/agencies. The chapter included an overview of e-government by introducing definitions of e-government according to different perspectives and presented an e-government definition selected by the researcher that covers all e-government aspects. The other sections of the chapter presented the analysis of e-readiness measurement models and brief descriptions of various e-government readiness measurement models. Analysing these measurement tools revealed their inadequacy in measuring e-government readiness at municipal level. The next chapter will explain the methodology that was followed to reach the research objectives of this study.

Chapter 3: Research Methodology

This chapter presents the methodological steps followed in this study in order to accomplish the research objectives of this study as outlined in Chapter 1. Firstly an interactive scoping literature review methodological framework outlined by Arksey and O'Malley (2005) is used to identify the important factors of an e-government readiness measurement framework (Objective 1). Next the data collection methods are discussed, followed by an explanation of structural equation model-partial least squares (SEM-PLS) analytical technique, which was used to discover which critical factors influence e-government readiness in order to include these factors in the e-government readiness framework (Objective 2). Finally, this chapter explains the application of the FIMIX-PLS method to uncover the unobserved heterogeneity in user perceptions of e-government readiness (Objective 3).

3.1 Scoping review

Scoping review is a methodology used to explain the breadth and depth of a field of research and to analyse and interpret the findings of the studies that are reviewed (Levac, Colquhoun and O'Brien, 2010). Scoping reviews comprises research from different sources, but scoping research questions do not address the proof for a particular intervention. Instead of measuring the quality of the incorporated studies, scoping review produces an output that is linked to the purpose of the review.

The present review followed the guidelines for conducting a scoping review outlined in the Arksey and O'Malley (2005) framework. The five stages of this methodological framework are: identifying the research question; identifying relevant studies; study selection; charting data; collating, summarising and reporting the results (see Table 3.1). This method follows a narrative synthesis process that is predominantly appropriated to the appraisal of a contrasting body of studies that are mainly qualitative in nature.

Table 3.1 – Stages of the scoping review methodology framework

Stage 1	Identifying the research question
Stage 2	Searching for relevant studies
Stage 3	Selecting studies
Stage 4	Charting the data
Stage 5	Collating, summarising and reporting the result
Stage 6	Consulting with stakeholders to inform or validate with the study findings.

The following section presents the results of the scoping review methodological analysis of e-government readiness measurement factors as discussed by various researchers in research journals and conference journals.

3.1.1. Review procedure

The scoping review methodological analysis procedure follows systematic review steps as shown in Table 3.1 (Khan *et al.*, 2003). In the current study, the analysis started with defining the research area as being "the identification of factors influencing e-government readiness". In the next step, the researcher used search engines to retrieve related research papers from the databases of the ACM Digital Library (http://dl.acm.org), Google Scholar (http://scholar.google.co.za), IEEE Explore (http://ieeexplore.ieee.org), Science Direct (http://www.sciencedirect.com) and Springer LNCS (http://www.springer.com/lncs). The databases sufficiently cover the most related journals and conference proceedings within e-government readiness. Database searches covered the period from January 2006 to September 2013 and were restricted to English language peer reviewed. Table 3.2 shows a set of keywords that were used to logically guide the search. Irrelevant issues were eliminated in next step whereby papers that were judged obsolete and unconnected to the research area were eliminated. The final step outlined the research area by summarizing and interpreting the findings.

Table 3.2 Searching keywords for scoping review

Keywords	
1	e-government
2	e-readiness
3	e-government readiness
4	e-readiness measures
5	e-government readiness measurement

3.1.2 Review findings

Contents of 35 studies found to be related to e-government or e-readiness measurement was analysed. Sixteen studies (45.71%) were directly related to e-government readiness. Four (11.43%) studies focused on e-readiness rather than e-government readiness and fifteen (42.86%) related to measurement on e-government maturity level or development stage. Characteristics of the studies that were directly related to e-government readiness were taken for further analysis. Table 3.3 shows the details of these selected studies.

Table 3.3: E-government readiness framework analysis

Author	Study		Purpos		Focus			Factors					
	1	2	1	2	1	2	3	1	2	3	4	5	6
Ahmed and Hussein (2006)	×			×	×			×		×		×	×
Rahman (2007)	×		×		×			×		×		×	
Yunis and Sun (2009)		×		×			×	×			×		×
Azab *et al.*(2009)		×		×	×			×		×		×	×
Zheng and Jiang (2011)		×		×		×		×				×	×
Alghamdi *et al.* (2011)	×			×	×			×		×		×	×
Shin-Ping Liu (2012)		×		×	×						×	×	×
Koh *et al.* (2008)		×		×		×					×	×	
Yuan *et al.* (2012)		×		×			×				×		
Khalil (2011)		×		×			×		×				
Sabri *et al.* (2012)	×			×		×			×				
Accenture		×	×				×	×			×		
UNDESA		×	×				×	×			×		×
WASEDA		×	×				×				×		×
UNU		×		×	×					×	×	×	×
CPP		×	×				×				×		

KEY:
Study type (Conceptual=1; Empirical=2),
Purpose (Benchmarking=1; Decision support for planning and intervention=2),
Focus (Government organisation=1, local/municipal government=2; National/global=3),
Factors (Citizen=1; Cultural Factors=2;
Business/ Industries=3; E- service=4; Government=5; Technology=6)

As can be seen from Table 3.3, 12 (75%) of 16 studies used an empirical method while the rest of the studies (25%) were based on a conceptual framework. All these studies were categorised into two purposes, that is benchmarking of a nation (31.25%) and decision support for planning and intervention (68.75%). The majority of studies focused on measurement at a national or global level (43.75%), followed by the government organisational level (37.5%). Remarkably little attention was paid to measuring e-government at the local or municipal level (18.75%). A score of 1 was allocated to a study that discussed a particular e-government readiness factor of citizen, cultural, business/industries, e-services, government and technology. According to the analysis as shown in the table 3.3, the majority of studies focused on e-services (21.95%) and technological factors (21.95%) followed by citizen (19.51%) government (19.51%), business/industry (12.20%) and cultural factors (4.88%). Citizen, business/industrial, e-services, government and technological factors had a high frequency of occurrence in many studies reviewed as contributing to e-government readiness. Cultural factors had a low

frequency of occurrence in reviewing papers. An important observation is that no single study incorporated *all these* heterogeneous factors.

3.2 E-government readiness measurement framework

While recognizing the notable contributions of previous studies on e-government readiness, it was evident that very little has been written on readiness grades of e-government at the municipal level of government. In an attempt to overcome the shortcomings that exist in the previous e-government readiness measurement models, a framework encompassing heterogeneous factors affecting e-government readiness at municipal level was developed in this study. There are five primary evaluation areas or building blocks proposed in this work to execute any e-government initiative at the municipal level of government (Figure 3.1). These building blocks represent the basic factors to be evaluated before launching an e-government system and can guarantee the right implementation in the right direction. The building blocks are:

- Supporting e-services readiness;
- Individual citizen readiness;
- Technological infrastructure readiness;
- Government readiness and
- Supporting industry readiness.

The overall readiness of e-government is the ability and readiness of government to develop and practice the better e-government services. The dependent variable, overall readiness of e-government is evaluated in terms of these five factors along with the following five conceptual measures (Table 3.4).

Table 3.4 conceptual measures of overall e-government readiness

PRS1	E-government agenda is on the top list of municipal government priority
PRS2	E-government in the municipality is attracting citizen audience
PRS3	E-government readiness status of the municipality is encouraging
PRS4	E-government development in the municipality is improving
PRS5	E-government activities have started in the municipality

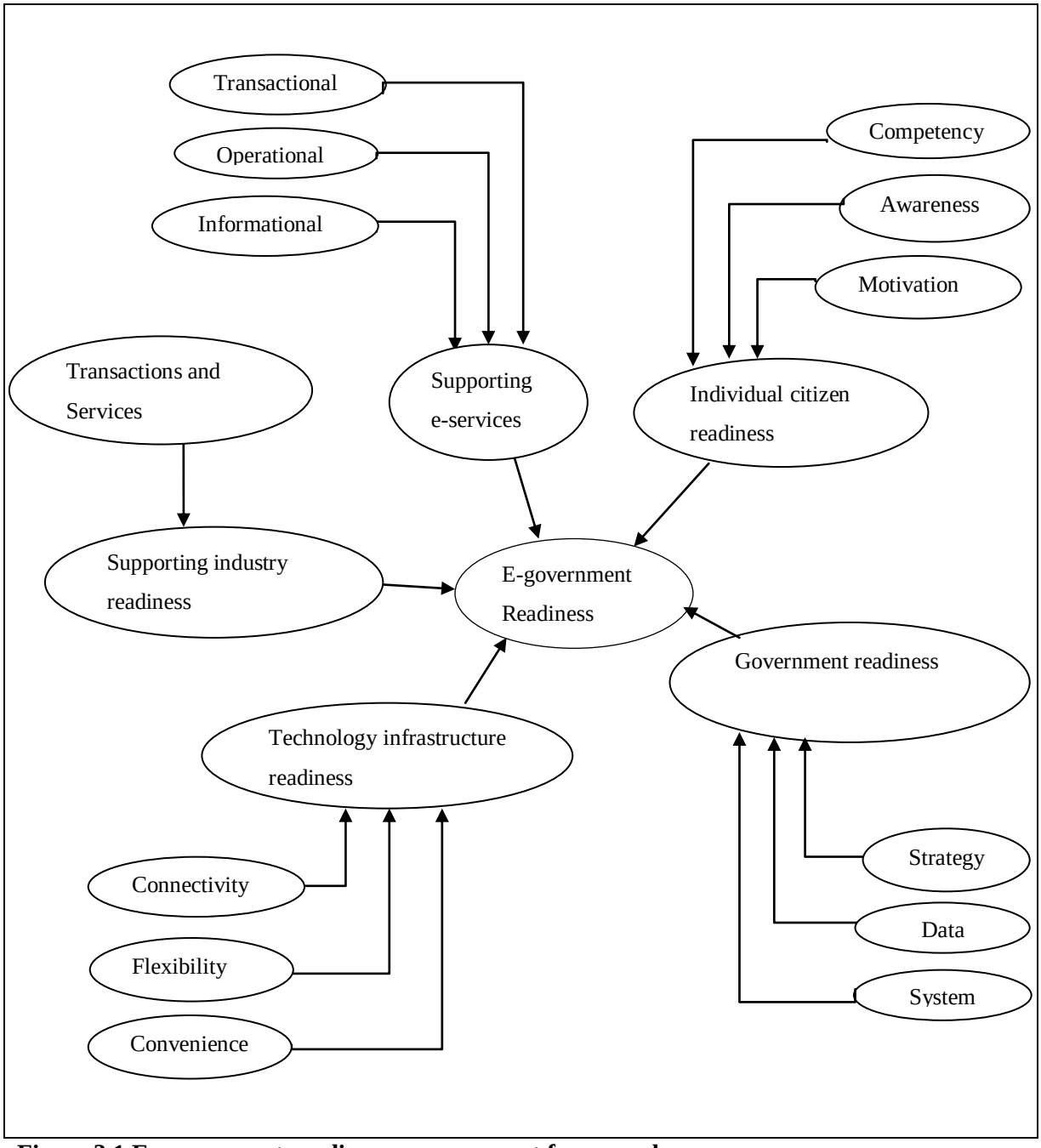

Figure 3.1 E-government readiness measurement framework

The following sections briefly describe the methods used to develop the framework for e-government readiness measurement.

3.2.1 Description of e-government readiness measurement framework

Factors of the proposed framework to contain a number of evaluation metrics and conceptual measures derived from the literature. A questionnaire instrument (Appendix A) was developed to be employed as a tool for validating the suggested framework. It was distributed to employees from all three categories (metropolitan, district and local) of municipality in Eastern Cape Province of South Africa. The first part of the questionnaire covered questions on employees' demographic details/personal information. The second part focused on the conceptual measures of five selected factors: supporting e-services, citizen readiness, technology infrastructure readiness, government readiness and supporting industry readiness. Each question in the second part reflected a measurement construct corresponding to the five selected factors of the e-government readiness framework. All conceptual measures were evaluated using a 7-point Likert scale from 1 to 7. All questions used anchors at each end of the 7 point Likert scale. Different response anchors (Completely not Provided – Completely provided; Very low – Very high; Very low awareness – Very high awareness; Lowly motivated – Highly motivated; Poorly connected – Well connected; Highly inconvenient – Highly convenient; Highly inflexible – Highly flexible; Strongly disagree – Strongly agree) were used based on the type of questions provided.

The following section explains the theoretical background from which all constructs under each factor are derived. A factor and its related evaluation metric and conceptual measures are provided in the respective tables under each section.

3.2.1.1 Supporting e-services

Supporting e-services are the all interactive services that are delivered on the internet using highly developed telecommunication technologies, information and multimedia technologies. The importance of this building block in an e-government context has been noted by some researchers (Papadomichelaki and Mentzas, 2012; Yuan *et al.,* 2012; Elling *et al.,* 2012; Koh *et al.,* 2008). E-services are primarily used for informational, operational and transactional purposes (Koh *et al.,* 2008). E-government services range from the lowest point of static provision of information (Shalini, 2009; Koh *et al.,* 2008; West, 2006; Aichholzer 2001) to the highest point of transactional services (Shalini, 2009; Koh *et al.,* 2008; West, 2008; Aichholzer, 2001) requiring online payment for services provided (West,

2006). Features of websites can be considered as services if the entire transaction can occur online (West, 2007). In the current study the supporting e-services were evaluated in terms of informational, transactional and operational use of e-services.

Informational use: organisational dissemination of information to educate, entertain, influence or reach citizens.

Transactional use: a coordinated sequence of user and system activities to provide service and transfer value.

Operational use: new mechanisms for conducting business operations through integration of information systems, human intellect and other resources into a synergistic network.

Table 3.5 presents the various suggested evaluation metrics of supporting e-services building blocks along with the corresponding conceptual measures.

Table 3.5 Conceptual measures of supporting e-services (adapted from Koh and Prybutok, 2003).

Factors	Evaluation Metric	Conceptual measures	
Supporting e-services readiness (Online publishing of municipality information- SEIU1)	Informational	SEIU2	Online publishing of GIS data
		SEIU3	Online publishing of municipality budget
		SEIU4	Online publishing of employee manual
		SEIU5	Online tour guide of municipality
		SEIU6	Online publishing of minutes of meetings
		SEIU7	Online information from government
		SEIU8	Online video broadcasting of meetings
		SEIU9	Online audio broadcasting of meetings
		SEIU10	Online broadcasting of live traffic cams
		SEIU11	Online TV and postal services
		SEIU12	Online political debates
	Transactional	SETU1	Online calls for bids or proposals
		SETU2	Online bidder applications
		SETU3	Online utility payments
		SETU4	Online collection of fees
		SETU5	Online collection of fines
		SETU6	Online tax collection
		SETU7	Online payments to service providers
	Operational	SEOU1	Online request for services
		SEOU2	Online residence permit application and renewal
		SEOU3	Online licence application and renewal
		SEOU4	Online voter registration
		SEOU5	Online request for records
		SEOU6	Online property/intellectual property registration
		SEOU7	Online business or organisation registration
		SEOU8	Online change business or deregister business
		SEOU9	Online surveys and polls
		SEOU10	Online forums and discussions
		SEOU11	Online job applications
		SEOU12	Support for e-mail communication
		SEOU13	Support for online calendar
		SEOU14	Support for scheduling meetings online
		SEOU15	Support for online document management
		SEOU16	Support for video conferencing
		SEOU17	Emergency management

3.2.1.2 Individual citizen readiness

Individual citizen readiness is defined as the evaluation of citizens in terms of their competency in e-government processes, policies and relationship, awareness of and participation in e-government services, and motivation for and willingness to adopt and promote e-government. Various studies have emphasized that individual citizen readiness is one of the factors which has significant impact on e-government readiness (Zakaria and Janom, 2011; Ahmed and Hussein, 2006; Bui *et al.*, 2003). Citizens' competency (Ahmed and Hussein, 2006; Hossan *et al.,* 2006) is one of the success factors for implementing e-government. Increasing citizens' awareness (Alateyah, Crowder and Wills 2012; Chan *et al.,* 2010; Molla and Licker, 2005) is vital for developing their attitudes toward using e-government technologies. Awareness of citizen about the commence of an e-government technology guide to the prospective for improved normative pressures (Chan *et al.,* 2010; Molla and Licker, 2005). Citizen awareness is essential to successfully build communication between government and citizen (Prima and Ibrahim 2011). Motivation is an important component of management measures which guide civic participation in e-government services (Airong and Xiang 2008). In this study individual citizen readiness factors were evaluated in terms of indicators related to competency, awareness, and motivation of the individual citizen.

Competency: citizen's competencies in support of e-government initiatives are defined, acquired, developed and sustained for e-government design, delivery and ongoing operations.

Awareness: the degree to which society understands the e-government initiative and e-government privacy and security management.

Motivation: citizens' willingness to participate effectively in e-government implementation activities.

Table 3.6 presents the various suggested evaluation metrics of citizen readiness building blocks along with the corresponding conceptual measures.

Table 3.6 Conceptual measures of individual citizen readiness

Factors	Evaluation Metric	Conceptual measures	
Individual citizen readiness (Skills to access information regarding e-government applications ICRC5)	Competency	ICRC1	Knowledge and skills on e-government relationships
		ICRC2	Knowledge and skills on e-government process
		ICRC3	Knowledge and skills on e-government policies
		ICRC4	Knowledge and skills on e-government industry structure
		ICRC6	Skills to govern and coordinate projects related to e-government
		ICRC7	Skills to lead people in achieving e-government adoption success
	Awareness	ICRA1	Public advocacy, branding and media adverts on e-government
		ICRA2	E-government training supports at cybercafé, schools and special centres
		ICRA3	People understanding about how e-government is used
		ICRA4	Requirements placed on people to use e-government
		ICRA5	Pride in using e-government
		ICRA6	E-government security and privacy awareness training programs
		ICRA7	Commitment of stakeholders to e-government security and privacy management
		ICRA8	Relevant regulations and laws of e-government security and privacy management
		ICRA9	Government commitment to e-government security and privacy management
	Motivation	ICRM1	Willingness to spend time and effort on e-government implementation
		ICRM2	Willingness of non-governmental organisations to promote e-government
		ICRM3	Willingness of governmental to promote e-government
		ICRM4	Training on mix aspects of e-government management and technical areas
		ICRM5	Initiative to increase willingness of citizen to adopt e-government

3.2.1.3 Technology infrastructure readiness

Technology infrastructure readiness involves all the necessary technology resources including hardware, software, communication and networks infrastructure, internet penetration, and technology services across organisation which provide a foundation for e-government applications and services. Experts have appreciated the inclusion of technology infrastructure as one of the dimensions which has significant importance in e-government readiness (Shin-Ping Liu, 2012; Yunis and Sun, 2009; Azab *et al.*, 2009; Ahmed and Hussein, 2006). Connectivity is one of the technological challenges that affect the sustainability and usability of services and are becoming challenges in the proliferation of e-government services (Singh and Chauhan, 2012). Flexibility allows people to do more with technology in response to advanced services and requirements. Convenient technology that minimises the need for support is salient in facilitating conditions for mandatory e-government technology (Chan *et al.*, 2010). In this study, technology infrastructure readiness is evaluated in terms of connectivity, flexibility and convenience.

Connectivity: the ability of any technology component to attach to any of the other components inside and outside the organisational environment.

Flexibility: the ability to easily and readily diffuse or support a wide variety of hardware, software, communication technologies, data and core applications in the e-government environment.

Convenience: the citizen's insight of the time and endeavour essential to use an e-government technology.

Table 3.7 presents the various suggested evaluation metrics regarding the technology infrastructure readiness building blocks along with the corresponding conceptual measures.

Table 3.7 Conceptual measures of technology infrastructure readiness

Factors	Evaluation Metric	Conceptual measures	
Technological Infrastructure Readiness (Reliable internet connectivity, broadband speed- TIRCT1)	Connectivity	TIRCT2	Appropriate security systems to protect information
		TIRCT3	Appropriate security systems to protect online transactions
		TIRCT4	Internet ICT standards that comply with industry quality standards
	Convenience	TIRC1	E-government applications are convenient and benefits to use
		TIRC2	Response time of e-government applications is acceptable
		TIRC3	E-government applications do not request for too much information
	Flexibility	TIRF1	E-government applications are flexible to change
		TIRF2	E-government application response to service quality issues ease of use
		TIRF3	E- government applications accept input data in a simple format

3.2.1.4 Government readiness

Government readiness is the preparedness of government to integrate and coordinate data for smooth interaction among various e-services and applications. The importance of government readiness as a critical aspect of electronic government has already been stressed in other studies (Alghamdi *et al.*, 2011; Koh *et al.*, 2008). Strategic, system and data are the three levels that need to be addressed to transform a government organisation into a provider of fully integrated e-government services (Koh *et al.*, 2008). E-government is more effective with a comprehensive strategic plan and successful e-government requires carefully planned strategies aligned with business objectives (Chang *et al.*, 2006). To achieve a more synergistic value of e-government, data infrastructure is important and

without this e-government will remain fragmented and isolated. Data flows across functional boundaries are essential in system implementation for the coordination and integration of various e-government initiatives (Koh *et al.*, 2008). In the current study evaluation of government readiness is in terms of indicators related to strategy, system and data.

Strategy: the planning and alignment of internet activities with the business objectives for the preparedness for large-scale systemic change.

System: the coordination and integration of different internet applications across different functions and services.

Data Support: the organisation of data in a unified and standardised form that best enables robust and diverse third party use.

Table 3.8 presents the various suggested evaluation metrics of the government readiness building blocks along with the corresponding conceptual measures.

Table 3.8 Conceptual measures of government readiness (adapted from Koh *et al*., 2008)

Factors	Evaluation Metric	Conceptual measures	
Government Readiness (The municipality has strategic plans that govern all internet activities -GRST1; The municipality has clearly stated the objective of using the internet- GRST2)	Strategy	GRST3	The internet is an integral part of the municipality business plan
		GRST4	The internet strategies of the municipality are deliberately aligned with the strategic plans
		GRST5	The municipality provides initiatives and guidance to encourage e-government development process
		GRST6	The municipality provides allocation to training, procurement of ICT infrastructure and maintenance investment related to e-government
		GRST7	The municipality provides clear and sufficient e-government policy involving contractual arrangement and documentation
		GRST8	The municipality provides metrics and indicators for assessing investment and impact of e-government
		GRST9	Establishment of well–defined related inter municipality e-government strategies plan
	System	GRS1	The municipality carefully coordinates development of all internet applications
		GRS2	The municipality pays close attention to ensuring compatibility among internet applications
		GRS3	The municipality has a centralized function that oversees the development of all internet applications
		GRS4	The internet application at municipality are designed and developed to work with legacy systems
		GRS5	The municipality provides internet infrastructure and network coverage facilities to bridge digital divide
	Data support	GRD1	All internet applications within the municipalities can share data with other internet applications
		GRD2	All internet applications within the municipalities can share data with non-internet applications
		GRD3	All internet applications within the municipalities share standardized data
		GRD4	All government data within the municipalities are open source
		GRD5	All government data are provided in local contents

3.2.1.5 Supporting industry readiness

Supporting industry readiness refers to the measurement of the presence, development, service level and cost structure of support-giving institutions such as telecommunications, financial and IT industries whose activities might affect e-government services. The importance of industry readiness has been highlighted by several researchers (Alghamdi *et al.*, 2011; Azab *et al.*, 2009; Rahman, 2007; UNU (Ojo *et al.*, 2007); Ahmed and Hussein, 2006). Investments in infrastructure development by government and support giving agencies need to go hand-in-hand with business development for the successful e-readiness of industries (Molla and Licker, 2005). Sufficient and reliable services (Zakaria and Janom, 2011), technical support from the IT and logistics industries, and the ability of financial institutions to support electronic transactions are important in the context of readiness of industries. In our study, supporting industry readiness is evaluated in terms of services and transactions.

Services and transactions: the availability of reliable internet technology infrastructure and reliable logistic services and universal communication standards to support e-government services and transactions.

Table 3.9 presents the various suggested evaluation metrics of supporting industry readiness as building blocks along with the corresponding conceptual measures.

Table 3.9 Conceptual measures of supporting industry readiness (adapted from Zakaria and Janom, 2011)

Factors	**Evaluation Metric**	**Conceptual measures**	
Supporting Industry Readiness (Sufficient services involving the Internet and telecommunication infrastructure from ICT industry - SIRST1; Sufficient and reliable services and technical support from ICT industry- SIRST2)	Services and Transac-tions	SIRST3	Ability of courier and logistic industry to integrate e-government services and product delivery
		SIRST4	Ability of financial and commercial institutions to support secured technology infrastructure for e-government transactions
		SIRST5	Ability of qualified legal expertise to draw up a related e-government contracts and agreements

3.2.2 Target population

The target population is the collection of elements (i.e. people) from which information to be gathered to solve the research problem (Nel *et al.,* 2003). The study targeted government employees from all three categories (metropolitan, district and local) of municipality in Eastern Cape Province of South Africa. The rationale behind selecting government employees in the Eastern Cape was that this province was easily accessible by the researcher and government employees are in a good position to perceive e-government services and functions (Azab *et al.,* 2009). Since it is not possible to study the whole target population, researcher have to draw a sample that is, a subset of the target population called a sampling frame (Babbie, 1990).

3.2.3 Sampling frame and method

Baines and Chansarkar (2002) define a sampling frame as a list or means of representing the sampling units (i.e. items being measured or is available for measurement at some stage of the sampling process). The researcher thus obtained a list of municipalities of Eastern Cape Province and conveniently selected four municipalities: Buffalo City Metropolitan, Amathole District, Oliver Reginald Tambo (O R Tambo) District and King Sabata Dalindyebo (KSD) local). According to Diamantopoulos and Schlegelmilch (2006), there are various sampling methods that can be used to obtain a sample. Leedy and Ormrod (2005) add that often researchers overlook practical issues related to data availability or the availability of respondents. Taking into account the availability of the targeted respondents in various government departments from four municipalities of Eastern Cape Province, the researcher deemed random sampling to be adequate for this study to ensure sufficient data collection in order to meet the objectives of this study.

3.2.4 Instrument validity

The measurement instrument was distributed to the targeted respondents to solicit data for model validation. Conceptual measures as per Table 3.3, 3.4, 3.5, 3.6 and 3.7 were used to develop the measurement instrument to identify the critical factors that affect the readiness of municipal e-government. The measurement instrument used to collect data was

administered to the employees in the selected government departments of four municipalities (Buffalo City, Amathole, O.R Tambo and KSD) in Eastern Cape Province of South Africa.

According to Rigdon *et al*. (2010), the PLS method has the ability to handle heterogeneous data with a small sample size of not less than 100. However to increase the validity of the research result, 240 questionnaires were distributed to sampled government employees and were completed on the basis of availability and willingness to participate. Out of the 240 questionnaires, 225 were returned, although six were unusable as they were incomplete, leading to average response rate of 93.7%. This resulted in a sample size of 219 for this study.

3.2.5 Respondent demography

The first section of the survey sought information on the demographic profile of respondents, including their age, gender, experience with computers and e-government in order to help in the analysis of the questionnaire response (Table 3.10).

Table 3.10 Profile of respondents (N=219)

Characteristics	Category	Frequency	Percentage (%)
Age of respondent	16-25	5	2.30
	26-35	98	44.70
	36-45	59	26.90
	46-55	46	21.00
	>55	11	5.00
Gender of respondent	Female	95	43.40
	Male	124	56.60
Experience with computers	Never	3	1.40
	<1 Year	21	9.60
	<2 Year	34	15.50
	>2 Year	161	73.50
Experience with e-government	Never	73	33.30
	<1 Year	57	26.00
	<2 Year	38	17.40
	>2 Year	51	23.30
Internet access by computer	Never	13	5.90
	Yearly	5	2.30
	Monthly	11	5.00
	Weekly	44	20.10
	Daily	146	66.70
Internet access by mobile	Never	24	11.00
	Yearly	4	1.80
	Monthly	27	12.30
	Weekly	66	30.10
	Daily	98	44.70
Owning computers	No	84	38.40
	Yes	135	61.60
Residence location	Rural	72	32.90
	Township	89	40.60
	Urban	58	26.50
Municipality	O R Tambo	26	11.90
	King Sabata Dalindyebo	41	18.70
	Buffalo City	126	57.50
	Amathole	26	11.90

The analysis of demographic data reflects that a larger number of survey respondents were under the age group of 26-35 (44.7%) compared to other age groups: 16-35 (2.3%), 36-45 (26.9%), 46-55 (21.0 %) and >55 (5.0%). A higher number of respondents were male (56.6%) compared to female (43.4%). The majority of respondents resides in a township (40.6%). There were 32.9% of respondents from rural area and 26.5% of respondents from the urban area. A large number of respondents own computers (61.6%) while 38.4% of respondents do not own computers. The majority of respondents have more than two years' experience with computers (73.5%), 15.5% of respondents have more than 1 years' experience with computers, 9.6% of respondents have less than 1 year experience and only 1.4% of respondents stated that they never used computers. The majority of respondents are experienced with e-government (66.7%) while 33.3% of respondents have no experience with e-government. Among the experienced respondents, 23.3% of respondents have more than 2 years' experience with e-government, 17.4% of respondents have more than 1 years' experience with e-government and 26.0% have less than a year of experience with e-government.

Most of the survey respondents have access to the internet, whether it is through mobile phones or computers. 66.7% of respondents stated that they daily access the internet by computer, 20.1% of respondents weekly, 5% monthly and 2.3% yearly. Only 5.9% of respondents have never accessed the internet by computer. 44.7% of respondents stated that they daily access the internet by mobile on a daily basis, 30.1% weekly, 12.3% weekly and 1.8% yearly. Only 11% of respondents have never accessed the internet by mobile.

3.3 Data analysis

Analysis of the data was achieved through adopting the structural equation model-partial least squares (SEM-PLS) analytic technique, as employed in SmartPLS software. The structural equation models are methods of understanding relationships among various constructs that comprise and extend regression and factor analysis procedures (Bollen, 1989). SEM is a multivariate method that allows the simultaneous examination of the relationship among the exogenous (independent) latent variables and endogenous (dependent) latent variables within a model (Kline, 2011).

SEM was used for three main reasons based on Kelloway's (1998) suggestions. First, since this study used measures to represent constructs, SEM performs explicit tests of the excellence of the model as well as of specific parameters (e.g. factor loadings) comprising the model. SEM checks the extent to which the measures reflect the intended constructs. Second, since this study was principally concerned with the relationships among the measures, SEM techniques allow for the specification and testing of complex path models reflecting causal processes. Third, SEM allows a distinctive analysis that considers questions of both measurement and prediction. SEM offers a flexible and powerful means of simultaneously examining the excellence of measurement and assessing predictive relationships among constructs. In Cliff (1983) discussed the introduction of SEM techniques as a statistical revolution.

SEM techniques can be classified into covariance based SEM, which is implemented by AMOS software and component based SEM, which is generally called partial least square (PLS) that is implemented by SmartPLS software. Covariance based SEM requires that sample data under study be of normal distribution. In contrast, PLS makes no assumption about data distribution, so it can effectively work with unobservable factors and it takes measurement errors into consideration (Aibinu and Al-Lawati, 2010). Hence, PLS would appear to be superior to covariance based SEM because of its generality. PLS is certainly gaining more popularity as an alternative to covariance based SEM because of its ability to handle heterogeneous data with a small sample size (Rigdon *et al.*, 2010).

3.3.1 Reliability and validity

Since the proposed framework was derived from the literature, and the aim of the empirical research was to test this framework, it was important to verify the reliability and validity of the measures used in the study (Cronbach, 1951) to draw valid inferences from the research leading to theory building. Reliability was measured by the estimate of internal consistency and composite reliability. Individual item reliability is the extent to which the measurements of factors measured with multiple-item scale reflect the true score of the factors relative to the error (Hulland, 1999; Aibinu and Al-Lawati, 2010). The internal consistency of a factor estimates how consistently individuals respond to the items within a scale (Shin, 2009). Composite reliability is a measure of the overall reliability of a collection of heterogeneous, but similar items (Roca *et al.*, 2009). Composite reliability (CR) is estimated in terms of the

outer loading of an item to represent correlations between item and factor and is calculated as (Henseler *et al.,* 2009):

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum (1 - \lambda_i^2)} \qquad (3.1)$$

Internal consistency is calculated for the number of model items (N) and mean inter-correlation among items ($\bar{r}$) using Cronbach alpha (α). The Cronbach alpha measures how well a set of items or factors measures a single uni-dimensional factor and is calculated as (Cronbach, 1951):

$$\alpha = \frac{N - \bar{r}}{1 + (N - 1) - \bar{r}} \qquad (3.2)$$

Validity was measured by the estimate of convergent validity and discriminant validity of model factors. Convergent validity is the extent to which items of a factor represent the same factor (Fornell and Larcker, 1981). Discriminant validity indicates the extent to which a given factor differs from other factors (Pahnila and Warsta, 2010). Convergent validity is measured by average variance expected (AVE), which is calculated to determine the amount of variance that a factor captures from its measurement items and is calculated as (Henseler *et al.,* 2009) :

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum (1 - \lambda_i^2)} \qquad (3.3)$$

Discriminant validity is measured by calculating the Pearson product moment correlation between all pairs of factors. The Pearson product moment correlation r between factors x and y with means $\bar{x}$ and $\bar{y}$ respectively is calculated as (Spiegel, 1972):

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 (y_i - \bar{y})^2}} \qquad (3.4)$$

3.3.2 Model predictive power

The coefficient of determination (R^2) of a dependent factor and goodness of fit (GoF) is the criteria often used to assess the predictive power of a research model. R^2 is the amount of variation in a dependent factor that is explained by the research model and is computed as (Cornell and Berger, 1987):

$$R^2 = 1 - \frac{\sum (y_i - \bar{y})^2}{\sum (y_i - \bar{y})^2} \qquad (3.5)$$

where y_i is the i[th] observation of the dependent factor, x_i is the value of the independent factor at, which y_i is observed, $\overline{y_i}$ is the predicted responses at each point x_i obtained with a fitted regression equation and $\bar{y}$ is the mean of y_i. R^2 values of 0.67, 0.33 and 0.19 are respectively considered to be substantial, moderate and weak (Chin, 1998).

A global evaluation criterion for model quality is also assessed by GoF proposed by Tenenhaus *et al*. (2005). Its purpose is to account for the PLS model performance at both measurement and structural model focusing on the overall prediction performance of the model. The GoF is the geometric mean of the average communality index (CI) and average R^2, computed as (Tenenhaus *et al.,* 2005):

$$GoF = \sqrt{\overline{CI} * \overline{R^2}} \qquad (3.6)$$

In order to understand the contribution of each explanatory variable to the prediction of the dependent variable, the value of multiple R^2 is decomposed in terms of the multiple regression coefficient and correlations between the dependent variable and the explanatory ones as follows (Tenenhaus *et al.*, 2002):

$$R^2 = \sum_i \beta_i cor(y, x_i) \qquad (3.7)$$

Where β_i is the path coefficient between the dependent factor y_i and independent factor x_i

3.3.3 Moderating effect

The test for moderating effect can be assessed by determining its strength or effect size and then testing for its significance. The effect size of f^2 is calculated in terms of $R^2(i)$ (R^2 included) with moderating effects and $R^2(e)$ (R^2 excluded) with main effect as (Helm *et al.*, 2010):

$$f^2 = \frac{R^2(i) - R^2(e)}{1 - R^2(i)} \qquad (3.8)$$

The effect size is considered large, medium and small if greater than 0.35, 0.15 and 0.02 respectively (Cohen, 1988). The significance of the effect size is tested using the F-test as (Aibinu and Al-Lawati, 2010):

$$F = (f^2)(N - m - 1) \qquad (3.9)$$

Where N is the number of the sample size, m is the number of the latent variable for the dependent variable.

Analysis in PLS path modeling does not address the problem of heterogeneity and thus leads to ambiguous PLS path modeling results (Esposito Vinzi *et al.,* 2007). This limitation leads to the next phase of this study which uses finite mixture partial least squares (FIMIX-PLS) to identify and effectively treat unobserved heterogeneity in the path model by segmentation.

3.4 Unobserved heterogeneity

In order to achieve the third objective, this study applied FIMIX-PLS to uncover the unobserved heterogeneity in government employees while measuring e-government readiness. Traditional structural equation Model (SEM) assumes homogeneity across an entire population: data is treated as if it was collected from a single population. In many real-world applications, this assumption of homogeneity is often unrealistic, as individuals are likely to be heterogeneous in their perceptions and evaluation of latent constructs. Because of undetected heterogeneity in data samples, researchers' conclusions can be seriously misleading and result in flawed inferences and management implications (Sarstedt and Ringle, 2010). Uncovering unobserved heterogeneity in structural equation modeling (SEM) has been studied for several years in the past (Sarstedt *et al.,* 2011). Nonetheless, only recently have researchers demonstrated that PLS-PM results and their interpretation can be misleading if unobserved heterogeneity affects inner model estimates (Sarstedt and Ringle, 2010; Sarstedt *et al.,* 2009). Previous publications on PLS-PM largely ignored this critical issue (Sarstedt *et al.,* 2009).

Presently, researchers have proposed various methods for class detection that hold substantial promise for segmentation in PLS-PM (Sarstedt *et al.,* 2011). However, FIMIX-PLS is the main choice for segmentation tasks within a PLS context (Sarstedt, 2008b). The

method permits the simultaneous estimation of model parameters and segment affiliations of observations (Sarstedt *et al.*, 2011). Empirical studies (Sarstedt *et al.*, 2009; Hahn *et al.*, 2002) also show that FIMIX-PLS has valuable features for further distinguishing and specifying the findings and interpretation of PLS-PM analyses.

Response based segmentation using the FIMIX-PLS has recently received increased research attention in marketing and managerial disciplines (Sarstedt *et al.*, 2009). But the problem of heterogeneity has been rarely applied in the technology and information systems context. In the internet banking context, FIMIX-PLS has been applied for example by Loureiro and Miranda (2011) to capture the heterogeneity in PLS-PM of brand awareness or associations, perceived quality, internet banking trust, internet banking brand equity, and brand loyalty. This approach enabled them to identify two segments of customers that resulted in heterogeneity within the inner model. Recently, FIMIX-PLS has been applied by Halilovic and Cicic (2013) for identification of distinctive customer segments amongst those using Information Systems (IS). In this study, segmentation of IS was made on the basis of cognitive beliefs and affect which influence one's intention to continue using IS, and two different segments of users were derived.

Very few studies have reported on the effect and treatment of heterogeneity caused by unobserved factors or items, even though a number of studies have reported on the application of PLS in e-government readiness context. This study, therefore, applies FIMIX-PLS to uncover heterogeneity in government employees in validating an e-government readiness framework and to find the factors which best characterise the different segments of government employees perception on e-government readiness.

There are several PLS-based methods to uncover heterogeneity using segmentation and examples include decision tree structure (PATHMOX), distance measure based PLS topological path modeling (PLS-TPM), response based detection of segments in PLS (REBUS), fuzzy PLS path modeling for latent classification detection (FPLS-LCD), PLS genetic algorithm segmentation (PLS-GAS), finite mixture PLS (FIMIX-PLS) and PLS prediction oriented segmentation (PLS-POS) (Sarstedt 2008a). However Sarstedt (2008b) presents a theoretical review of available segmentation procedures and concludes that FIMIX-PLS is the primary choice for segmentation tasks within PLS context.

The application of FIMIX-PLS requires four key steps (Sarstedt and Ringle, 2010). The first step of FIMIX-PLS is to perform an estimate of a path model using the PLS algorithm and empirical data for manifest variables in the outer model. The resulting latent variables (LV) scores in the inner path model are used to execute the FIMIX-PLS in the second step. The FIMIX-PLS captures the segment specific heterogeneity of the path model, which is concentrated on the estimated relationships between latent variables. The FIMIX-PLS then calculates the probability of each of the predetermined K number of segments. FIMIX-PLS then calculates the probability of each of the predetermined K number of segments. The mixing proportion determines the relative size of segments k (k=1, 2,.. K) with each positive and all summing to unity. The segment specific distribution function is defined, assuming that each endogenous LV is distributed as a finite mixture of conditional multivariate normal densities as (Sarstedt *et al.,* 2011; Sarstedt *et al.,* 2009):

$$\eta_i = \sum_{k=1}^{K} \pi_k \left(\frac{|B_k|}{(2\pi)^{M/2}\sqrt{|\psi_k|}} \right) \exp\left(-\frac{1}{2}(B_k\eta_i + \Gamma_i\xi_i)'\psi_k^{-1}(B_k\eta_i + \Gamma_i\xi_i) \right) \qquad (3.10)$$

where, ξ_i is an exogenous variable vector in the inner model in respect of observation i, B_k is the path coefficient matrix of the endogenous variable and Γ_k of the exogenous LVs, ψ_k is the matrix of each segment regression variances of the inner model on the diagonal and zero else and M is the number of endogenous LV in the inner model.

The critical decision problem, which remains unresolved in the application of FIMIX-PLS segmentation, is regarding the number segments to retain from the data. This decision is crucial as decision makers rely on it for strategic decision making (Sarstedt and Ringle 2010). This problem is often referred to as model selection. Various tests and heuristics have been proposed to determine the number of segments. A heuristic approach in the form of model selection criteria is frequently used to determine the number of segments that can be categorised into information and classification criteria. In keeping with a substantive theory, a combination of criteria is used by researchers to guide their decision on the number of segments (Sarstedt *et al.,* 2011). The most widely used information criteria include Akaike information criterion (AIC) (Akaike 1973), consistent AIC (CAIC) (Bozdogan 1987), modified (AIC) with factor 3 (AIC3) (Bozdogan 1994), Bayes information criterion (BIC) (Schwarz, 1978) and classification criteria include normed entropy statistic (EN) (Ramaswamy *et al*., 1993).

This study applies CAIC criterion as this criterion is very promising to determine the correct number of segments (Sarstedt *et al.*, 2011). This study also applies the EN, which is a critical classification criterion for analysing whether segment specific FIMIX-PLS results produce well separated clusters (Sarstedt *et al.*, 2011). The EN criterion indicates the degree of all observations' classification and their estimated segment membership probabilities P_{ik}. In addition, it reveals the most appropriate number of latent segments for a clear-cut FIMIX-PLS segmentation:

$$EN_k = 1 - \frac{\left(\sum_{i=1}^{I} \sum_{k=1}^{K} - P_{ik} \ln(P_{ik}) \right)}{I \ln(K)} \qquad (3.11)$$

The EN ranges between 0 and 1, wherein the quality of the classification is commensurate with the increase in EN_k. The more the observations exhibit high membership probabilities, for example, higher than 0.7, the better they uniquely belong to a specific class and can be properly classified using high EN values. The applications of FIMIX-PLS reveal that EN values above 0.5 results in estimates of P_{ik} that allow unambiguous or fuzzy segmentation (Sarstedt *et al.*, 2009, Sarstedt and Ringle 2010).

In the next step, a subsequent ex-post analysis aims to determine the factors that lead to segments similar to the ones obtained by FIMIX-PLS. The new segments are then used in the third step to calculate segment specific or local models whose model parameters can be compared by means of PLS multi-group comparison procedures. The t-test parametric analysis is employed to determine if segments are statistically different from each other. The t-test statistic approach is based on whether the standard errors of the path estimators in the compared segments are equal or not. If they are equal, the t-test statistic is computed as (Eberl, 2010):

$$t = \frac{Path_{segment1} - Path_{segment2}}{\sqrt{\left[\frac{(m-1)^2}{(m+n-2)} * S.e^2._{segment1} + \frac{(m-1)^2}{(m+n-2)} * S.e^2._{segment2} \right]} * \left[\sqrt{\frac{1}{m} + \frac{1}{n}} \right]} \qquad (3.12)$$

Where:

Path Segment1 and 2	estimate for the path coefficient in both segments respectively
M	number of cases in segment 1
N	number of cases in segment 2

S.e. sample 1/2 standard error of the path coefficient in both segments respectively (gained from the re-sampling)

However should there be evidence of the standard errors' inequality in the two segments, the t-test statistic is computed as (Eberl 2010):

$$t = \frac{Path_{segment1} - Path_{segment2}}{\sqrt{S.e^2._{segment1} + S.e^2._{segment2}}} \quad (3.13)$$

3.5 Summary

This chapter explained the methodology followed in this study. First, it presented the result of the scoping review methodological analysis to identify the factors that affect readiness of e-government. Next, the chapter described the explanation of a preliminary framework that was developed based on the relevant literature. The chapter highlighted the corresponding constructs of each of the five factors of the framework: supporting e-services readiness, individual citizen readiness, technological infrastructure readiness, government readiness and supporting industry readiness. The next steps involved in data analysis were discussed followed by the steps to uncover the unobserved heterogeneity. The next chapter presents an analysis of the data and discussion of the results.

Chapter 4: Empirical Results

This chapter presents the experimental results of the developed framework for e-government readiness measurement using partial least squares (PLS) approach. The PLS results of the structural model are first presented to discover the critical factors that influence e-government readiness for the case of municipal government (Objective 2). Secondly the finite mixture partial least squares (FIMIX-PLS) data clustering method is used to uncover unobserved heterogeneity amongst government employees in validating the e-government readiness framework model (Objective 3).

4.1 Critical factors influencing e-government readiness

In order to identify critical factors influencing e-government readiness as tested for municipalities case using standard PLS, the validity of all factors used in the readiness framework are verified using confirmatory factor analysis (CFA). Individual item reliability analysis, convergent validity and discriminant validity are used to evaluate the adequacy of the model of relationship between the latent variables and the items measuring them. This is achieved by observing the item loadings, Cronbarch's alpha, composite reliability (CR) and average variance expected (AVE) value to determine if they meet the minimum requirements.

The predictive power of the research model of this study was determined after the estimation of model quality, which was assessed in terms of reliability and validity metrics. Equations 3.1 to 3.4 as presented in Chapter 3 can manually be used for this purpose. However, to achieve greater efficiency, it was performed using SmartPLS Version 2.0 software to test the quality of the research model of this study. For the CFA analysis, all measured items were specified as reflective indicators of their corresponding factors and each factor was allowed to co-vary freely with all other factors. The raw dataset was used as input to the PLS software and path significances were estimated using the bootstrapping re-sampling technique with 500 sub-samples.

The developed framework for e-government readiness was validated by applying the following six methods in the Standard PLS statistical analysis, namely: item reliability and validity; factor reliability and validity; research model predictive power; goodness of fit (GoF) index; direct effect and effect size. To capture the unobserved heterogeneity in path modeling, FIMIX-PLS was applied with the following four steps: apply the standard PLS path model to provide the path model estimate on the aggregate data level; identification of a number of segments; selection of an explanatory variable for the segmentation, and; segment specific estimation of the PLS path model for the evaluation and interpretation of the segment specific PLS results.

4.1.1 Item reliability and validity

The purpose of measurement item reliability analysis is to identify low reliability items by evaluating their item loadings. Confirmatory factor analysis (CFA) was performed using SmartPLS 2.0 software to test the quality of the research model. For the CFA analysis, all measured items were specified as reflective of their corresponding factors and each factor was allowed to co-vary freely with all other factors. The raw dataset was used as input to the PLS software and path significances were estimated using the bootstrapping re-sampling technique with 500 sub-samples. Bootstrapping is a procedure that is used in PLS to provide confidence intervals for all parameter estimates building the basis for statistical inference (Henseler *et al.,* 2009).

Table 4.1 shows the results of confirmatory factor analysis, wherein it can be seen that factor loadings are significant at $p < 0.05$ and exceeded 0.50, with a minimum loading of 0.57 for support item SEOU2. This implies that all items demonstrate a satisfactory level of individual item reliability and the loadings are all statistically significant. Researchers have accepted items with a significant loading of 0.50 (Pahnila and Warsta, 2010; Hair *et al.,* 2006; Chin, 1998).

Table 4.1 Confirmatory factor analysis

Item	Item Mean	Item Std Dev	Item Loading	Item	Item Mean	Item Std Dev	Item Loading	Item	Item Mean	Item Std Dev	Item Loading
GRD1	2.73	1.59	0.89	ICRC5	2.82	1.67	1.00	SEOU8	1.81	1.31	0.69
GRD2	2.65	1.47	0.92	ICRC6	2.73	1.56	0.92	SEOU9	2.48	1.38	0.64
GRD3	2.64	1.42	0.93	ICRC7	2.79	1.53	0.91	SEOU10	2.61	1.45	0.72
GRD4	2.42	1.40	0.79	ICRM1	3.01	1.63	0.88	SEOU11	3.25	1.80	0.70
GRD5	2.46	1.39	0.83	ICRM2	2.84	1.46	0.90	SEOU12	3.89	2.01	0.65
GRS1	2.77	1.59	0.89	ICRM3	2.96	1.47	0.89	SEOU13	2.63	1.64	0.66
GRS2	2.77	1.38	0.93	ICRM4	2.70	1.38	0.91	SEOU14	2.14	1.50	0.79
GRS3	2.55	1.44	0.93	ICRM5	2.79	1.49	0.88	SEOU15	2.25	1.50	0.80
GRS4	2.54	1.43	0.90	PRS1	3.03	1.67	0.91	SEOU16	2.10	1.32	0.74
GRS5	2.56	1.46	0.88	PRS2	3.05	1.62	0.93	SEOU17	2.17	1.39	0.72
GRST1	2.86	1.62	0.98	PRS3	3.03	1.63	0.91	SETU1	2.40	1.53	0.82
GRST2	2.98	1.60	0.98	PRS4	2.97	1.60	0.93	SETU2	2.37	1.32	0.77
GRST3	3.05	1.60	0.85	PRS5	2.99	1.69	0.90	SETU3	2.38	1.49	0.85
GRST4	2.95	1.53	0.91	SEIU1	2.51	1.53	1.00	SETU4	2.22	1.34	0.86
GRST5	2.87	1.52	0.90	SEIU2	2.51	1.45	0.74	SETU5	2.25	1.39	0.89
GRST6	2.75	1.49	0.90	SEIU3	2.05	1.33	0.78	SETU6	2.51	1.70	0.71
GRST7	2.63	1.43	0.91	SEIU4	1.92	1.28	0.77	SETU7	2.58	1.75	0.72
GRST8	2.42	1.41	0.83	SEIU5	2.36	1.42	0.69	SIRST1	3.06	1.60	0.96
GRST9	2.49	1.48	0.83	SEIU6	1.87	1.31	0.65	SIRST2	2.96	1.54	0.96
ICRA1	2.42	1.46	0.82	SEIU7	2.86	1.74	0.71	SIRST3	2.74	1.48	0.94
ICRA2	2.34	1.38	0.85	SEIU8	1.64	1.05	0.69	SIRST4	2.65	1.46	0.93
ICRA3	2.37	1.28	0.89	SEIU9	1.55	1.00	0.75	SIRST5	2.62	1.43	0.92
ICRA4	2.38	1.33	0.90	SEIU10	1.53	1.05	0.71	TIRC1	3.14	1.75	0.93
ICRA5	2.46	1.41	0.88	SEIU11	1.70	1.33	0.67	TIRC2	3.11	1.67	0.96
ICRA6	2.35	1.37	0.90	SEIU12	1.94	1.29	0.65	TIRC3	3.16	1.69	0.93
ICRA7	2.33	1.35	0.90	SEOU1	2.55	1.59	0.74	TIRCT1	3.66	2.04	1.00
ICRA8	2.31	1.38	0.90	SEOU2	1.69	1.18	0.57	TIRCT2	3.39	1.86	0.96
ICRA9	2.26	1.36	0.86	SEOU3	1.71	1.25	0.62	TIRCT3	3.30	1.76	0.96
ICRC1	2.73	1.55	0.91	SEOU4	1.58	1.19	0.59	TIRCT4	3.24	1.72	0.94
ICRC2	2.82	1.54	0.95	SEOU5	1.88	1.40	0.66	TIRF1	2.93	1.56	0.93
ICRC3	2.84	1.60	0.93	SEOU6	1.74	1.16	0.70	TIRF2	2.86	1.47	0.97
ICRC4	2.50	1.46	0.89	SEOU7	1.73	1.30	0.66	TIRF3	2.88	1.51	0.96

Measurement item validity was assessed using Chin's (1998) cross factor loading technique. This method prescribes a requirement for measurement items to load higher on one factor than the scale items for other factors and for no cross-loading to occur. As part of item validity testing, cross factor loading are used to determine whether measurement items can discriminate between factors being studied from other similar factors (Leedy, 1997). Discriminant validity results are thus computed with SmartPLS software version 2.0 using path weighting scheme (see Appendix B). All items measuring a particular factor loaded higher in their respective factor as compared to other factors. It can therefore be concluded that this study's measurement items were all discriminate valid.

4.1.2 Factor reliability and validity

The purpose of measuring factor reliability is to check model internal consistency. Traditionally, it is measured with Cronbach's α (Cronbach, 1951) which provides an estimate of reliability based on the item inter-correlations. However, PLS provides a better measure of internal consistency through composite reliability (CR) which uses the item loading obtained within the research model (Aibinu and Al-Lawati, 2010). Equations 3.1 and 3.2 as presented in Chapter 3 were used to estimate composite reliability and Cronbach's α. Table 4.2 shows the result of scale properties in which all items are composite reliable as they exceed the benchmark of 0.70 (Pahnila and Warsta, 2010).

Table 4.2 Scale Properties

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Awareness	1.00																		
2. Citizen	0.68	1.00																	
3. Competency	0.77	0.89	1.00																
4. Connectivity	0.68	0.61	0.68	1.00															
5. Convenience	0.71	0.63	0.69	0.81	1.00														
6. Data	0.69	0.49	0.51	0.66	0.70	1.00													
7. Flexibility	0.66	0.59	0.62	0.70	0.85	0.69	1.00												
8. Government	0.70	0.54	0.60	0.70	0.74	0.69	0.71	1.00											
9. Industry	0.59	0.58	0.59	0.64	0.67	0.68	0.61	0.68	1.00										
10. Information	0.51	0.35	0.38	0.47	0.49	0.58	0.48	0.45	0.45	1.00									
11. Motivation	0.63	0.53	0.61	0.70	0.72	0.70	0.70	0.58	0.67	0.51	1.00								
12. Operation	0.63	0.48	0.52	0.57	0.56	0.61	0.55	0.55	0.51	0.74	0.58	1.00							
13. Readiness	0.67	0.62	0.67	0.72	0.73	0.63	0.67	0.74	0.71	0.48	0.62	0.55	1.00						
14. Service	0.45	0.30	0.35	0.45	0.50	0.44	0.49	0.47	0.41	0.64	0.52	0.52	0.46	1.00					
15. Strategy	0.75	0.58	0.63	0.71	0.77	0.75	0.75	0.87	0.70	0.54	0.62	0.64	0.79	0.44	1.00				
16. System	0.70	0.52	0.55	0.69	0.74	0.85	0.72	0.80	0.68	0.55	0.62	0.64	0.72	0.49	0.84	1.00			
17. Technology	0.67	0.60	0.70	0.84	0.77	0.59	0.68	0.69	0.62	0.34	0.65	0.47	0.67	0.46	0.67	0.61	1.00		
18. Transaction	0.61	0.51	0.57	0.54	0.59	0.56	0.54	0.55	0.53	0.65	0.58	0.67	0.59	0.59	0.57	0.57	0.52	1.00	
19. Transactions	0.63	0.47	0.49	0.61	0.65	0.79	0.62	0.61	0.83	0.58	0.66	0.58	0.67	0.43	0.71	0.71	0.55	0.53	1.00
Internal consistency (α)	0.96	1.00	0.96	0.96	0.93	0.92	0.95	0.95	0.91	0.91	0.94	0.93	0.95	1.00	0.95	0.95	1.00	0.91	0.92
Composite reliability (CR)	0.97	1.00	0.97	0.97	0.96	0.94	0.97	0.98	0.96	0.92	0.95	0.94	0.96	1.00	0.96	0.96	1.00	0.93	0.95
Convergent validity (AVE)	0.77	1.00	0.85	0.93	0.88	0.76	0.91	0.96	0.92	0.51	0.79	0.50	0.84	1.00	0.77	0.82	1.00	0.65	0.87

Factor validity was assessed through the analysis of the average variance extracted (AVE) which must exceed 0.50 for each factor to be valid (Bhattacherjee and Sanford, 2009; Fornell and Larcker, 1981; Pahnila and Warsta, 2010). The results calculated using equation (3.3) as presented in Chapter 3 is shown in Table 4.3. All factors exhibited AVE value >0.50 with the smallest AVE values 0.50 for operational e-services, which was equal to the desired minimum of 0.50. In addition, after applying Nunnally and Bernstein's (1994) benchmark for Cronbach's α (0.7), all constructs showed good reliability with a minimum value being 0.91 for technology, informational e-service and industry factors. These findings reveal that there is convergent validity and good internal consistency in the measurement model. This leads to the fact that the measurement items of each latent variable measure them well and is not measuring another latent variable in the research model. In addition discriminant validity is assessed using the cross-loading criterion which states that an indicator's loading should be higher than all of its cross loadings (Hair *et al.*, 2011). Appendix B shows that all items measuring a particular factor loaded higher in their respective factor as compared to other factors. Hence, all criteria for factor validity are met.

4.1.3 Model predictive power analysis

The predictive power (R^2) of the research model was estimated after the determination of reliability and validity. The predictive power was calculated using equation 3.5 as presented in Chapter 3. Figure 4.1 shows the R^2 values of citizen readiness (0.79), government readiness (0.77), industry readiness (0.69), supporting e-services (0.46), technology (0.73) and overall municipal readiness (0.68). The predictive power of 0.68 for overall municipal readiness indicates 68% of the e-government readiness as a result of all five independent factors. This result suggests that the model fit to data is at an acceptable level for all independent factors.

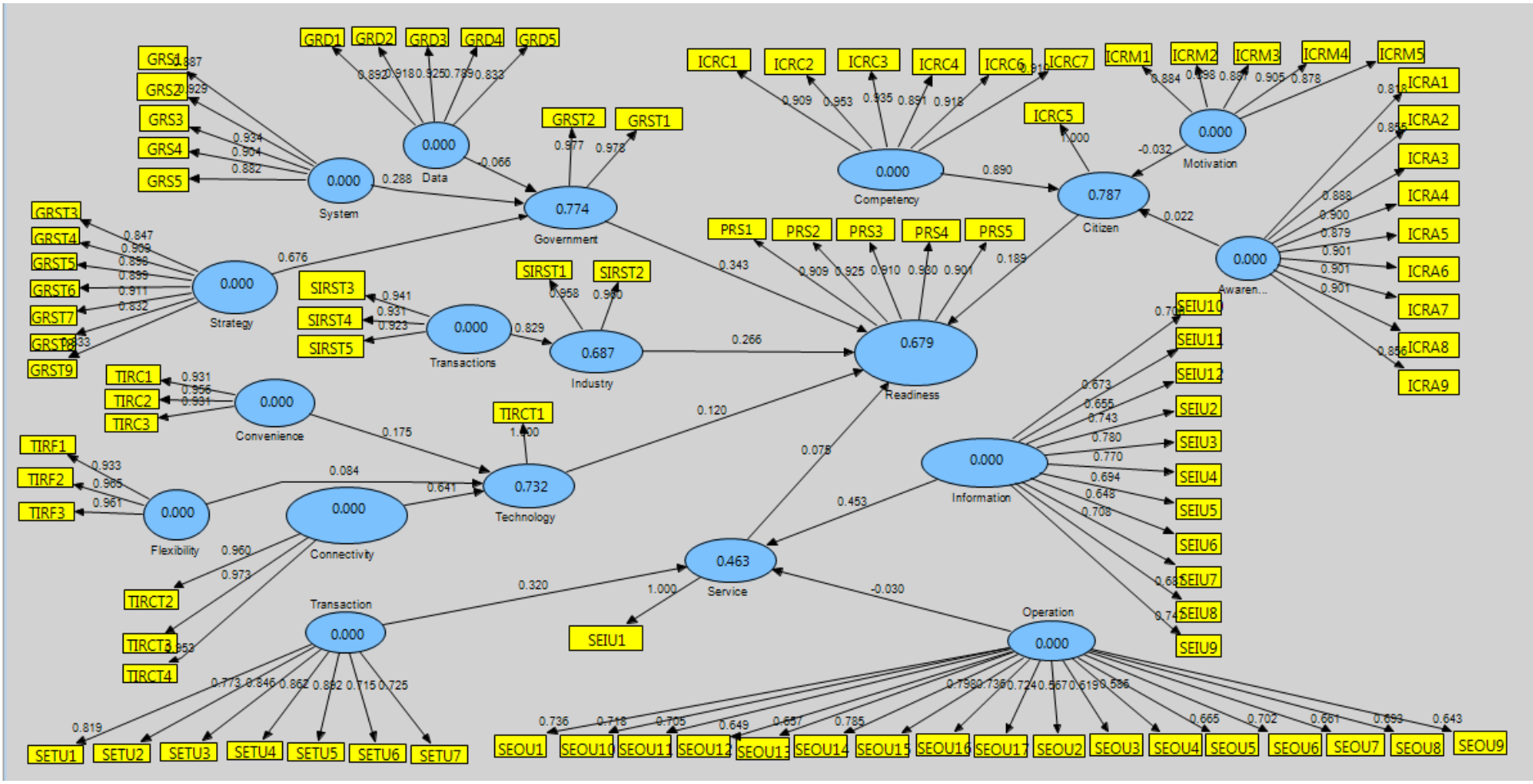

Figure 4.1 Structural model estimation

A global evaluation criterion for model quality is assessed through the goodness of fit (GoF) index proposed by Tenenhaus *et al*., (2005). The intention is to account for the PLS model performance at both the measurement and structural model with a focus on the overall prediction performance of the model. The GoF index is obtained as the geometric mean of the average commonality index (CI) and the average R^2 value calculated in equation (3.6) as presented in Chapter 3. The results showed an overall 0.81 goodness of fit.

The R^2 value of 0.68 for e-government readiness is very satisfactory taken into account the complexity of the model. The value of R^2, in the case of standardized variables, may be decomposed in terms of the multiple regression coefficient and correlations between the dependent variable and the explanatory variables in equation 3.7 as presented in Chapter 3. The decomposition allows understanding the contribution of each explanatory variable to the prediction of the dependent one. Table 4.3 shows the contribution of each explanatory variable to the prediction of framework for e-government readiness. The results show that government readiness is the most significant variable in the prediction of framework for e-government readiness contributing to 37.62 % of the R^2 followed by industry readiness (27.97%) and citizen readiness (17.34%). Technology readiness and supporting e-services contributes 11.90 % and 5.08 % of R^2 respectively.

Table 4.3 Contribution of each explanatory variable

Explanatory variable for e-government Readiness	$\widehat{\beta}_j$	**Correlation**	**Percentage %**
Citizen readiness	0.189	0.62	17.34%
Government readiness	0.343	0.74	37.62%
Industry readiness	0.266	0.71	27.97%
Supporting e-service	0.075	0.46	5.08%
Technology readiness	0.120	0.67	11.90%

4.1.4 Direct effect

In order to establish the robustness of the research model developed in this study, the direct effects of citizen readiness, supporting e-services, government readiness, industry readiness

and technology readiness on the research model were tested. The path coefficient, standard deviation and t-value were obtained using the SmartPLS 2.0 bootstrapping procedure.

Table 4.4 shows that citizen readiness directly influenced e-government readiness with an estimated path coefficient of 0.19, t-value of 2.77 and p-value of 0.006. This indicates that citizen readiness has a direct impact on the readiness of e-government. For the path between government readiness and the e-government readiness, this study estimated a path coefficient of 0.34, t-value of 3.70 and p-value of 0.0003. This shows that readiness of e-government is greatly supported by the readiness of government. Industry readiness directly influenced e-government readiness with an estimated path coefficient of 0.27, t-value of 3.21 and p-value of 0.0015. This indicates the influence of industry readiness on e-government readiness. Supporting e-services was not found to influence e-government readiness with an estimated path coefficient of 0.08, t-value of 1.49 and p-value of 0.1385. This means that supporting e-services has no direct impact on e-government readiness. Results also reveal that there was no direct relation of technology readiness to e-government readiness with a path coefficient of 0.12, t-value of 1.84 and a p-value of 0.066. This means that technology readiness is not directly supporting e-government readiness.

Table 4.4 Test of direct path coefficients

Path	Path coefficient	Stded	t-value	p-value
Citizen -> Readiness	0.19	0.07	2.77	0.006 *
Government -> Readiness	0.34	0.09	3.70	0.0003 **
Industry -> Readiness	0.27	0.08	3.21	0.0015 *
Service -> Readiness	0.08	0.05	1.49	0.1385
Technology -> Readiness	0.12	0.06	1.84	0.066

** p-value < 0.001; *p-value < 0.05

4.1.5 Effect size of independent factors

Table 4.5 illustrates the effect size of the corresponding independent factors of each endogenous latent construct which is calculated using the equation (3.8) and (3.9) as presented in Chapter 3. The result shows that 'government readiness' (f^2=0.15) and 'supporting industry' (f^2=0.10) have medium effect size on the overall readiness of e-government while 'citizen readiness' (f^2=0.06) has small to medium effect size. The effect size of 'technology readiness' (f^2=0.02) is small but supporting e-services resulted in an

effect size of (f^2= 0.01) less than the smallest benchmark of 0.02 (Cohen, 1988). Of the five factors of overall municipal e-government readiness, the effect sizes of all factors are significant.

Table 4.5 Effect Size (f^2) of independent factors

Factors	R^2	R^2	Effect size (f^2)	Inference	F	p-value
	Included	Excluded				
Citizen readiness	0.68	0.66	0.06	Small to medium effect	12.95	0.0001 **
Government readiness	0.68	0.63	0.15	Medium effect	31.21	0.0001 **
Industry readiness	0.68	0.65	0.10	Medium effect	21.11	0.0001 **
Supporting e-services readiness	0.68	0.68	0.01	Less than smallest effect	2.79	0.0416 *
Technology readiness	0.68	0.67	0.02	Small effect	4.18	0.0067 *

** p-value < 0.0001; *p-value < 0.05

The effect size comparison result reveals a consistent effect size of each of the e-government readiness factors on the R^2 values of this study's research model.

4.2 Heterogeneity test

In an attempt to ensure that the results on the aggregate data level are not affected by unobserved heterogeneity in the inner path model estimates, this study exploits the capabilities of finite mixture (FIMIX-PLS) to uncover such differences in the sample data (Equation 3.10 to 3.12). The FIMIX-PLS module of Smart PLS 2.0 was applied to segment the sample based on the estimated scores for factors. In this case the number of segments is unknown and the identification of an appropriate number of K classes is not straightforward (Ringle *et al.,* 2005). Hahn *et al*. (2002) proposed a heuristic approach where FIMIX-PLS is operated with consecutive numbers of latent classes K (K=1, 2, .., 10) and to compare the class-specific outcomes for criteria such as the log likelihood AIC, CAIC and BIC. Table 4.6 shows this result to establish comparisons for different numbers of classes.

Table 4.6 FIMIX-PLS evaluation criteria, maximum iteration and relative segment sizes

K	Maximum Iteration	Akaike information criterion (AIC)	Bayesian Information criteria (BIC)	Consistent AIC (CAIC)	Normed entropy statistic (EN)	Relative segment size			
						s=1	s=2	s=3	s=4
2	200	2141.60	2307.67	2307.89	0.65	0.31	0.69		
	400	2038.39	2204.45	2204.68	0.72	0.68	0.32		
	600	**2036.83**	**2202.89**	**2203.12**	**0.73**	**0.70**	**0.30**		
	800	2038.39	2204.45	2204.68	0.72	0.68	0.32		
3	200	2076.90	2327.69	2328.03	0.67	0.22	0.68	0.10	
	400	2093.43	2344.23	2344.56	0.67	0.33	0.47	0.21	
	600	2075.08	2325.87	2326.21	0.67	0.31	0.20	0.49	
	800	2013.47	2264.26	2264.60	0.79	0.59	0.16	0.25	
4	200	1976.49	2312.01	2312.46	0.82	0.57	0.19	0.06	0.17
	400	2027.61	2363.13	2363.58	0.80	0.45	0.42	0.08	0.04
	600	2014.95	2350.47	2350.92	0.77	0.31	0.27	0.04	0.38
	800	2028.65	2364.17	2364.62	0.79	0.15	0.24	0.05	0.56

In this study, the FIMIX-PLS results were computed for two, three and four classes to determine the adequate model. The adequate model i.e. the number of segments, was chosen according to the minimum value of CAIC measures, which has been substantiated as working well with FIMIX-PLS (Sarstedt *et al.*, 2011). According to the results in Table 4.6, the choice of two classes with 600 maximum iteration sizes seems to be appropriate for e-government users' segmentation purposes, especially in terms of CAIC. It can been seen that the CAIC value generally increases as the number of classes increases and as compared to other classes the choice of two classes exhibits the lowest CAIC of 2203.12. In addition the EN result of 0.73 also reaches a proper level indicating well separable groups of data (Sarstedt *et al.,* 2011).

In the next step of FIMIX-PLS, the observations were assigned to each segment according to the segment membership's maximum probability. The first segment represents 70% of the sample and the second segment 30%. Subsequently, each segment was analysed separately by applying the standard PLS-PM algorithm to each set of data. Before evaluating goodness of fit measures and inner model relationships, all segment based path

model estimation were tested for validity and reliability. Path coefficients were tested for significance by means of a bootstrapping procedure with 500 resample of construct level sign change and the number of cases equal to the original sample size. In all cases standard errors of path estimates were not equal hence equation (3.13) as presented in Chapter 3 was used for multi-segment path comparison. The global data model and FIMIX-PLS results are presented in Table 4.7.

Table 4.7 Path coefficient and GoF measures

Path	Global	FIMIX-PLS		T[mgp]
		K=1	K=2	K=1 and K=2
Awareness -> Citizen	0.06	0.09	-0.11	2.13 *
Citizen -> Readiness	0.18 *	0.18 *	0.220 *	-0.35
Competency -> Citizen	0.89 ***	0.84 ***	0.97 ***	-1.21
Connectivity -> Technology	0.64 ***	0.76 ***	0.56 **	1.13
Convenience -> Technology	0.18 *	0.23	0.12	0.69
Data -> Government	-0.08	-0.08	-0.11	0.29
Flexibility -> Technology	0.1	-0.11	0.26 *	-2.52 *
Government -> Readiness	0.35 **	0.41 ***	0.29	0.63
Industry -> Readiness	0.27 *	0.28 *	0.29 *	-0.06
Information -> Service	0.44 ***	0.39 **	0.46 **	-0.45
Motivation -> Citizen	-0.04	-0.08	0.07	-1.92 *
Operation -> Service	-0.08	0.26	-0.15	2.40 *
Service -> Readiness	0.07	0.08	0.08	-0.07
Strategy -> Government	0.68 ***	0.78 ***	0.62 ***	1.17
System -> Government	0.29 *	0.2	0.34 *	-0.75
Technology -> Readiness	0.12	0.16 *	0.11	0.41
Transaction -> Service	0.32 ***	0.17	0.44 **	-1.48
Transactions -> Industry	0.83 ***	0.84 ***	0.82 ***	0.28
R^2 Citizen	0.79	0.74	0.84	
R^2 government	0.77	0.82	0.74	
R^2 Industry	0.69	0.70	0.68	
R^2 Readiness	0.68	0.77	0.61	
R^2Services	0.46	0.45	0.53	
R^2 Technology	0.73	0.80	0.70	
GoF	0.81	0.82	0.81	

*** p<0.0001, **p<0.001 and *p<0.05. T[mgp]=t-value for multi group comparison

The final step of FIMIX-PLS involves the identification of certain factors or items to form and characterize the two uncovered government employees segments using demographic indicators. Statistical Package for Social Science (SPSS) software was used for this analysis. The analysis reveals that internet access by computer is the principal difference that characterizes the uncovered segments. The result is shown in Table 4.8 wherein it can be seen that in segment two, the majority of participants rarely access internet by computer. In segment one, 30.63 % of participants access the internet by computer whereas only 24.07 % of participants in segments two access the internet by computer. Segment one comprises government employees who access the internet by computer more frequently than segment two. It can be concluded that the two segments differ based on their internet accessibility using computer and this marks the basis of segmentation of observations.

Table 4.8 Descriptive analysis based on internet access by computer

Response		**Segment 1**	**Segment 2**
Rarely	1. Never 5. Yearly	69.37	75.93
Frequently	2. Daily 3. Weekly 4. Monthly	30.63	24.07
Total		100.00	100.00

An evaluation of the PLS-PM estimates of these two priori segmented datasets confirms the satisfactory results (illustrated in Table 4.7). The R^2 value of the overall e-government readiness of the first segment is considerably higher than that in the global model, indicating an improved model fit. Even though the second segment's goodness of fit is the same as the global model, the R^2 value still falls slightly below the global model result. However the segments derived from the FIMIX-PLS analysis clearly exhibits a good model fit. Government employees in the first segment, who accessed the internet more frequently than the second segment, perceive that:

- All model factors except supporting e-services directly affect the readiness of e-government;
- Technology readiness is important in overall e-government readiness (a result which is contrary to the global model results);

- Citizen competency has a strong direct relationship with citizen readiness whereas awareness and motivation has no significant relationship with citizen readiness;
- Technology readiness is strongly affected by connectivity rather than convenience and flexibility;
- Strategy has a strong direct relationship with government readiness whereas the effect of data and system on government readiness is insignificant;
- Informational services support e-services, whereas the effect of operational and transactional services on supporting e-services are irrelevant; and
- Industry readiness is strongly affected by transactions and services.

Participants in segment 2, who access the internet less frequently than the first group, perceive that:

- Readiness of e-government is influenced by citizen readiness and supporting industry readiness;
- Supporting e-services and readiness of government and technology have no influence on overall e-government readiness;
- Citizen competency has a strong direct relationship with citizen readiness whereas awareness and motivation has no significant relationship with citizen readiness;
- Technology readiness is affected by connectivity and flexibility whereas convenience has no influence on technology readiness;
- Strategy and system have a direct relationship with government readiness whereas the effect of data on government readiness is insignificant;
- Informational and transactional services affect supporting e-services, whereas the effect of operational services on supporting e-services are irrelevant; and
- Industry readiness is strongly affected by transactions and services.

4.3 Discussion of results

The framework for e-government readiness measurement can evaluate how ready a country, a city or a particular government organisation is to develop e-government and thus provides an efficient channel to carry out preparing, monitoring, and measurement of the initiatives towards implementing an information society in general and e-government in particular (Ojo *et al.*, 2005). Offering crucial signposts to point policy makers and practitioners in the

right direction is the most prominent reason for having readiness measures for e-government. This research presented a framework of five heterogeneous factors concerning individual citizen readiness, government readiness, supporting e-services, technology infrastructure and supporting industry readiness to measure overall e-government readiness. The scale demonstrates a better model based on findings from a variety of reliability and validity tests.

The predictive power of 0.68 for overall municipal readiness shows that about 68% of the e-government readiness is as a result of all five independent factors. This result suggests that the model fit to the data is at an acceptable level for all independent factors. The predictive power (R^2) of the main effect model is acceptable for all independent factors. The result shows that citizen readiness, government readiness, industry readiness, supporting e-services and technology readiness have R^2 values of 0.79, 0.77, 0.69, 0.46 and 0.73 respectively. The structural model shows that about 68% of the e-government readiness is due to all five independent factors in the model. Government readiness is the most important variable in the prediction of e-government readiness contributing to 37.62% of the R^2. This indicates the importance of the role of government in the development and implementation of e-government services and other information communication technologies for the successful implementation of e-government. The factors of industry readiness, technology readiness and citizen readiness are contributing 27.97%, 17.34% and 11.90% of the R^2 value respectively. On the contrary, the contribution of the factor of supporting e-services is low (5.08%). It is noticeable that the readiness of e-government is not restricted to governmental bodies. Citizen readiness, supporting industry readiness, technology readiness and supporting e-services are important factors in predicting the readiness of e-government. In addition, the effect size analysis also reveals the contribution of each factor to the predictive power of the research model. The effect size shows that 'government readiness' (f^2=0.15) and 'supporting industry' (f^2=0.10) have medium effect size (Cohen, 1988) on the overall readiness of e-government while 'citizen readiness' (f^2=0.06) has small to medium effect size (Cohen, 1988). The effect size of 'technology readiness' (f^2=0.02) is small (Cohen, 1988) but supporting e-services resulted in an effect size of (f^2= 0.01) less than the smallest benchmark of 0.02 (Cohen, 1988).

The overall prediction performance of the model is assessed through the goodness of fit (GoF) index which shows that overall the model data fit of 0.81 is of higher level. The

results show that the relationship between different factors in the framework confirms that all identified heterogeneous factors are good predictors of e-government readiness. The factors like citizen readiness, government readiness, industry readiness and technology infrastructure readiness have a high impact on e-government readiness whereas supporting e-services has a modest impact.

The results highlight the importance of citizen readiness on e-government readiness. This indicates that citizens are major factors in the introduction and success of e-government projects and so must be seriously considered in the e-government development process. The importance of citizen readiness in determining e-government readiness is consistent in literatures (Azab *et al.*, 2009; Yunis and Sun, 2009). Moreover, lack of skilled ICT government employees and low literacy levels citizens with less motivation brings major challenges for e-government implementation. In addition, the lack of awareness of services available prevents citizens from becoming familiar with the added value that e-government services could offer in their everyday life.

The results reveal that the impact of government readiness in determining e-government readiness is very significant. The results show that about 37.62% of e-government readiness is due to government readiness. This indicates that implementing e-government requires a huge amount of government resources. E-government involves far more than putting computers on the desks of government officials. The requirement for e-government includes an interoperability infrastructure which will make better communication between government and citizens (G2C), government and business enterprises (G2B), and government and government (G2G) more friendly, unambiguous, and affordable. Accomplishing these engages changing both internal processes and the ways in which government interacts with citizens and supporting industry and business enterprises. This result supports the findings of Koh *et al*. (2008) and Shin-Ping Liu (2012) who pointed out that e-government is more effective with a comprehensive strategic plan and successful e-government requires carefully planned strategies aligned with business objectives. This in contrast to the findings of Azab *et al*. (2009) who report that government strategy has a modest effect on e-government readiness.

The result of this study reveals that the support of industries is a key factor for enabling e-government readiness. The importance of industry readiness has been highlighted in the

literature (Alghamdi *et al.,* 2011; Azab *et al.,* 2009; Rahman, 2007; Ahmed and Hussein, 2006). The results emphasise that the technical support and service level of supporting industries such as IT industries, financial and logistics industries are important in the context of e-government readiness. Therefore, investment in infrastructure development by government and supporting industries should go hand-in-hand with the implementation of service developments and transaction improvements at the municipal level.

The results show that supporting e-services have a modest impact on e-government readiness. The importance of e-services was highlighted in literature (Yuan *et al.,* 2012; Shin-Ping Liu, 2012; Yunis and Sun, 2009; Koh *et al.,* 2008). E-service delivery is undoubtedly a key component of any e-government effort (Grant and Chau, 2005). The modest effect of e-services can possibly be attributed to the low levels of awareness of a large number of employees regarding the particular services delivered electronically at their municipalities which prevents them from perceiving their effect. The progression from mere information services to fully electronic transaction services is key elements to achieve the improved e-service quality.

Finally, the results of this study show the impact of technology infrastructure readiness on overall government readiness. Previous research has indicated that technology readiness is one of the greatest determinants of e-government readiness (Azab *et al.,* 2009; Sun and Yunis, 2009). The effect of technology infrastructure on e-government readiness emphasises the fact that technology is the main source of change and power for enabling the process of e-government initiatives. E-government could never exist without applying information technology and technology is considered as a tool to advance the internal administration process of e-government. Technological infrastructure with reliable and accessible connectivity needs to be incorporated in municipalities for the effective and efficient service delivery of e-governments.

This study utilised FIMIX-PLS to capture the heterogeneity in PLS path modeling of citizen readiness, government readiness, industries readiness, supporting e-services, technology readiness and overall e-government readiness. This approach enabled the researcher to identify two segments of government employees that result in heterogeneity within the inner model. There were differing opinions among members of the segments regarding their perception of the factors affecting the readiness of e-government. The study findings show

that the main difference characterising the two uncovered data segments lay in internet accessibility using computers. This led to the observation that the impact of government readiness, technology readiness and supporting industry readiness on e-government readiness is stronger in the first segment than the second segment i.e. the segment with more internet access by computer. The segment specific analysis clearly shows that, depending on the participants' background, the impact of factors that influence the readiness of e-government can differ vastly. Government employees having frequent access to internet by computer (Segment 1) highly support the importance of government readiness, technology readiness and industry readiness. This implies that the level of exposure to internet technology improved their knowledge in predicting the contribution of governmental, technological and industrial readiness for e-government.

4.4 Summary

This chapter discussed the findings obtained from the experimental results. Through comparing the model derived from the results with those models found in the literature, this model demonstrated that all five factors examined are predictors of e-government readiness, and are therefore suitable as a framework for measuring e-government readiness. For government to be e-ready there is a strong need for expanding e-services and government readiness that fuelled by upgrading industry and technology infrastructure readiness along with raising citizen readiness. The final chapter will summarise the study, state its main limitations, and present recommendations for further research.

Chapter 5: Summary, Recommendations and Conclusion

This chapter reflects upon the entire study by summarising it, highlighting the research gap and explaining the contribution of this study in answering the research questions raised in the beginning. This chapter also discusses the research limitations and suggests avenues for future work.

5.1 Summary

E-government has become the key term that describes the modernisation of the processes and functions of government using the tools of ICT to improve the access to and delivery of government services to benefit society, business partners and employees. Through new technologies e-government provides people with convenient access to government information and services, improves the quality of the services and creates greater opportunities to participate in democratic institutions and processes. The progress towards e-government cannot be implemented in isolation without having a thorough understanding of the context in which e-government operates. Specific e-government services are increasingly being implemented at municipal level rather than provincial or national level. Moreover, the majority of citizens is closer to the municipal government and are easily accessible to services provided by the municipal governments rather than those services provided provincial or national governments. An e-government readiness measurement provides policy and decision makers with a detailed scorecard of their municipalities' status relative to others attempting to implement e-governance. This underlines the importance of conducting research to develop a framework to measure the readiness status of e-government at the municipal level.

The intensive analysis of the literature indicated that a complete set of heterogeneous factors that determine e-government readiness as well as diversity in structural techniques used is not incorporated in many of the past studies that were reviewed in this dissertation. The majority of studies reviewed focused on measurement at national or global level (43.75%),

followed by a government organisational level (37.5%). Remarkably, little attention has been granted to measuring e-government at the local or municipal level (18.75%) which results in a clear gap in investigating e-government readiness at the municipal government level. Moreover, in existing e-government readiness frameworks, very few studies have reported on the effect and treatment of heterogeneity caused by unobserved or latent factors, even though a number of studies have reported on the application of structural equation modeling (SEM) in technology based e-government readiness measurement frameworks. While recognising the valuable contribution the previous studies provided, measurement at the municipal level of governance and complete inclusion of heterogeneous factors into a measurement that determines an e-government readiness are omitted in the majority of existing studies. In addition, there is no evidence in the literature that FIMIX-PLS has been used to capture the heterogeneity in PLS path modeling related to technology based e-government readiness measurement frameworks.

In view of these gaps, the primary contribution of this study is to provide a framework with heterogeneous factors incorporated as a tool to measure e-government readiness at municipal level. An e-government measurement framework was developed by the researcher and validated encompassing the effect of five heterogeneous factors: (i) citizen readiness; (ii) government readiness, (iii) supporting e-services, (iv) supporting industry readiness and (v) technology infrastructure readiness. The effect of these factors on e-government readiness, and the relations between them, was examined. The proposed framework was empirically validated in this study based on the response from government employees working in all three categories (metropolitan, district and local) of municipalities in Eastern Cape Province of South Africa.

This study used a survey method for data collection to obtain feedback from government employees. The Standard PLS path modeling has confirmed that all five factors affect e-government readiness but with a different level of effect. FIMIX-PLS data clustering method was utilised to uncover unobserved heterogeneity in government employees in validating the e-government readiness framework. The research findings show that the main difference characterizing the two uncovered government employee segments lies in the amount of internet access using computers.

5.2 Answering the research questions

This section reviews the research questions along with their solutions as follows.

a. Which heterogeneous factors can be used to measure e-government readiness status? The scoping review of the literature was useful in identifying the five heterogeneous factors – (i) individual citizen readiness, (ii) government readiness, (iii) supporting e-services, (iv) supporting industry readiness and (v) technology infrastructure readiness.

b. Which framework provides heterogeneous factors in predicting e-government readiness status at municipal level? The developed framework proved to be robust in predicting e-government readiness status at municipal level. Each of the five factors contains a number of measurable sub-factors which enable the measurement of overall e-government readiness. The predictive power of this study's research model reflects that the model fit to the data was of substantial levels (Chin, 1998) in that about 68% of e-government readiness was determined to be as a result of all five independent factors. The evaluation result shows the five factors to be significant determinants of municipality e-government readiness with an overall goodness of fit performance of 0.81 and predictive power of 0.68. Thus, this study proved the high significance of citizen readiness, government readiness, supporting industry readiness and technology infrastructure readiness as compared to the modest effect of supporting e-services on e-government readiness.

c. Is there any heterogeneity in user perception of e-government readiness and if there is, which factors best characterise the different segments of government employees perception on e-government readiness? The finite mixture partial least squares (FIMIX-PLS) data clustering method was used to uncover unobserved heterogeneity in government employees in validating e-government readiness framework. The analysis revealed that internet access by computer was the principal difference that best characterizes the two uncovered segments. There were differing opinions among members of the segments regarding their perception on the factors affecting the readiness of e-government. The impact of government readiness, technology readiness and supporting industry readiness for e-government readiness is stronger

in the first segment (having frequent access to internet by computer) than the second segment.

5.3 Recommendations

Knowledge acquired in this study can potentially benefit decision and policy makers and all interested groups in preparing for an effective and efficient implementation of e-government projects. Information from this study may also help them to recognise that effective e-government implementation requires the use of technologies to achieve more efficiency in the functioning of government and to enhance the delivery of government services for industries and individual citizens. This study highlights the set of relevant factors required for measuring readiness of e-government. These factors are useful inputs to the formulation of policies and strategies for effective e-government. The evaluation of e-government readiness for municipalities can provide a barometer to understand the critical needs of citizens. In addition, it can be useful for improving the effectiveness of government services and helpful for the ICT industry to be aware of the key factors necessary for implementing efficient and effective infrastructures to support efficient delivery of e-services.

The distinctive contribution made in this study lies in the development of an e-government readiness framework with heterogeneous factors suitable for municipal measurement. The framework was validated to establish the effects of citizen readiness, government readiness, supporting industry readiness, technology readiness and supporting e-services on e-government readiness. The predictive power of 0.68 indicates that about 68% of the readiness of overall municipal readiness is the due to the five factors in the framework. The evaluation result shows the evaluation factors to be significant determinants of municipality e-government readiness with an overall goodness of fit performance of 0.81 and predictive power of 0.68.

Specifically, the contributions of this study to knowledge and practice in e-government at the municipal level can be summarised as follows:

a. Systematic identification of the critical factors affecting e-government readiness through intensive scoping review;

b. The development of a framework based on five heterogeneous factors (individual citizen readiness, government readiness, supporting industry readiness, technology readiness and supporting e-services on e-government readiness) that affect the readiness of e-government;
c. The empirical effects of the establishment that these five factors can have an e-government readiness; and
d. The empirical study of heterogeneity detection in e-government readiness survey data generated from government employees .

5.4 Limitations and suggestions for further research

Although this study has achieved its aim and answered the research questions, the research has some limitations. The data collection method that produced the strength and effect of relationship among the factors of the framework depended on the opinion of 219 government employees from 4 different municipalities in Eastern Cape Province of South Africa. A larger sample size that cuts across other stakeholders such as citizens and business partners and the entire provinces might be desirable to detect other significant effects. Although government employees are the core people of government operations and services, it would be a necessary for further research surveys involving diversified user groups engaged with all the constituents of government.

Only four municipalities of Eastern Cape Province of South Africa were used for the evaluation for this study. Eastern Cape is largely rural and this, coupled with the vastness of the landscape and current paucity of infrastructure, inhibits the infiltration of Information Communication Technology. While the selected metropolitan and district municipalities are well served by infrastructure, its local municipalities are still faced with challenges such as service delivery, skills development and access to information and communications. It would be also valuable to generalise the research findings to produce a generic e-government readiness framework that could be applied in any context. Further research should include more municipalities in more provinces to test the developed framework. Such research can be ongoing. A further recommendation is that this e-government readiness framework be used for ranking municipalities based on their readiness to launch e-government systems.

Although other factors such as mobile technology and culture are proved to be important in the context of e-government, they are not investigated in this research. More investigation should be studied regard to these factors especially mobile technology, which is significantly expanding the capacity of e-government.

5.5 Conclusion

The findings of this study offer significant insight for e-government decision and policy makers regarding the important factors for development of e-government highlighted in the developed framework. By utilising the findings of this study, decision makers will be better positioned to understand the impact of their policies and be better prepared for launching e-government systems in municipalities. The conclusions drawn from this study can be used as a tool to identify weaknesses and strengths and can be used to prepare a plan to help decision and policy makers achieve the readiness required for successful implementation of the e-government systems.

This study provides a framework with five primary evaluation areas or building factors to implement any e-government initiative at the municipal level of government. These factors represent the basic components to be measured before launching an e-government system and will ensure the right implementation in the right direction. The factors to be measured are citizen readiness, government readiness, supporting e-services, supporting industry readiness and technology infrastructure readiness. There are a number of sub factors and measuring constructs under each factor.

These study findings revealed that citizen readiness, government readiness, supporting industry readiness and technology infrastructure readiness had a high impact on e-government readiness as compared to the modest effect of supporting e-services. By highlighting key sub-factors in each factor, policy makers would be able to recognise the importance of those factors in order to prioritise them in launching an e-government system. The detailed factors used in this study can help decision and policy makers analyse their

municipalities' unique needs and develop customised action plans to improve e-government readiness through an optimal allocation of resources.

In conclusion, studies like this which aim at taking heterogeneous factors into measurements that determine e-government readiness by municipalities are relevant and necessary in order to propose areas for improvements and future action plans. It is recommended to conduct further research in more municipalities as well as to consider such research as an on-going process.

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APPENDIX A: DATA COLLECTION INSTRUMENT

Empirical study on development and validation of a framework for e-government readiness measurement

The purpose of this empirical study is to engage public administration, business, industry, civil society and citizen at local and municipal levels to measure e-government readiness. E-government, although inconsistent in definition, is generally touted as a means to efficiently reach citizens with government services. The e-government readiness measurement framework purpose to measure composite measure of supporting e-government services, individual citizen readiness, technology infrastructure readiness, government readiness and supporting industry readiness. This study will provide a foundation for policymakers and practitioners aspiring at enhancing readiness measurement and service delivery improvement across nations for the successful expansion of e-government.

The following sets of questions are intended to measure the e-government readiness.

1. **Readiness Measures – Demography (Age, Gender, Experience, Residence)**

A. Age ☐ 16-25 ☐ 26-35 ☐ 36 -45 ☐ 46-55 ☐ > 56

B. Gender ☐ Female ☐ Male

C. Experience with computers ☐ Never ☐ < 1 year ☐ < 2 years ☐ > 2years

D. Experience with e-government ☐ Never ☐ < 1 year ☐ < 2 years ☐ > 2years

E. Internet access by Compute ☐ Never ☐ Daily ☐ Weekly ☐ Monthly ☐ Yearly

F. Internet access by mobile ☐ Never ☐ Daily ☐ Weekly ☐ Monthly ☐ Yearly

G. Owning computers ☐ Yes ☐ No

H. Residence Location ☐ Township ☐ Rural ☐ Urban

I. Municipality _____

J. Province _____

2. Supporting E-Services - Informational Use

	Completely not provided =						Completely provided =
	1	**2**	**3**	**4**	**5**	**6**	**7**
Online publishing of municipality information	☐	☐	☐	☐	☐	☐	☐
Online publishing of GIS Data	☐	☐	☐	☐	☐	☐	☐
Online publishing of municipality budget	☐	☐	☐	☐	☐	☐	☐
Online publishing of employee manual	☐	☐	☐	☐	☐	☐	☐
Online tour guide of municipality	☐	☐	☐	☐	☐	☐	☐
Online publishing of minutes of meetings	☐	☐	☐	☐	☐	☐	☐
Online information from government	☐	☐	☐	☐	☐	☐	☐
Online video broadcasting of meetings	☐	☐	☐	☐	☐	☐	☐
Online Audio broadcasting of meetings	☐	☐	☐	☐	☐	☐	☐
Online broadcasting of live traffic cams	☐	☐	☐	☐	☐	☐	☐
Online TV and postal services	☐	☐	☐	☐	☐	☐	☐
Online political debate	☐	☐	☐	☐	☐	☐	☐

3. Supporting E-Services - Transactional Use

	Completely not provided =						Completely provided =
	1	**2**	**3**	**4**	**5**	**6**	**7**
Online calls for bids or proposals	☐	☐	☐	☐	☐	☐	☐
Online bidder applications	☐	☐	☐	☐	☐	☐	☐
Online utility payments	☐	☐	☐	☐	☐	☐	☐
Online collection of fees	☐	☐	☐	☐	☐	☐	☐
Online collection of fines	☐	☐	☐	☐	☐	☐	☐
Online tax collection	☐	☐	☐	☐	☐	☐	☐
Online payments to service providers	☐	☐	☐	☐	☐	☐	☐

Supporting e-Services

4. Supporting E-Service - Operational Use

	Completely not provided =						**Completely provided =**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Online request for services	☐	☐	☐	☐	☐	☐	☐
Online residence permits application and renewal	☐	☐	☐	☐	☐	☐	☐
Online license application and renewal	☐	☐	☐	☐	☐	☐	☐
Online voter registration	☐	☐	☐	☐	☐	☐	☐
Online request for records	☐	☐	☐	☐	☐	☐	☐
Online property/intellectual property registration	☐	☐	☐	☐	☐	☐	☐
Online business or organisation registration	☐	☐	☐	☐	☐	☐	☐
Online change business or deregister business	☐	☐	☐	☐	☐	☐	☐
Online surveys and polls	☐	☐	☐	☐	☐	☐	☐
Online forums and discussions	☐	☐	☐	☐	☐	☐	☐
Online job applications	☐	☐	☐	☐	☐	☐	☐
Support for e-mail communication	☐	☐	☐	☐	☐	☐	☐
Support for online calendar	☐	☐	☐	☐	☐	☐	☐
Support for scheduling meeting online	☐	☐	☐	☐	☐	☐	☐
Support for online document management	☐	☐	☐	☐	☐	☐	☐
Support for video conferencing	☐	☐	☐	☐	☐	☐	☐
Emergency management	☐	☐	☐	☐	☐	☐	☐

5. Individual Citizen Readiness - Competency

	Very Low =						Very High =
	1	**2**	**3**	**4**	**5**	**6**	**7**
Knowledge and skills on e-government relationship	☐	☐	☐	☐	☐	☐	☐
Knowledge and skills on e-government process	☐	☐	☐	☐	☐	☐	☐
Knowledge and skills on e-government policies	☐	☐	☐	☐	☐	☐	☐
Knowledge and skills on e-government industry structure	☐	☐	☐	☐	☐	☐	☐
Skills to access information regarding e-government applications	☐	☐	☐	☐	☐	☐	☐
Skills to govern and coordinate projects related to e-government	☐	☐	☐	☐	☐	☐	☐
Skills to lead people in achieving e-government adoption success	☐	☐	☐	☐	☐	☐	☐

6. Individual Citizen Readiness - Awareness

	Very Low Awareness =						Very High Awareness =
	1	**2**	**3**	**4**	**5**	**6**	**7**
Public advocacy , branding and media adverts on e-government	☐	☐	☐	☐	☐	☐	☐
E-government training supports at cybercafé, schools and at special centres	☐	☐	☐	☐	☐	☐	☐
People understanding about how e-government is used	☐	☐	☐	☐	☐	☐	☐
Requirements placed on people to use e-government	☐	☐	☐	☐	☐	☐	☐
Pride in using e-government	☐	☐	☐	☐	☐	☐	☐

E-government security and privacy awareness training programs	☐	☐	☐	☐	☐	☐	☐
Commitment of stakeholders to e-government security and privacy management	☐	☐	☐	☐	☐	☐	☐
Relevant regulations and laws of e-government security and privacy management	☐	☐	☐	☐	☐	☐	☐
Government commitment to e-government security and privacy management	☐	☐	☐	☐	☐	☐	☐

7. Individual Citizen Readiness -Motivation

	Lowly Motivated =						**Highly Motivated =**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Willingness to spent time and effort on e-government implementation	☐	☐	☐	☐	☐	☐	☐
Willingness of non-governmental organisations to promote e-government	☐	☐	☐	☐	☐	☐	☐
Willingness of government to promote e-government	☐	☐	☐	☐	☐	☐	☐
Training on mix aspects to e-government management and technical areas	☐	☐	☐	☐	☐	☐	☐
Initiatives to increase willingness of citizen to adopt e-government	☐	☐	☐	☐	☐	☐	☐

8. Technology Infrastructure Readiness - Connectivity

	Poorly Connected =						**Well Connected =**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Reliable internet connectivity, high broadband speed	☐	☐	☐	☐	☐	☐	☐
Appropriate security systems to protect	☐	☐	☐	☐	☐	☐	☐

information							
Appropriate security systems to protect online transactions	☐	☐	☐	☐	☐	☐	☐
Internet ICT standards that comply with industry daily standards	☐	☐	☐	☐	☐	☐	☐

9. Technology Infrastructure Readiness - Convenience

	Highly Inconvenient =						**Highly Convenient =**
	1	**2**	**3**	**4**	**5**	**6**	**7**
E-government applications are convenient and benefits to use	☐	☐	☐	☐	☐	☐	☐
Response time of e-government applications is acceptable	☐	☐	☐	☐	☐	☐	☐
E-government applications do not request for too many information	☐	☐	☐	☐	☐	☐	☐

10. Technology Infrastructure Readiness - Flexibility

	Highly Inflexible =						**Highly Flexible =**
	1	**2**	**3**	**4**	**5**	**6**	**7**
E-government applications are flexible to change	☐	☐	☐	☐	☐	☐	☐
E-government applications response to service quality issue ease of use	☐	☐	☐	☐	☐	☐	☐
E-government applications accept input data in simply format	☐	☐	☐	☐	☐	☐	☐

11. Government Readiness - Strategy

	Strongly Disagree =						Strongly Agree =
	1	**2**	**3**	**4**	**5**	**6**	**7**
The municipality has strategic plans that governs all internet activities	☐	☐	☐	☐	☐	☐	☐
The municipality has clearly stated objectives of using the internet	☐	☐	☐	☐	☐	☐	☐
The internet is an integral part of the municipality business plans	☐	☐	☐	☐	☐	☐	☐
The internet strategies of the municipality are deliberately aligned with its strategic plans	☐	☐	☐	☐	☐	☐	☐
The municipality provides initiatives and guidance to encourage e-government development process	☐	☐	☐	☐	☐	☐	☐
The municipality provides allocation for training, procurement of ICT infrastructure and maintenance investment related to e-government	☐	☐	☐	☐	☐	☐	☐
The municipality provides clear and sufficient e-government policy involving contractual arrangement and documentation	☐	☐	☐	☐	☐	☐	☐
The municipality provides metrics and indicators for assessing investment and impact of e-government	☐	☐	☐	☐	☐	☐	☐
Establishment of well-defined related inter-municipality e-government strategies plan	☐	☐	☐	☐	☐	☐	☐

12. Government Readiness - System

	Strongly Disagree =						Strongly Agree =
	1	**2**	**3**	**4**	**5**	**6**	**7**
The municipality carefully coordinates development of all internet applications	☐	☐	☐	☐	☐	☐	☐
The municipality pays close attention to ensuring compatibility among Internet applications	☐	☐	☐	☐	☐	☐	☐
The municipality has a centralized function that oversees the development of all internet applications	☐	☐	☐	☐	☐	☐	☐
The internet applications at municipality are designed and developed to work with legacy systems	☐	☐	☐	☐	☐	☐	☐
The municipality provides internet infrastructure and network coverage facilities to bridge digital divide	☐	☐	☐	☐	☐	☐	☐

13. Government Readiness - Data Support

	Strongly Disagree =						Strongly Agree =
	1	**2**	**3**	**4**	**5**	**6**	**7**
All internet applications within the municipalities can share data with other internet applications	☐	☐	☐	☐	☐	☐	☐
All internet applications within the municipalities can share data with non-internet applications	☐	☐	☐	☐	☐	☐	☐
All internet application within the municipalities share standardized data	☐	☐	☐	☐	☐	☐	☐
All government data within the	☐	☐	☐	☐	☐	☐	☐

municipalities are open source							
All government data are provided in local contents	☐	☐	☐	☐	☐	☐	☐

14. Supporting industry Readiness - Services and Transactions

	Strongly Disagree =						**Strongly Agree =**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Sufficient services involving Internet and telecommunications infrastructure from IT industry	☐	☐	☐	☐	☐	☐	☐
Sufficient and reliable service and technical support from IT industry	☐	☐	☐	☐	☐	☐	☐
Ability of courier and logic industry to integrate e-government services and products delivery	☐	☐	☐	☐	☐	☐	☐
Ability of commercial and financial institutions to support secured technology infrastructure for e-government transactions	☐	☐	☐	☐	☐	☐	☐
Ability of qualified legal expertise to draw up related e-government contracts and agreements	☐	☐	☐	☐	☐	☐	☐

15. Overall Readiness Status – Municipal Readiness Status

	Strongly Disagree =						**Strongly Agree =**
	1	**2**	**3**	**4**	**5**	**6**	**7**
E-government agenda is on the top list of municipal government priority	☐	☐	☐	☐	☐	☐	☐
E-government in the municipality is attracting citizen audience	☐	☐	☐	☐	☐	☐	☐
E-government readiness status of the	☐	☐	☐	☐	☐	☐	☐

municipality is encouraging							
E-government development in the municipality is improving	☐	☐	☐	☐	☐	☐	☐
E-government activities have started in the municipality	☐	☐	☐	☐	☐	☐	☐

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APPENDIX B: CROSS LOADING ANALAYSIS OF MODEL ITEMS

		Awareness	Citizen	Competency	Connectivity	Convenience	Data	Flexibility	Government	Industry	Informational	Motivation	Operational	Readiness	Service	Strategy	System	Technology	Transactional	Transactions
Data	GRD1	0.68	0.52	0.57	0.65	0.70	**0.89**	0.69	0.76	0.66	0.46	0.67	0.55	0.65	0.47	0.75	0.80	0.65	0.55	0.66
	GRD2	0.62	0.48	0.49	0.62	0.67	**0.92**	0.65	0.67	0.62	0.52	0.62	0.56	0.57	0.41	0.71	0.80	0.55	0.53	0.70
	GRD3	0.59	0.43	0.44	0.56	0.60	**0.93**	0.61	0.59	0.64	0.54	0.61	0.54	0.58	0.32	0.68	0.78	0.47	0.49	0.75
	GRD4	0.56	0.30	0.32	0.49	0.49	**0.79**	0.47	0.39	0.45	0.53	0.55	0.52	0.42	0.36	0.48	0.61	0.39	0.40	0.63
	GRD5	0.53	0.33	0.34	0.51	0.56	**0.83**	0.55	0.48	0.58	0.51	0.60	0.49	0.46	0.35	0.57	0.68	0.44	0.44	0.72
System	GRS1	0.65	0.56	0.58	0.65	0.71	0.75	0.71	0.81	0.67	0.44	0.62	0.51	0.70	0.48	0.81	**0.89**	0.62	0.53	0.59
	GRS2	0.70	0.48	0.53	0.66	0.71	0.76	0.67	0.78	0.59	0.50	0.54	0.60	0.67	0.48	0.79	**0.93**	0.62	0.55	0.62
	GRS3	0.66	0.44	0.46	0.61	0.67	0.79	0.63	0.75	0.59	0.51	0.49	0.61	0.63	0.42	0.79	**0.93**	0.54	0.52	0.67
	GRS4	0.61	0.44	0.47	0.57	0.65	0.81	0.65	0.66	0.63	0.52	0.57	0.58	0.62	0.40	0.74	**0.90**	0.48	0.47	0.72
	GRS5	0.53	0.40	0.44	0.62	0.61	0.76	0.60	0.62	0.60	0.54	0.57	0.62	0.66	0.41	0.68	**0.88**	0.46	0.50	0.64
Government	GRST1	0.69	0.54	0.62	0.70	0.74	0.65	0.71	**0.98**	0.67	0.42	0.57	0.53	0.74	0.49	0.85	0.78	0.72	0.54	0.58
	GRST2	0.67	0.51	0.56	0.66	0.70	0.69	0.68	**0.98**	0.65	0.46	0.57	0.55	0.72	0.43	0.85	0.79	0.64	0.53	0.61
Strategy	GRST3	0.63	0.56	0.57	0.65	0.73	0.64	0.72	0.82	0.61	0.47	0.57	0.49	0.71	0.43	**0.85**	0.72	0.62	0.48	0.57
	GRST4	0.66	0.57	0.62	0.70	0.73	0.68	0.69	0.84	0.69	0.44	0.58	0.53	0.73	0.40	**0.91**	0.77	0.65	0.48	0.65
	GRST5	0.70	0.56	0.65	0.67	0.69	0.67	0.64	0.81	0.70	0.45	0.61	0.57	0.77	0.38	**0.90**	0.73	0.65	0.52	0.66
	GRST6	0.68	0.55	0.56	0.67	0.71	0.67	0.70	0.80	0.61	0.49	0.52	0.61	0.69	0.39	**0.90**	0.77	0.62	0.54	0.64
	GRST7	0.66	0.47	0.52	0.59	0.65	0.68	0.64	0.78	0.63	0.50	0.54	0.58	0.68	0.38	**0.91**	0.76	0.55	0.52	0.64
	GRST8	0.64	0.44	0.49	0.55	0.59	0.64	0.60	0.62	0.53	0.47	0.49	0.56	0.59	0.35	**0.83**	0.71	0.51	0.49	0.60
	GRST9	0.59	0.39	0.43	0.51	0.57	0.64	0.60	0.61	0.47	0.56	0.45	0.59	0.61	0.39	**0.83**	0.73	0.46	0.50	0.57
Awareness	ICRA1	**0.82**	0.72	0.72	0.59	0.66	0.58	0.63	0.61	0.61	0.45	0.57	0.59	0.59	0.43	0.66	0.60	0.59	0.61	0.60
	ICRA2	**0.85**	0.55	0.64	0.56	0.63	0.62	0.61	0.63	0.53	0.40	0.55	0.60	0.59	0.37	0.66	0.62	0.60	0.56	0.58

	ICRA3	**0.89**	0.65	0.70	0.60	0.64	0.60	0.59	0.61	0.49	0.42	0.55	0.53	0.61	0.34	0.68	0.64	0.56	0.52	0.52
	ICRA4	**0.90**	0.53	0.64	0.59	0.61	0.58	0.56	0.61	0.48	0.43	0.55	0.53	0.57	0.42	0.61	0.58	0.58	0.53	0.55
	ICRA5	**0.88**	0.65	0.68	0.62	0.64	0.64	0.59	0.63	0.56	0.44	0.59	0.51	0.62	0.40	0.67	0.63	0.61	0.54	0.56
	ICRA6	**0.90**	0.53	0.64	0.63	0.62	0.63	0.58	0.64	0.46	0.50	0.54	0.62	0.60	0.44	0.67	0.63	0.62	0.52	0.55
	ICRA7	**0.90**	0.58	0.68	0.60	0.57	0.57	0.51	0.55	0.46	0.44	0.54	0.52	0.55	0.36	0.62	0.58	0.59	0.47	0.49
	ICRA8	**0.90**	0.54	0.63	0.60	0.63	0.65	0.61	0.64	0.52	0.51	0.58	0.59	0.60	0.43	0.71	0.66	0.58	0.50	0.58
	ICRA9	**0.86**	0.58	0.68	0.56	0.59	0.55	0.52	0.57	0.50	0.45	0.53	0.52	0.54	0.34	0.60	0.56	0.58	0.49	0.50
Competency	ICRC1	0.68	0.79	**0.91**	0.64	0.65	0.48	0.59	0.58	0.58	0.39	0.57	0.48	0.64	0.39	0.61	0.54	0.68	0.54	0.46
	ICRC2	0.74	0.83	**0.95**	0.64	0.66	0.50	0.58	0.59	0.57	0.41	0.57	0.52	0.62	0.35	0.63	0.55	0.65	0.56	0.48
	ICRC3	0.74	0.81	**0.93**	0.62	0.66	0.51	0.58	0.56	0.56	0.31	0.60	0.47	0.60	0.29	0.60	0.53	0.66	0.50	0.48
	ICRC4	0.69	0.76	**0.89**	0.60	0.61	0.45	0.52	0.55	0.52	0.30	0.55	0.49	0.61	0.31	0.53	0.48	0.63	0.54	0.41
	ICRC6	0.67	0.87	**0.92**	0.64	0.61	0.43	0.53	0.49	0.49	0.31	0.55	0.46	0.64	0.29	0.53	0.46	0.59	0.48	0.39
	ICRC7	0.71	0.83	**0.91**	0.59	0.65	0.47	0.60	0.55	0.56	0.35	0.55	0.45	0.61	0.31	0.58	0.49	0.66	0.54	0.47
Citizen	ICRC5	0.68	**1.00**	0.89	0.61	0.63	0.49	0.59	0.54	0.58	0.35	0.53	0.48	0.62	0.30	0.58	0.52	0.60	0.51	0.47
Motivation	ICRM1	0.59	0.58	0.60	0.65	0.69	0.63	0.66	0.59	0.73	0.44	**0.88**	0.50	0.58	0.48	0.57	0.58	0.65	0.56	0.62
	ICRM2	0.60	0.49	0.59	0.63	0.61	0.62	0.57	0.53	0.58	0.42	**0.90**	0.50	0.53	0.47	0.55	0.55	0.57	0.53	0.54
	ICRM3	0.53	0.46	0.51	0.57	0.62	0.60	0.63	0.45	0.51	0.43	**0.89**	0.48	0.53	0.39	0.52	0.50	0.49	0.44	0.56
	ICRM4	0.56	0.41	0.53	0.67	0.68	0.66	0.64	0.52	0.56	0.50	**0.91**	0.56	0.58	0.50	0.59	0.59	0.60	0.52	0.63
	ICRM5	0.52	0.37	0.46	0.58	0.60	0.61	0.58	0.47	0.53	0.50	**0.88**	0.54	0.52	0.49	0.50	0.53	0.54	0.50	0.59
Readiness	PRS1	0.63	0.54	0.62	0.73	0.71	0.58	0.64	0.72	0.68	0.45	0.63	0.50	**0.91**	0.52	0.72	0.68	0.73	0.52	0.61
	PRS2	0.67	0.59	0.66	0.67	0.69	0.56	0.64	0.69	0.62	0.45	0.56	0.52	**0.93**	0.48	0.73	0.67	0.65	0.52	0.62
	PRS3	0.56	0.61	0.65	0.63	0.62	0.57	0.56	0.69	0.65	0.39	0.53	0.52	**0.91**	0.33	0.70	0.63	0.57	0.54	0.60
	PRS4	0.60	0.57	0.59	0.64	0.67	0.59	0.59	0.67	0.69	0.42	0.56	0.46	**0.93**	0.37	0.72	0.66	0.57	0.52	0.63
	PRS5	0.61	0.54	0.57	0.63	0.67	0.58	0.63	0.63	0.62	0.48	0.55	0.52	**0.90**	0.41	0.73	0.68	0.55	0.59	0.62
Services	SEIU1	0.45	0.30	0.35	0.45	0.50	0.44	0.49	0.47	0.41	0.64	0.52	0.52	0.46	**1.00**	0.44	0.49	0.46	0.59	0.43
Informational	SEIU10	0.27	0.02	0.02	0.10	0.10	0.29	0.09	0.12	0.14	**0.71**	0.19	0.52	0.07	0.33	0.19	0.23	0.01	0.32	0.26
	SEIU11	0.36	0.08	0.08	0.23	0.21	0.40	0.24	0.22	0.15	**0.67**	0.29	0.62	0.17	0.27	0.34	0.38	0.04	0.33	0.33
	SEIU12	0.44	0.37	0.39	0.38	0.41	0.50	0.39	0.42	0.37	**0.65**	0.36	0.63	0.45	0.32	0.53	0.51	0.24	0.49	0.45

	SEIU2	0.36	0.34	0.41	0.42	0.47	0.37	0.44	0.36	0.37	**0.74**	0.45	0.45	0.39	0.69	0.39	0.41	0.35	0.56	0.39
	SEIU3	0.34	0.13	0.14	0.32	0.39	0.45	0.38	0.35	0.36	**0.78**	0.43	0.51	0.29	0.57	0.42	0.38	0.24	0.55	0.48
	SEIU4	0.26	0.17	0.19	0.29	0.31	0.40	0.39	0.24	0.22	**0.77**	0.32	0.48	0.25	0.40	0.33	0.37	0.18	0.35	0.35
	SEIU5	0.42	0.45	0.44	0.44	0.44	0.37	0.40	0.41	0.50	**0.69**	0.35	0.46	0.55	0.49	0.48	0.40	0.41	0.57	0.45
	SEIU6	0.34	0.13	0.17	0.29	0.25	0.43	0.24	0.32	0.26	**0.65**	0.37	0.50	0.29	0.34	0.35	0.37	0.24	0.31	0.43
	SEIU7	0.52	0.48	0.50	0.50	0.55	0.55	0.52	0.49	0.50	**0.71**	0.53	0.61	0.55	0.54	0.53	0.54	0.43	0.56	0.57
	SEIU8	0.34	0.14	0.16	0.27	0.26	0.39	0.24	0.28	0.24	**0.69**	0.24	0.56	0.32	0.27	0.34	0.37	0.16	0.36	0.38
	SEIU9	0.34	0.15	0.15	0.21	0.17	0.33	0.14	0.17	0.21	**0.75**	0.26	0.59	0.20	0.35	0.25	0.29	0.11	0.42	0.36
Operational	SEOU1	0.59	0.38	0.49	0.59	0.55	0.53	0.53	0.59	0.43	0.52	0.53	**0.74**	0.58	0.56	0.62	0.63	0.53	0.63	0.47
	SEOU10	0.55	0.47	0.52	0.53	0.51	0.47	0.49	0.55	0.42	0.47	0.43	**0.72**	0.56	0.38	0.57	0.54	0.54	0.54	0.39
	SEOU11	0.54	0.51	0.49	0.56	0.49	0.46	0.50	0.50	0.46	0.45	0.48	**0.70**	0.56	0.43	0.55	0.47	0.52	0.54	0.47
	SEOU12	0.57	0.62	0.62	0.59	0.58	0.44	0.56	0.54	0.56	0.43	0.60	**0.65**	0.62	0.44	0.56	0.49	0.58	0.56	0.50
	SEOU13	0.48	0.38	0.42	0.44	0.43	0.35	0.34	0.32	0.42	0.49	0.49	**0.66**	0.37	0.36	0.39	0.37	0.37	0.47	0.43
	SEOU14	0.41	0.23	0.25	0.35	0.35	0.47	0.34	0.36	0.28	0.60	0.39	**0.79**	0.26	0.36	0.42	0.46	0.21	0.38	0.42
	SEOU15	0.46	0.36	0.37	0.41	0.40	0.51	0.39	0.42	0.36	0.65	0.38	**0.80**	0.37	0.40	0.51	0.54	0.30	0.49	0.42
	SEOU16	0.40	0.30	0.31	0.35	0.36	0.45	0.38	0.39	0.35	0.55	0.32	**0.74**	0.39	0.33	0.44	0.48	0.26	0.42	0.40
	SEOU17	0.45	0.32	0.37	0.43	0.46	0.46	0.41	0.45	0.43	0.61	0.37	**0.72**	0.42	0.42	0.51	0.47	0.34	0.47	0.51
	SEOU2	0.18	0.07	0.06	0.10	0.06	0.22	0.08	0.05	0.05	0.43	0.20	**0.57**	0.02	0.16	0.16	0.25	0.09	0.25	0.18
	SEOU3	0.18	0.06	0.02	0.13	0.11	0.35	0.16	0.12	0.09	0.48	0.23	**0.62**	0.11	0.20	0.23	0.30	0.07	0.30	0.24
	SEOU4	0.23	0.17	0.11	0.13	0.09	0.34	0.15	0.10	0.14	0.47	0.29	**0.59**	0.11	0.18	0.23	0.27	0.07	0.32	0.23
	SEOU5	0.35	0.16	0.23	0.24	0.25	0.38	0.27	0.23	0.26	0.51	0.34	**0.66**	0.22	0.35	0.30	0.37	0.20	0.40	0.40
	SEOU6	0.31	0.16	0.17	0.18	0.20	0.33	0.24	0.21	0.19	0.53	0.29	**0.70**	0.16	0.25	0.30	0.32	0.11	0.41	0.33
	SEOU7	0.23	0.12	0.08	0.13	0.13	0.32	0.20	0.11	0.15	0.54	0.22	**0.66**	0.11	0.19	0.21	0.26	0.05	0.29	0.29
	SEOU8	0.30	0.16	0.18	0.19	0.22	0.38	0.27	0.21	0.23	0.45	0.27	**0.69**	0.18	0.20	0.31	0.33	0.14	0.36	0.32
	SEOU9	0.57	0.57	0.61	0.54	0.52	0.40	0.45	0.48	0.49	0.44	0.47	**0.64**	0.53	0.30	0.52	0.48	0.52	0.60	0.40
Transactional	SETU1	0.44	0.42	0.47	0.51	0.60	0.47	0.56	0.51	0.48	0.53	0.48	0.51	0.55	0.57	0.51	0.50	0.53	**0.82**	0.44
	SETU2	0.56	0.52	0.57	0.48	0.52	0.44	0.41	0.49	0.53	0.47	0.49	0.49	0.53	0.37	0.49	0.45	0.50	**0.77**	0.46
	SETU3	0.52	0.44	0.47	0.46	0.45	0.47	0.41	0.47	0.39	0.53	0.47	0.57	0.51	0.49	0.49	0.52	0.37	**0.85**	0.40

	SETU4	0.44	0.37	0.46	0.39	0.39	0.36	0.34	0.40	0.35	0.54	0.37	0.56	0.45	0.51	0.40	0.40	0.36	**0.86**	0.32
	SETU5	0.55	0.37	0.46	0.38	0.47	0.48	0.46	0.48	0.37	0.57	0.46	0.58	0.46	0.52	0.50	0.49	0.39	**0.89**	0.43
	SETU6	0.47	0.41	0.44	0.43	0.43	0.42	0.41	0.30	0.46	0.44	0.53	0.55	0.38	0.36	0.37	0.33	0.43	**0.71**	0.47
	SETU7	0.48	0.37	0.40	0.43	0.48	0.52	0.44	0.44	0.44	0.55	0.51	0.55	0.43	0.47	0.46	0.48	0.38	**0.72**	0.51
Industry	SIRST2	0.55	0.50	0.52	0.58	0.61	0.67	0.55	0.61	**0.96**	0.47	0.62	0.50	0.65	0.38	0.65	0.66	0.55	0.47	0.84
Transactions	SIRST1	0.58	0.61	0.63	0.64	0.68	0.64	0.62	0.69	0.96	0.40	0.65	0.47	0.72	0.41	0.69	0.64	0.65	0.54	**0.75**
	SIRST3	0.62	0.43	0.46	0.59	0.64	0.75	0.60	0.61	0.83	0.53	0.63	0.51	0.67	0.42	0.69	0.68	0.53	0.50	**0.94**
	SIRST4	0.55	0.45	0.47	0.56	0.59	0.72	0.53	0.53	0.78	0.53	0.62	0.56	0.60	0.35	0.63	0.63	0.48	0.49	**0.93**
	SIRST5	0.58	0.43	0.42	0.56	0.60	0.73	0.59	0.56	0.70	0.57	0.59	0.56	0.60	0.43	0.66	0.67	0.53	0.49	**0.92**
Convenience	TIRC1	0.66	0.63	0.67	0.75	**0.93**	0.64	0.83	0.68	0.66	0.44	0.67	0.51	0.68	0.49	0.70	0.65	0.72	0.56	0.60
	TIRC2	0.70	0.57	0.66	0.78	**0.96**	0.69	0.80	0.73	0.64	0.49	0.70	0.50	0.69	0.51	0.74	0.72	0.76	0.56	0.63
	TIRC3	0.64	0.57	0.62	0.76	**0.93**	0.65	0.76	0.66	0.59	0.46	0.65	0.56	0.70	0.42	0.72	0.71	0.68	0.55	0.60
Technology	TIRCT1	0.67	0.60	0.70	0.84	0.77	0.59	0.68	0.69	0.62	0.34	0.65	0.47	0.67	0.46	0.67	0.61	**1.00**	0.52	0.55
Connectivity	TIRCT2	0.65	0.60	0.65	**0.96**	0.78	0.63	0.71	0.70	0.60	0.46	0.67	0.55	0.72	0.46	0.70	0.67	0.85	0.53	0.57
	TIRCT3	0.67	0.57	0.64	**0.97**	0.77	0.65	0.65	0.66	0.61	0.46	0.69	0.56	0.69	0.43	0.69	0.66	0.80	0.54	0.61
	TIRCT4	0.65	0.60	0.67	**0.95**	0.80	0.62	0.66	0.65	0.63	0.43	0.66	0.53	0.68	0.40	0.67	0.66	0.77	0.51	0.58
Flexibility	TIRF1	0.60	0.55	0.59	0.64	0.79	0.64	**0.93**	0.67	0.59	0.47	0.66	0.49	0.66	0.52	0.73	0.67	0.64	0.55	0.57
	TIRF2	0.65	0.58	0.60	0.67	0.79	0.66	**0.96**	0.67	0.57	0.45	0.67	0.54	0.61	0.43	0.71	0.69	0.65	0.51	0.59
	TIRF3	0.65	0.56	0.57	0.69	0.83	0.68	**0.96**	0.69	0.59	0.45	0.67	0.53	0.64	0.46	0.72	0.70	0.66	0.49	0.61