INTEROPERABLE E-GOVERNMENT IN MALAYSIA: A FRAMEWORK FOR TRANSPARENT PUBLIC DELIVERY SYSTEM

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ABSTRACT

We are now living in an information age. ICT will never become a cliché. E-government is what reinvents the public delivery system. This research looks at interoperable e-government in Malaysia and its framework for transparency in public delivery system. The significance of this research profoundly paves the way to support the ICT strategies in public sector to deliver interoperable e-government that enhances public service into excellent service and better governance.

This research presents literature review of many areas pertaining to the revolution in public sector, the reinvention of public delivery system with e-government, case studies on e-government adoption and technology trends that are undoubtedly, key to innovate public delivery system.

Progressing the e-government maturity model is consistent with how Malaysia has to deal with the public demand. Transparency has emerged as an important agenda even though it may appear to have long been oblivion. Key factors that are determinant to bring transparency in public delivery system are identified. These factors are referred to as interoperable e-government factors. A descriptive framework for these factors was formulated. Data collection through stratified random samples was conducted. Data analysis was performed and the research was able to assess and confirm the hypothesis related to these factors. Empirically, the research is able to conclude that the degree of convenient service delivery and the level of intensely streamlined services are the most significant interoperable e-government factors that bring impact to transparency in public delivery system.

Service-Oriented Architecture (SOA) development framework was chosen as the software development framework. SOA is fast moving into mainstreaming applications as it is based on services-oriented approaches that support the service-enablement strategy in implementing interoperable e-government and progressing the maturity model. SOA as a development methodology is also suitable in addressing the complex enterprise architecture that exists in public sector. A system called e-Tourism was developed based on this framework to illustrate the interoperable e-government. E-Tourism is chosen as it implements a real-world application which involves the different facets of public sector interactions; the public delivery channel to deal with citizen, businesses and public at large in promoting this country globally and fostering the domestic economy and the electronic channel that supports a cohesive information exchanges in a collaborative and interoperable environment for cross-functional and cross-agencies services.

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CHAPTER 1 - INTRODUCTION

1.1 Introduction/Background

The advent of information and communication technology (ICT) is undoubtedly an important concept in supporting public delivery system. Embracing ICT, paves way to the implementation of information systems for automation and computerization of public delivery system. We are seeing governments around the world revolutionizing the way public service is delivered (Siddiquee, 2006). The introduction of the Internet technology has revamped the traditional way of doing things. It has introduced many innovative ways in providing new interaction channels for public to deal with government. This new channel for public information resources and services provisioning delivered electronically and online through the information systems, is what termed as electronic government (e-government). E-government makes the public delivery system more efficient (Gichoya, 2005).

One of the most significant aspect of government revolution is public delivery system with e-government that is driven by the rising expectations of the citizen whom demands the government to provide service that is more convenient, comprehensive, streamline, reliable, faster, pleasant and transparent. This in turn put pressures on the government to transform itself to deliver more efficient and effective public services (Siddiquee, 2006). Public delivery system has to introduce fundamentally different ways of interaction with the citizen. Public delivery system cannot remain status quo and hope

to meet the higher demands of service. The rapid evolution of ICT opens to many opportunities for introducing e-government that innovates public delivery system. In this competitive global economy and in order to move to greater heights in public service, governments must be agile towards organizational and technological changes driven by the modernization effect through the e-government strategy. Governments have to be synonymous with the agility in meeting the higher demands of public service.

The scope of the e-government is delivered to benefit the various public sector constituents that include the general public/citizen, business entities and government themselves. The e-government services can be broadly categorized under the 3 different facets of interactions (UN, 2005). They are:

1. Government to citizen (G2C) services
2. Government to business (G2B) services
3. Government to government (G2G) services

ICT is a consistent feature of e-government. ICT has a major role to play as the main conduit and enabler for the e-government to support the 3 different facets of public delivery system. Ideally, the G2C, G2B and G2G services are intertwined in a cohesive public delivery system.

Governments have to have the ability in responding to the information age in this new globalize economy. In realizing this, Malaysia, en route towards achieving Vision 2020, manifested by the launched of Multimedia Super Corridor (MSC) in 1996. This

embarks the government's endeavour to promote ICT in Malaysia and to leverage the potential of ICT to develop Malaysia towards a knowledge society (k-society).

The MSC flagships applications were developed as spearheads to the ICT initiatives in Malaysia. The "Government of Malaysia: Blueprint for Electronic Government Implementation" forges ahead with ICT as the enabler to reinvent the public sector in enhancing public delivery system (MAMPU, 1997). E-government is a flagship application under MSC. Initially, the e-government flagship targets key applications for key government services. The e-government flagship applications spearhead the e-government initiatives in Malaysia. The e-government flagship applications include Project Monitoring System (PMS), Electronic Labour Exchange (ELX), Human Resource Management Information System (HRMIS), e-Perolehan, eSPKB, e-Syariah and e-Services. They provide G2C, G2B and G2G services. Till today, we have seen many e-government applications, which are made available for the public in the pursuit to improve the public delivery system. Some of these initiatives are agency-led and they are not necessarily falls under the MSC E-Government flagship applications. Such examples available include the Traffic Summons Info and Payment under Polis Diraja Malaysia (PDRM) and Jabatan Pengangkutan Jalan (JPJ) which are also linked via e-Services, e-Filing for citizen and business tax filing by Lembaga Hasil Dalam Negeri (LHDN) via https://e.hasil.org.my/, i-Akaun through Kumpulan Wang Simpanan Pekerja (KWSP) myEPF portal and many more.

Over and above, the fundamental success to public delivery system in Malaysia is not just merely web-enabling information resources over the Internet. E-Government needs to offer complete, integrated, comprehensive and streamlined e-government applications that set tone to provide the foundation to improve transparency in public delivery system. Sarji (1996a, b) wants processes to be streamlined to remove red tapes and unnecessary bureaucracy; approval processes for the issuance of permits and licenses needs to be expedited. Hence, it is impetus for e-government to innovate public delivery system that is able to interoperate more efficiently to support the intended transparency in public service.

Finger *et al*. (2003) defined transparency as governance. It is by which the organizations can interact with each other. For an organization to be able to interact with each other, the systems must be able to interoperate. Encapsulating interoperability in e-government can help reaffirm transparency in public delivery system.

Transparency has always been in the national agenda. The Ninth Malaysia Plan 2006 – 2010 had unveiled five strategic key thrusts for the National Mission for 2006 to 2020 (EPU, 2006). The fifth key thrust is "To strengthen the institutional and implementation capacity". Under this thrust, it requires machinery that provides governance through the improvement of public delivery system, streamline of processes and put performance measures in place. Under governance for public administration and public services, transparency has always been on the national backdrop. Back in April 2004, the Government of Malaysia had outlined the National Integrity Plan (JPM, 2004).

It is a strategic plan with a purpose to primarily enhance national ethical and integrity values (JPM, 2004). One of its key objectives is to enhance efficiency in the public delivery system and to reduce unnecessary bureaucracy while improving governance and ethics. It aims to embark both short-term and long-term measures to improve government transparency in public service delivery system (JPM, 2004). The Malaysian Integrity Institute (MII), which is an independent agency, has been formed and entrusted to implement the necessary measures to support the stated aim and objectives (JPM, 2004). Enhancing the public delivery system is an important step towards improving the level of transparency in Malaysia.

According to Faruqi (1995), the concept of transparency is derived from accountability and responsibility. Therefore, transparency in public delivery system is derived from being responsiveness and accountable. Heeks (1998) stated that increased accountability is a key component in public sector revolution. His investigation covers the relationship between accountability and both ICT and information systems. According to Heeks (1998), information systems are an essential part of public sector accountability.

In striving towards greater transparency in public delivery system, e-government needs to grow the value chain and progresses through the e-government maturity model. There are many representation of the e-government maturity model. DMR Consulting had developed the E-Government Maturity Model based on four distinct and

complementary stages. As taken from DMR, the four characteristic stages are as represented below:

Stage 1 - Web Presence

Posting or publishing basic information on Internet;

Stage 2 - Interaction

Publishing more information; providing basic search capabilities; saving, downloading and printing of forms; communicating via emails and linking with other websites;

Stage 3 - Transaction

Offering self-service applications using electronic forms to full electronic implementation of services including electronic signatures and payment (if required) and opportunities to develop cross-agency services; and

Stage 4 - Transformation

Providing long-term goal of all e-government initiatives, allowing integrated services to be offered on the 'one-stop-shop' principle, improving customer satisfaction and making government organization totally transparent to public.

United Nations on the other hand, reproduced Web Measure Assessment Model to assess e-government readiness based on five stages e-government evolution (UN, 2005). Regardless, the objective of either model is to measure progressive maturity of e-government.

Based on the e-government maturity model, public delivery system has to be able to interact and transact, as these are the paves the way for an interoperable e-government. This is the progression to stage 3 (Transaction) of the model. According to IEEE (1990), interoperability is the ability for two or more systems or components, interconnected, in a heterogeneous environment working together in exchanging information and using information that has been exchanged in an integrated manner. These capabilities are crucial for public delivery system in order to promote collaboration and deliver integrated across-agency services. These capabilities are not only providing the convenience that the citizens need but also removing any unnecessary bureaucracy. This serves as the foundation to the ultimate transformation where total transparency in public delivery system is achieved when the e-government evolved to the most matured model at stage 4 (Transformation).

Governments around the world had made various degree of progress in delivering e-government (West, 2004). The progress can be measured against the stages of e-government maturity model. These stages reflect the increasing capability of the e-government applications. The progression can be taken incrementally or some may leapfrog through these stages. It all depends on many factors. Some progressed fast and well ahead of others (West, 2004). The pace of the progression can be very subjective and determinant by many factors that can bring impact to the public delivery system. Assessing the state of the current e-government application portfolio and benchmark against the e-government maturity model can be the yardstick in determining the high potential and strategic applications moving forward. This serves as a performance

measures and helps to give an indication of the current stance of e-government applications and evaluate the gaps between current and the desired evolution of the e-government applications. ICT as a strategic enabler can address the growing concerns and demands in public sector moving forward.

Over the years, governments had invested in many different systems and diverse technologies to support the operations. There are many silos and disparate systems that made up the enterprise architecture. Making e-government interoperate means that the services are to be streamlined within the agencies and across agencies to facilitate the information sharing and information exchanges across the heterogeneous architectures. Software development framework based on the principle of Service-Oriented Architecture (SOA) is a framework that can be adopted, as it is suitable to address large government complex and fragmented software architectures. It is a new paradigm in system development perspectives. SOA gives a framework for software development that looks at building services from the existing and new systems and coordinates these services in a streamline and interoperable manner. SOA provides a pragmatic solution to develop interoperable e-government that will address e-government challenges and realize transparency in public delivery system.

Several studies have examined the public sector revolution. E-government helps in this revolution by reinventing public delivery system. Siddiquee (2006) had reported on public sector reform measures in Malaysia. Siddiquee (2006) broadly discusses transparency and accountability in public delivery system for a more responsive

government. Siddiquee (2006) mentioned the government's expectation for more online services with one public service portal that can interoperate and collaborate processes amongst the Malaysian public sector. Literatures from Heeks (1995, 1998, 2000, 2004) had profound studies on public sectors reform measures, the diffusion of e-government to reinvent public service and management of corruption in public sector. Janssen *et al*. (2006) had studied on how services orchestrations supporting cross agency collaboration in public sector administration.

This research seeks to extend prior researches by studying the intrinsic factors of an interoperable e-government that are determinants to improve transparency in public delivery system. This research also seeks to assess empirically, the significance of the intrinsic factors of an interoperable e-government on transparency in public delivery system in Malaysia. This research also seeks to determine a development framework that can be adopted for the development of an interoperable e-government application that improves transparency in public delivery system.

1.2 Statement of Problem

"Interoperable E-Government in Malaysia: A Framework for Transparent Public Delivery System."

With the rise of the Internet, online delivery of public information and services has prevails to be a key enabler to support e-government initiatives everywhere in the

world. The Government of Malaysia has taken every effort to improve the public service delivery system with e-government services now offered by various different agencies. Interoperability in e-government is becoming important in setting the path for the Malaysian e-government to move up the ladder of the e-government maturity model. Interoperable e-government is where information and services flow and exchanged within agencies and across agencies (Gortmaker *et al*., 2004). Interoperable e-government will be more intense when information and services delivers the expected scale and form of use from the services provided. Interoperable e-government delivers convenience to public service when the services are made less onerous compared with the traditional way of dealing with government. Interoperable e-government delivers streamline information and services beyond organization boundaries. Interoperable e-government provides alternatives to the oppressive traditional way of dealing with the government agencies though its supports for multiple-channel delivery mechanism. These form the intrinsic factors for interoperable e-government that improve transparency in public delivery system. It is intrinsic because it forms the essence inherent to the factors contributing to the interoperability e-government. A transparent public delivery system is the basic principle for an excellent public service.

In performing the research of the stated problem, it is key to can uncover some of these areas:

1. Determine the significance of interoperable e-government in Malaysia measured by the level of intensity of services offered, on improving transparency in public delivery system.

2. Determine the significance of interoperable e-government in Malaysia measured by the level of streamlined services offered, on improving transparency in public delivery system.

3. Determine the significance of interoperable e-government in Malaysia measured by the degree of convenience provided, on improving transparency in public delivery system.

4. Determine the significance of interoperable e-government in Malaysia measured by the degree of sophistication of the delivery mechanism, on improving transparency in public delivery system.

5. Determine a framework that can be adopted for the development of an interoperable e-government application that improves transparency in public delivery system.

1.3 Research Objectives

This research is carried out to support the following objectives:

1. To identify the intrinsic factors of an interoperable e-government that are determinants to transparency in public delivery system.

2. To assess empirically, the significance of the intrinsic factors of an interoperable e-government on improving transparency in public delivery system in Malaysia.

3. To determine a framework that can be adopted for the development of an interoperable e-government application that improves transparency in public delivery system.

1.4 Scope

The scope of this research covers the three facets of e-government interactions in Malaysia. They are G2C, G2B and G2G services. The e-government concept is the use of ICT for online and electronic delivery of public information and public services. Against this backdrop, many government agencies in Malaysia had embarked on e-government initiatives, using various degree of ICT for various scales and forms of the online public delivery services, targeting at various constituents including public/citizen, businesses and government. The scope covers all of the Malaysia public sector driven e-government initiatives that covers all agency-led initiatives and the MSC e-government flagship applications.

The scope of e-government in Malaysia covers the breadth of all online delivery of information resources and services in Malaysia provided by the government federal government and the agencies and departments beneath them; the state governments and

the agencies and departments beneath them; local authorities, statutory bodies, kuasi government and wider public service providers such as public higher learning institutions and public healthcare service providers.

1.5 Research Questions

This research attempts to answer the following questions:

1. Does interoperable e-government in Malaysia measured by the level of intensity of services provided, significant in improving transparency in public delivery system?

2. Does interoperable e-government in Malaysia measured by the level of streamlined services offered, significant in improving transparency in public delivery system?

3. Does interoperable e-government in Malaysia measured by the degree of convenience provided, significant in improving transparency in public delivery system?

4. Does interoperable e-government in Malaysia measured by the degree of sophistication of the service delivery mechanism, significant in improving transparency in public delivery system?

5. What development framework can be adopted for the development of an interoperable e-government application that improves transparency in public delivery system?

1.6 Definition of Terms

The followings are the definition of terms based on the key words:

1. Interoperability comes from two main words i.e. inter and ability to operate. Inter denotes among. The ability to operate means the ability to function or work. Interoperable is the ability for information systems to interoperate and communicate in conjunction with each other. An interoperable system allows information flows and information exchanges (synchronously and/or asynchronously) in an interconnected environment encompassing infrastructures like communication protocols, hardware, software, application, and database layers. An interoperable system allows systems to be integrated. Integration can be cohesive and interconnectivity can sometimes be seamless.

2. E-government is the use of ICT that delivers information systems that provides online and electronic channels for the delivery of information resources and the provisioning of public services. E-Government applications are the practical use of ICT for more innovative delivery of public information resources and services to the public. E-government is as an alternative

channel to the traditional way of dealing with government and public sector organizations. E-government should provide a more efficient and effective means when dealing with public sector organizations. The context of e-government covers the 3 facets of interactions in G2C, G2B and G2G services that can also be intertwined in a cohesive manner.

3. Framework means structure that provides basic guidelines. In this context, the framework is for system development methodology for building information systems based on technology foundation. The framework here also refers to proven system development methodology.

4. Transparent means something that is provided which is obvious, able to see clearly or able to see the truth. Transparent makes information available. Transparent provides reliable, timely and valid information. Transparent demonstrates openness in decisions and actions, from source to recipient. Transparent gives clarity in decisions and actions, from source to recipient. Transparent supports free flow of information, from source to recipient.

5. Public delivery system is an organized set of processes and procedures that function to deliver information resources and services to the public at large. In this context, the government as a whole is the provider of the public service. The government information services that are facilitated by means of e-government makes the public delivery system.

1.7 Limitation of Study

This study does not examine the underlying barriers that are detrimental in the implementation of interoperable e-government to achieve the intended objectives of a transparent public delivery system. This study is not set out to cover or propose business process re-engineering approaches in the government agencies that may potentially happen when processes are reviewed in providing interoperability and cross-agency integration. This study also does not withstand the stigma of managing change to the human factor that could happen with the provisioning of interoperable e-government or from any re-engineering of process.

1.8 Significance of Study

Malaysia has come a long way in implementing e-government applications in supporting its public delivery system. This is marked by the initiatives that Malaysia had started when MSC was introduced about a decade ago. Formulating the ICT strategy towards interoperability of e-government applications that promotes transparency brings bona fide strengths to the Malaysian government in paving the way to enhance the integrity values and better governance.

This study is to support the Malaysia's national agenda that the government and the country aspires to be.

The whole concept of providing interoperability in e-government applications that promotes cross-functional and cross-agency integration can be implemented and can delivers the results expected in helping to improve transparency in public delivery system and enrich integrity values for public governance.

Successful deployment of e-government applications based on SOA development framework that forms the basis of service-enablement, demonstrates an interoperable e-government that helps improves transparency in public delivery system.

1.9 Expected Research Outcomes

Whilst ensuring the Malaysian public delivery system meets the expectation of the public at large, it is hoped that at the end of this research, by assessing empirically, the intrinsic interoperable e-government factors that are determinant to transparency in e-government in Malaysia can be ascertained.

It is also hoped that at the end of this research, a development framework can be adopted for the development of an interoperable e-government application. This framework can be the base for public sector organizations to model the solution to address the diversity of the Malaysian e-government enterprise architectures in its endeavour to offer interoperable e-government that improves transparency in public delivery system. A system is developed based on this development framework to bring interoperability in e-government to effect.

1.10 Organization of Thesis

Here is the outline of the organization of this research paper.

Chapter 1 – Introduction

This chapter gives the background to the research problem, the objectives and scope of the research, the research questions, the definition of the terms used, the limitation and significance of the study and the expected research outcomes.

Chapter 2 – Literature Review

This chapter discusses the related literature review that supports this study.

Chapter 3 – Research Methodology

This chapter explains the sampling method, the instrument for research, the research design, the conceptual framework, the research variables, the hypotheses, the survey procedure and measurement.

Chapter 4 – Findings of the Study

This chapter discusses the outcome of the data collection. Based on the results of the survey, this chapter discusses the findings of the study from the data analysis.

Chapter 5 – Adopting a Development Framework

This chapter discusses the chosen development framework that can be adopted in creating interoperable e-government that improves transparency in public delivery system.

Chapter 6 – Developing a System

This chapter explains the system development effort to build a prototype of an interoperable e-government based on the chosen development framework. The system overview, system objective, system scope, users of the system, system development methodology, system configuration, system design, system development, system testing, limitations, future work are also discussed.

Chapter 7 – Concluding Remarks

This chapter concludes with the outcomes of the research, the limitation of the research and future work that can be expanded from this study.

CHAPTER 2 - LITERATURE REVIEW

2.1 Introduction

Public delivery system is the whole process of delivering or providing information and services delivered by the public sector to the public at large. The word public sector is also synonymous to the word government. So what is a government? According to Merriam Webster dictionary, a government is "the organization, machinery, or agency through which a political unit exercises authority and performs functions and which is usually classified according to the distribution of power within it". According to Oxford English Dictionary, the word government means "the governing body of a state".

This chapter is intended to provide the reviews of related literature that is focused on the following areas:

1. The revolution in public sector
    a. Background
    b. Driving factors
2. E-Government
    a. E-government scenarios
    b. E-government objectives
    c. Role of ICT
    d. E-government challenges
    e. E-government key success factors

3. Transparency in public delivery system
    a. Requirement for accountability
    b. Drivers for governance
4. E-Government interoperability
    a. Intensity of services
    b. Streamlined services
    c. Convenient services
    d. Sophistication of service delivery mechanism
5. ICT directions towards interoperability
    a. Technology trends
    b. Unleashing ICT

2.2 The Revolution in Public Sector

2.2.1 Background

Public sector is an institution that performs public administration and public governance. It governs, controls and provides information and services to its constituents. There is continuous endeavour to transform public sector as a value creation similar to how the private sector had undergone. The transformation is a platform to revolutionize the operation in order to streamline the processes and the cost of operation. It may entail a process reengineering for process improvements in order to achieve productivity gain and thus reduced the cost of government operations.

According to Heeks (1998), the revolution effort that forms the public sector reform agenda has been in decades. According to Yong, (2003) the transformation initiative towards reinventing the public sector management has evolved into a new phenomenon called the "New Public Management" (NPM). Barzelay (2001) stated that the NPM "instruments the government-wide" towards a more systematic "public management policy". This is a key concept that can be viewed to be able to achieve interoperability and cross agency public delivery system as NPM covers government-wide process (Barzelay, 2001). According to Siddiquee (2006), Malaysia has implemented NPM-type of improvements.

2.2.2 The Driving Factors

Revolution in public sector has prevails to become more important as we see the global scenarios of government reinventing themselves. Heeks (1998) said that public sector revolution has been ongoing. The degree of the revolution taken by government varies from country to country depending on the measures taken. It can be incremental or extremely radical (Yong, 2003). However, it is also important to ensure that the scope of the revolution addresses practicality and pragmatism as oppose to what would be ideal. Wescott (2004) refers to pragmatism and "not in an ad hoc manner".

The drivers of change in public sector are driven by many factors both internal (i.e. force from within government) and external factors. Heeks (1998) looks at the drivers of change from three different angles. He termed a "stereotypical" force in the

public sector reform is the drive from the public at large. This is an external force and it is a profound implication where the revolution in public sector is driven by the readiness and maturity of the society.

There are driving factors from within. According to Wescott (2004), the drivers for public sector reform are attributed from the strong leadership and coherent vision of goals for public service improvement. Similarly, the element of selectivity on what is pragmatic needs to be ascertained in managing the impact from the evolution. Leadership to Barzelay (2003) is the top officials that have crucial role to play for reforms to happen. An example given by Wescott (2004) is the Pakistan's new government in 1999, where they decentralized the reform efforts. This gives more empowerment for local government accountable to the public. Whatever the approach is, political leadership and power is also the driving factor for public sector reform (Heeks, 1998).

The drivers of the public sector revolution include the effort and focus to deliver more citizen-centric delivery of services (Yong, 2003). This allows a total new experience in public delivery system by making the services more "citizen-friendly" and "service conscious."

2.3 E-government

2.3.1 E-government Scenarios

The derivation of public sector revolution is the emergent of e-government. E-government reinventing the public delivery system is a global phenomenon. This has introduced many computerizations projects under the e-government initiatives that has been planned or implemented to meet its purpose in enhancing the public delivery system.

Various studies have revealed the diffusion of e-government in many countries across the globe. Based on the Global e-Government Ranking 2006, undertaken by Brown University, the countries pace in e-government varies (West, 2006). The ranking is based on the overall assessment of 1,935 government websites from 198 countries. Malaysia's country rating is 36 with a score of 32.7 out of 100 point in 2006. Some of the highly ranked e-government services are Korea, Taiwan, Singapore, United States and Canada.

In Malaysia, the national ICT program under MSC drives the e-government initiatives towards the strategic imperatives of becoming a knowledge-based economy. This is rooted from the "Vision 2020" for Malaysia to be a fully developed industrialized and knowledge society by the year 2020. The launched of MSC in 1996 earmarked e-government as one of the flagship applications. The birth of e-government flagships applications has then rolled out for more adoption to support the public delivery system.

There are also agencies' driven e-government initiatives. Admirably, the myGovernment website was introduced at http://www.gov.my, which is the access to the Malaysia's single-portal for e-services. The approach is made pragmatic with the services allowing Internet access from any device including GPRS/3G mobile or hand-held devices, anywhere and anytime. Ultimately these applications describes the intention to reinvent the public service delivery mechanism in a way in which e-government is strategic to enhance the delivery of service and provide better governance.

Yong (2003) described Brunei's vision and strategy towards e-government is to support the public sector reform. Brunei embarked on E-Brunei. The E-Brunei takes leadership from the Brunei IT Councils. Yong (2003) also provides example for India. India's National ICT programme drives the ICT action plans for the E-Governance in India. The E-Governance vision is "to apply Information Technology in the processes of government functioning to attain a SMART government. SMART is an acronym that means:

- Simple
- Moral
- Accountable
- Responsive and
- Transparent

Singapore is also amongst the world leader in e-government services. Singapore's e-government programme has been reinvigorated recently with five new strategic

priorities (Accenture, May 2004). Singapore attained above-average improvements in its overall customer relationship management score.

The United Kingdom (UK) Government with the CabinetOffice, statement set target for electronic delivery system for all government service by 2005. This British e-government initiative is called "UK-online" (Schedler and Schmidt, 2004). This can be accessed via http://www.uk-online.gov.uk. German Federal Government has embarked on the current e-government initiative called "BundOnline2005" (Schedler and Schmidt, 2004). The government actually concluded with over 440 online e-government services by end of 2005. Access to this is via http://www.bund.de.

According to Accenture's report (May 2004), the countries growth in the e-government maturity model has fallen off for second year in a row, some countries hit plateaus after a period of rapid development. The average maturity increase across all countries in 2004 was 5.6 percent in comparison to an average of 7.4 percent in 2003 and 11.5 percent in 2002. For the last four consecutive rows, the top three maturity countries are Canada, Singapore and United States. The 2004 e-government maturity score for Canada is 80 percent and both Singapore and United States with 67 percent. Malaysia falls at the seventeenth position with 46 percent with a large group of countries ranging between 50 to 60 percent. According to the report Malaysia had made steady progress year after year.

There are many case studies presented on e-government (Heeks 1998; Yong 2003; Deininger and Mpuga, 2005). Many of these literature does not describe any statistics on the level of satisfaction increase in the e-government delivery system and the quality of services attained from the e-government public delivery system. In fact, there is very little data of success and failure of e-government especially in developing countries (Heeks, 2004).

2.3.2 The Objectives of E-government

According to Kaul and Odedra (1991) e-government is the implementation of a wide range of ICT applications as government revolutionize the public delivery system. The objective of the implementing e-government is primarily to improve public sector performance (Ebrahim and Irani, 2005). E-government is to make the public delivery mechanism more effective as it speed up the delivery of services. In addition, it also improves the quality of services with citizen-centric services.

2.3.3 Role of ICT

There is great potential contribution of ICT in e-government that reinvents the public delivery system. The innovations driven by the advent in ICT has been the enabler for the public sector revolution though the emerged concept of e-government (Yong, 2003). The innovations should not be seen as the technology-drive but rather an enabler for the transformation for public service into a citizen-centric institution.

Conversely, Moon (2002) stated that in the case of the adoption of e-government in many local governments in the US, are still at infancy stage with no real expected results that e-government has promised.

Self-service applications are the services delivered directly to public for convenience. It spins off with the availability of Internet. In Malaysia, e-Filing is an example of self-service capabilities to file income tax return. It is a secure system using digital certificates. According to Accenture (2004) the Australian Tax office offers full online tax service for businesses with services offered including paying business returns online, transferring balances between accounts, requesting refunds, viewing tax accounts in details and paying obligations. There are many other examples of similar self-service and online tax return including French Tax via http://www.frenchtaxonline.com for online submission of income tax return forms.

ICT offers a great deal to the enhancement of public delivery system. It has clear position in taking e-government to the next phases of the e-government maturity model. Accenture (2003) believes that emerging technologies will play a key role in successfully managing the dynamic challenges in public sector. Those that are agile to technology advancement will be able to far outstrip any progress made thus far in the e-government implementation.

2.3.4 E-Government Challenges

There are challenges faced in e-government implementation. There are many factors to this. Human change, process change and the adaptation factor are difficult to manage. According to Westcott (2004), the public sector reform in Andhra Pradesh India, was a challenged as e-government initiatives was part of the reform strategy. As computerization is involved, it was a difficult process to overcome the sensitive issues as it involves the human factor (Wescott, 2004). New system was introduces in Cameroon Ministry of Public Service and Administration Reform (Kenhago, 2003). However, according to Kenhago (2003) the system was a failure, as it did not get the buy-in from the users. An example given by Heeks (1998) on a government's pension office was also a failure as there it was too difficult to overcome problems in adopting changes in the public delivery system.

Resistance to change is contributed by the inability to be agile and flexible to adapt to change. Resistance to change can also be attributed by people who are not motivated and not inspiring to support. Schedler and Schmidt (2004) refer to this as lack of "soft factors" stated that resistance to computerization is the "fear of losing their jobs" (Heeks, 1998; Bryant and Syan, 2002). Heeks (1998) based this on his study at one government's pension office. As computerization is an automation of processes, and if the traditional counter service or face-to-face is done without, the resistance of losing authority also attribute to resistance. Some fears for the lack of "necessary skills" as this is the impediment to computerization efforts (Heeks, 1998; Bryant and Syan, 2002). Schedler and Schmidt (2004) in their studies looked at "management activities, political

involvement and external factors" as some of the main obstacles to the implementation of e-government. Poor change management will hinder the reinvention of the public delivery system. Motivation needs to be instilled. This can be done with some incentives (Schedler and Schmidt, 2004). Political involvement as examined by Ingram (1977), is a strong drive to progress e-government. There are also many different factors involve in e-government implementation that can be detrimental to the success if they are not managed well (Schedler and Schmidt, 2004).

2.3.5 E-government Key Success Factors

Heeks (2004) gathered baseline data from Development Information Exchange and 40 reports on e-government cases from the University of Manchester. He extrapolates the result and the landscape of e-government projects in developing countries as "35% are total failures, 50% are partial failures and 15% are successes".

There are many reasons contributing to the high failure rates. Leadership commitment "top-down", political drive and executive sponsorship are key (Yong, 2003; Wescott, 2004). In addition, it is vital to have proven IT strategies (Yong, 2003). ICT strategies need to be the enabler to the reform agenda as it reinvents the traditional way of doing things. As investment and budget for ICT projects can be substantial, it is important to get the due return-of-investment (ROI). The take up rate or adoption rate of such investment is a contributing factor of success. The information system should deliver what it was intended for. This according to Stoltzfus (2004), the "motivation" for

implementing e-government applications is by meeting the public service needs. According to her, the motivation can come from the awareness of the importance and purpose of the e-government projects.

According to Gartner Study in 2002, 60% of government agencies have failed in the e-government projects implementation. The report also concluded that only 10% of governments would be able to move e-government successfully by 2005. It is key to have effective ICT planning, development and deployment (Gupta and Jana, 2003). Proper management is fundamental to projects implementation. This helps to implementation success and making sure the e-government project gets the expected return of investment.

2.4 Transparency in Public Delivery System

2.4.1 Requirements for Transparency

Accountability can be achieved when there is openness. Information availability gives added impetus to higher quality of service and satisfaction in public delivery system (Deininger and Muga, 2005). The government that is focused on being more citizen-centric through ensuring the delivery of high quality of public service is accountable for their performance (Yong, 2003). Indeed when there is lack of accountability it makes poor service delivery.

Consistent with the perspective, the more discourse of accountability in public sector setting can create pervasive corruption (Heeks, 1998). Corruption happens when there is abuse of power and authority towards the public for their own personal benefits. Heeks's (1998) view of the autonomy is towards the "valued resource" that includes the provision of information and service for those who will pay for it. Deininger and Mpuga (2005) defined corrupt practice as the "abuse of public power for personal gain".

The development of the nation's economy is paramount especially in a developing country (Deininger and Mpuga, 2005). This has always been the primary objective where the country is heading. However, the impact of corrupt in public delivery system can escalate to the problem where foreign investments backing-off that can make the country suffer from the depreciation on the nation's economic developments (Smarzynska and Wei, 2001). Deininger and Mpuga (2005) supported this through what they referred as a "transparent mechanism" in the act of being accountable in the managing of the public valued resources, which is essential in exploiting the full potential of economic growth.

Case studies by Heeks (1998) showed that despite the computerization of the work function, there are still loopholes for non-accountable act for those whom have access to the "valued resource". ICT does little to affect the root causes as the phenomenon rooted in the current context of culture, political and economic stability.

Transparency International Corruption Perceptions Index (CPI) 2006 is an index that charts the levels of corruption in public sector in 163 countries in the world. According to the index, the level of the country is determined from the scale of 0 for highly corrupt to 10 for highly clean. The index is a good benchmark for the government to be aware of their current stand and helps identify measures to reduce the undesirable consequences. In this report, Malaysia's scored a scale of 5.0 but Malaysia's position has dropped from level 39 in 2004 to level 44 in 2006. Other countries that are ranked high in the index with a scale of 9 and more are Finland, Iceland, New Zealand, Denmark, Singapore, Sweden and Switzerland. Based on this report, year-on-year there are countries that made improvements. This demonstrates that there are efforts to undermine the problem and making the transparency more evident. Developing countries are more exposed to corruption (Deininger and Mpuga, 2005). Loopholes and non-transparent procedures can lead to corruption (Heeks, 1998).

2.4.2 Drivers for Governance

After the fall of Enron, corporate governance comes to fore. Transparency plays a major function in achieving governance. Transparency is a worldwide phenomenon. The issue of governance is the agenda now but it is actually has been going on (Bardhan, 2000). According to Wescott (2004), Transparency International is to respond to the pressure to support the governance agenda. Wescott (2004) said, "Asia Development Bank (ADB) and other International Finance Institutions describe transparency as

governance". ADB defines governance as "the manner in which power is exercised in the management of a country's social and economic resources for the development."

Improvement in public sector should encapsulate transparency in the whole context of governance in the public sector revolution. E-government applications extend public delivery service while achieving the benefit of public sector performance (Accenture, 2004).

2.5 E-Government Interoperability

According to Accenture's (2004) report, many countries have attained the stage 2 (Interaction) of the E-Government Maturity Model by DMR Consulting. However, what has not happened in most of the countries is the progression to the subsequent stages of the maturity model that lead to the transformation of the public delivery system towards total-transparency. The shortcoming to the inability to offer interoperable e-government that involves cross-government impedes the progression for transparent public delivery system.

Malaysia has admirably defined the "Blueprint for E-Government Implementation" that sets the landscape and model for inter-agency and intra-agency collaborative environment (MAMPU, 1997). The aim is to support public sector revolution through the support of leading edge technology to foster efficiency and effectiveness (MAMPU, 1997). Complementing this, "Standards, Policies and

Guidelines – Malaysian Government Interoperability Framework (MyGIF)" version 1.0 was introduced in August 2003. MyGIF defines the specifications for standards, policies and guidelines for government application to interoperate, which governs the communication of the systems, the flow of information and exchanges of data and business process (MAMPU, 2003). They provide good guiding principles to propel e-government in Malaysia to greater heights. In supporting the Malaysian Public Sector Open Source Software Initiative (OSSI) master plan, MAMPU has introduced a "The Malaysian Government Interoperability Framework for Open Source Software (MyGIFOSS)" in February 2006 with similar purpose as MyGIF but with more focus to support Open Source Software (OSS) (MAMPU, 2006).

The UK Cabinet Office, under the e-Government Unit, has also defined the standards for seamless electronic government (UK, 2005). The standard is called e-Government Interoperability Framework (eGIF). The e-GIF defines the technical policies and specifications governing information flows across government and the public sector. They cover interconnectivity, data integration, e-services access and content management. According to eGIF, these technical policies and specifications are kept aligned to the changing requirements of the public sector and to the evolution of the market and technology. This is a direct emphasize on the reality of the diverse nature of business requirements and the dynamics nature of technology change that these specifications have to keep up with. Otherwise, the most intended e-government strategies are not realized due to application difficulties and environment changes that can be serendipitous.

Another example is New Zealand. New Zealand (NZ) Government has also came up with the policies and standards that support interoperability for cross-agency services (NZ GOV, 2006). E-government Interoperability Framework (e-GIF) is a collection of policies and standards endorsed for NZ Government information systems.

These examples are great examples that illustrate the efforts by the various governments to define ICT standards and policies to promote interoperable e-government to take to e-government to the subsequent level of maturity. Attaining interoperable e-government is not merely embracing the ICT standards and policies in the development and deployment of e-government but also the intrinsic factors or qualities that contributes to interoperable e-government. These intrinsic factors or qualities attributed to an interoperable e-government are viewed and categorized as follows:

- Intensity of services
- Streamlined services
- Convenient services
- Sophistication of the delivery mechanism

2.5.1 Intensity of Services

The greater diffusion of Internet helps to develop the public comfort in the uptake of electronic and online e-government services and makes the government more effective, more efficient and more transparent. Increased usage of Internet technology is

a "vehicle" for more transparent public delivery system (McIvor *et al.* 2002). It is learned from Cavalluzzo and Ittner (2004) that "data limitation" which is the inability of having information that is valid, reliable, timely and cost-effective impedes accountability. Conversely, when e-government services offered are more intense, it makes the public delivery system more transparent. In this context, the intensity of services offered is the form of use, which in this case is valid, reliable, timely and cost-effectiveness. This is allowing "anyone, from anywhere at anytime to access information and services and to communicate and to transact" (Deakins and Dillon, 2002). The intensity becomes prevalent when the services offered are more valid and acceptable to the public. Gaining the public trust in e-government is fundamental for any e-government efforts. E-government can offer reliable services that are dependable and trusted by the public when information resources can be accessed. According to Ebrahim and Irani (2005), "maintaining security and privacy of information is critical in the public delivery service to build public confidence and trust".

Public delivery system is more effective when the e-government can offer the information resources and services that are timely and relevant though the desired level of interoperability achieved within the e-government (Heeks, 1998). The Canadian Government has started on the e-government initiative and focuses on making information and services more available, more easily assessed and more organized that meets the needs from the public (Al-Mashari, 2007)

E-government can be made intense especially when its form of use is accepted by legislative. The example given by Al-Mashari (2007) is on the Dubai Government who made electronic documents legislatively valid and official as paper documents. This promotes a cross-agencies coordination and information flow that eventually makes public delivery system execution more punctilious. The Dubai Government will also intensify the public awareness level to encourage more participation from the citizen and businesses to conduct electronic transactions. It is learned from Russell and Bvuma (2001) that the South Africa's government transforms public service delivery and intensifies process improvement initiatives. This initiative commissioned with "Batho Pele", which means "People First", introduced in 1997. Amongst the overarching key principles adopted in "Batho Pele" includes the need to improve access level and to provide equal access to the government services. With a survey undertaken in 2000, the South Africa's government conceded that there are still a lot more improvements to be carried out by the government to strengthen and increase the intensity of "Batho Pele".

2.5.2 Streamlined Services

As the e-government progresses the maturity model, the rise in the public demand will seek for services that are more streamlined. The requirements for process coordination and collaboration amongst agencies are required in the quest to improve service delivery (Janssen *et al.*, 2006). This process coordination and collaboration is made possible with technology as technology enables systems to be able to interoperate. There is a growing need for e-government to be able to interoperate efficiently and

effectively. The public sector has highly fragmented enterprise architectures and silos of verticals of the various functional groups or organizational structures that makes it even important for the public to experience streamlined operations. When the operations are streamlined, process flows are coordinated and information can be exchanged, if not seamlessly by the systems. Gortmaker *et al.* (2004) agrees that public delivery system requires coordination of business process spanning multiple agencies. They view ICT and Internet technology as the means to address these requirements in order for better service delivery and interactions with public.

The process coordination within an agency or cross-agencies in a service-oriented approach interoperates and integrates through the fragmented enterprise architectures and in many cases re-engineering of processes could happened before processes can be streamlined. Convoluted processes need to be improved. Re-engineering of processes may entails a breakdown in functional and organizational boundaries (Pantazi and Georgopoulos, 2006). Organizations need to be agile to respond to the dynamics and the rising demand from the public.

Ongaro (2004) described how technology plays a significant role in building the interconnectivity for process-oriented approach across organizational and functional boundaries. Processes flows that are coordinated give an experience of one-stop-shop. This capability makes it less onerous alternative to the delivery channel of public service compared to the traditional way of dealing with government. For this to happen, systems need to be integrated. In order to be integrated, the systems need to be able to

communicate and interconnect. One way to communicate is by being able to establish the interfaces required within systems as referred to MyGIF (MAMPU, 2003). However, interfaces are done at systems level. From an end-user's point of view, these interfaces should be seamless to them.

When the systems are integrated and interconnected between systems and between organizational units, interoperability is achieved. Ebrahim and Irani (2005) stated that "providing integrated services can only be realized if organizational and functional groups are interconnected and that the systems are interoperable".

The value of the integrated and streamlined services from an interoperable environment depends on the extents of services and processes that are based on. There are examples of government initiatives to streamline the public delivery system. The Dubai Government E-Government initiative as described by Al-Mashari (2007) embarked in a phased implementation with its final stage focuses on streamlining of services by standardizing procedures and cross-agencies integration. According to Ongaro (2004), the Italian Government (especially at the local government) public sector reform begun in the 1990s. The efforts initiated with one-stop-shop service between the business communities and the public sector with technology innovations that implemented cross-organizational and cross-functional processes. Ongaro (2004) also highlighted the other enablers for the process coordination to functions includes executive leadership, organization cultures and legislations. Equilibrium of all these

factors has to be taken into consideration for any process improvement to take place in streamlining the public delivery system.

2.5.3 Convenient Services

We are now living in an information age. Internet has changed the way we do things. Internet is a major delivery channel for e-government. Getting services online through self-service capabilities makes it very convenient for the public to get the information resources and services anywhere at anytime. The survey done by the NZ Government shows that having a website presence is crucial for "information accessibility and improved communication" (Deakins and Dillon, 2002). According to Deakins and Dillon (2002) the NZ Government previously had numerous and fragmented websites but now it is presented with one portal called New Zealand Government Online at http://www.nzgo.gov.nz and this makes it more convenient to the public. Portals and personalized portals are the gateway to the information and services that give an integrated vision of the government. Ebrahim and Irani (2005) said that portals are key priority in a public sector environment to support the public delivery system through a single window.

Accessibility to information resources and services brings convenience to the public. Public services offer round the clock 24x7x354 services would deliver ease to the public to deal with the government anytime at their convenience (Siddiquee, 2006). Transactions, which were previously done over the counter, can now be offered online.

E-government enables the public online access to information resources and provisioning of services through personal computers, kiosks, telephones, mobile computing and other resources. There are many examples of efforts put in by various governments to increase convenience to the public to assess government information and services. The State of California encourages and makes the access to its public delivery system convenient to public by providing booths and stations in public areas like libraries (Al-Mashari, 2007). The UK Government on the other hand, offers services via digital TV, WAP mobile services in additions to the booths and stations (Al-Mashari, 2007). In bridging the digital divide between rural and urban areas in Malaysia, the government is working on building community centres that offer free Internet access (Al-Mashari, 2007). The NZ Government also offers computers for community at public areas (Deakins and Dillon, 2002). These are some of the examples on government's efforts in providing the resources, in making the public aware and in making people use the multi-channels that ease the public in conducting government transactions electronically by making the public delivery system more convenient.

It is also convenient to public when the services offered are complete. Completeness is when the government are providing services as a one-stop centre and an integrated service via flexible network in dealings with government agencies as well as citizens and business (Al-Mashari, 2007). The completeness in the services is feasible when the underlying systems are interoperable. This gives a complete new experience of a virtual one-stop-shop service (Janssen *et al.*, 2006).

2.5.4 Sophistication of Service Delivery Machanism

Internet technology is the enabler for innovative public delivery system. It exerts new ways where 'organizational units' can be connected (McIvor *et al.,* 2002). McIvor *et al.* (2002) also gave example on how "electronic bulletin boards" adopted in some governments gives a new productive way of cross functional and cross-agencies connectivity and collaboration and changed the old way of doing things.

The case study given on Next Steps agencies under the UK Government initiatives of reinventing public sector, revealed the utilization of Internet technologies such as email as an effective communication channel between the general public and the agencies as it allows public direct access (McIvor *et al.*, 2002). It also revealed the current varying degree of sophistication of online public information resources and services that are provisioned by these agencies.

When e-government offers comprehensive services, it offers many types of information resources and services and progresses through the maturity model with interactive capabilities by support for information exchanges, electronic transactions and electronic integration (Al-Mashari, 2007). E-Government is also comprehensive if it is built to reach out all parts of the government (Ebrahim and Irani, 2005). E-government is said to provide complete services, if the service offers is complete to a finish or to an end. This to some extend would requires participation from within agencies and/or cross agencies. Complete e-government services would definitely simplify dealing within agencies and/or cross agencies.

Technology now is available to make the public services more appealing and sophisticated in the dire endeavour to be more effective and transparent in public delivery system. The UK Government implemented 'contact centre' as an alternative channel for citizen-centric services (McIvor *et al*., 2002). The local authorities in the UK are progressing to sophisticated services such as online payment and other electronic formats (McIvor *et al.*, 2002). Deakins and Dillon (2002) stated that NZ local authorities would offer online payment and online transaction by 2004.

Short Message Service (SMS) via mobile phones has gained a lot of popularity and became very prevalent in all walks of life (West, 2004). This sophistication opens up services to multi-channel interactions. Online notifications via emails and SMS through any handheld device help to alert the public on the status of the transactions, service requests or application processing. There are also alternative channels of public delivery system via 3G or GPRS that not only makes it very sophisticated in its delivery of services but also makes it more convenient for public at large. The public delivery of service no longer has to be over the counter. According to Barnerjee and Chau (2004), there are alternative channels like kiosks and telephones that are brought about by modernized services. According to Al-Mashari (2007) the Dubai Government is geared to provide future electronic services via mobile devices. To Ebrahim and Irani (2005) websites, computers, kiosks, telephones, mobile computing (WAP) and digital TV as "access layer" in the public delivery system.

Technology is a panacea of many possibilities to reinvent and innovate the public delivery system. Technology presents an enormous impact to enhance public delivery system. Sophistication of public delivery system made possible technology facilitates interoperable e-government with the integration of systems and processes that offers more comprehensive services. This in turn fosters a more responsive public delivery system that delivers more value to the public.

2.6 ICT Directions

2.6.1 ICT Trends

Interoperability is the capability for systems to inter-operate even to an extend the capabilities to inter-operate within and across organizational boundaries. With the rising demand and expectation of efficient delivery system, automation cannot be viewed monolithically. With the diverse technology present in an organisation from the investment of present systems and the technology considered for new systems implementations, the enterprise architecture may appear convoluted. The case is similar in public sector where governments had already undergone automation or computerization projects in silos. Without a good guiding principle in ICT investment, the environment can lead to a closely intertwined in closed systems that make it difficult or cannot inter-operate.

To overcome this, the Government of Malaysia introduced MyGIF that defines the adoption guidelines to ICT standards and technical specifications based on existing

open standards and de facto standards (MAMPU, 2003). The main aim of MyGIF is to provide guidelines for any agency within or cross agencies to be able to communicate and interoperate efficiently and effectively. According to MyGIF, adopting open standards can help reduce the cost of ownership and at the same time open standards allows interoperability (MAMPU, 2003).

MyGIFOSS is the continuous endeavour of the Government of Malaysia to promote government agencies an interoperable framework for "the adoption of and migration to OSS through its guiding principles that enable open source and proprietary software to the exchange of information, integrate and interoperate efficiently and effectively" (MAMPU, 2006). MyGIFOSS establishes an interoperable framework and emphasizes the need to address openness and transparency. Similar to MyGIF, MyGIFOSS specifies recommendations on the technology standards and specifications based on primarily open standards. MyGIFOSS serves as a supplement to the MyGIF. The guidelines under MyGIF and MyGIFFOSS are mandatory for new systems or for building interfaces on the existing systems for it to interoperate or integrate (MAMPU, 2003, 2006).

Interoperable systems makes information exchanges and information flows between systems (MAMPU, 2006). Most importantly, cohesive information flows that innovates how services can be offered electronically, blurs the organisational boundaries with cross-agencies services that make public delivery system more transparent. Technology brings about a new paradigm shift in how service-enabled applications can

be developed and deployed from the heterogeneous environments underpinning organizational boundaries. McIvor *et al.* (2002) concurred on how "open systems" based on the Internet technology propel greater co-operation and communication across organizational boundaries. Open standards foster interoperability across enterprise architectures and functional and organizational structures (Evans and Wurster, 1997). Service-enabled application is now made possible with service-oriented development methodology that is called Service-Oriented Architecture (SOA). It is an evolution of software development supporting the software architectures in an organization that allows the expansion or extension from the existing architectures. With SOA, technology introduces solutions that can help improve public sector organizational agility and flexibility with service-oriented approaches. According to Barry and Associates, SOA is the collection of services. The service is well defined, self-contained and does not depend on the context of state of other services. With SOA, it is possible to evolve with new services or build composite services that automate cross-applications processes and information flows.

Web services spin off from the concept of SOA (Gortmaker *et al.*, 2004). Gortmaker *et al.* (2004) described that a combination of multiple web services in a predefined sequence is called the web services orchestration technology. The web services technology can be used to implement integrated information flow across e-government process coordination (Gortmaker *et al.,* 2004; Rezgui *et al.*, 2002). Web service is based on Extensible Markup Language (XML) (Gortmaker *et al.,* 2004). According to World Wide Web Consortium (W3C), XML, which is an open standard,

was earlier designed for electronic publishing; XML now is key technology for data transport and data exchange. XML is a simple, very flexible text format derived from SGML. SGML stands for Standard Generalized Markup Language, is an enabling tool used in html applications. According to Schneider (2004), W3C originally presented XML in 1996 but W3C released the first version in 2000. Park and Ram (2004) believe that emerging standards like XML and Web Services can resolve application interoperability problems.

SOA incorporates the Business Process Execution Language (BPEL) as the engine to orchestrate services in a complete business process (Janssen et al., 2006). BPEL is an open standard that is based on OASIS open standards (OASIS, 2006). With BPEL, web services can be included. Web Services is based on Simple Object Access Protocol (SOAP) which is a protocol that run under http that is used to invoke web services, Universal Description, Discovery and Integration (UDDI) where the web services are registered in a directory like and discovered, and Web Services Description Language (WSDL) to describe and interface with the web services (Park and Ram 2004; Gortmaker et al., 2004, Janssen et al., 2006, Kim and Kim, 2007). It is based on these standards that makes web services as what Gortmaker et al. (2004) described as "modular, accessible, well-described, implementation-independent and interoperable".

If interoperability is required between heterogeneous e-government applications of different technology, it is difficult to attain if they are based on different non-interoperable standards, proprietary or closed standards or termed as "architecture

mismatch" (Kulvatunyou *et al.*, 2003; Davis *et al.,* 2000). Open standards are where the specifications are made available to all. Open standards are non-proprietary standards (Kulvatunyou *et al*., 2003). These standards are set by international bodies or standards organizations.

According to Gortmaker *et al.* (2004), even though there are high expectations on web services and web services orchestration; this technology is not yet being used on a large scale in government or in business. It is a relatively new technology and lack of awareness of its benefits.

As taken from Accenture's Technology Vision for Government – Executive Summary 2003, Accenture's views on the technology are as follows:

- IT will become increasingly ubiquitous,
- Technology change will be incremental, not revolutionary – yet it will enable radical changes in what organizations can do,
- The growing standardization and commoditization in the technology industry will result in Web services becoming more dominant architecture for the delivery of interoperable business solutions.

Accenture (2003) stated that there should be investment in ICT in order to reap the benefits of a high performance environment in the public sector institution that could enhance public delivery system while gaining effectiveness and efficiency. It is also important to note that the SOA development framework is where the interoperability

architecture is based on. Not only interoperability integrates applications but interoperability also provides seamless process interactions and information flow.

2.6.2 Unleashing ICT

The scope of MyGIF covers five areas of interoperability framework i.e. interconnection of systems, data integration, information access, system security and metadata (MAMPU, 2003). MyGIF and MyGIFOSS spell out the standards and specifications that are mandatory to all new implementations that fall within these areas (MAMPU, 2003, 2006). MyGIF requires agencies to look into using or building interfaces for any integration to existing systems, other systems and legacy system (MAMPU, 2003).

Building interfaces may not necessarily be the best way to interconnect or interoperate. Interfaces are usually an approach for point-to-point integration. This approach will be unmanageable when it involves many points of interconnection. SOA on the other hand is a more holistic framework that expands and evolves around existing architectures to create an interoperable e-government (Janssen *et al.*, 2006). However, this is not the means to an end.

Many literatures were written about e-government diffusion and the implementation of applications towards meeting the public sector are drivers for transformation. There are literatures on enhancing accountability in public delivery

system and the evolution of governance in providing openness and transparency in the public sector institution. It is a distinct topic on how interoperability can be achieved in removing the organizational silos for better accountability and transparency that support information flow in a collaborative environment within the agency or cross agency.

A study by Forrester Research reported that "98% of companies it recently interviewed said that integration is either extremely important or very important to their firm's IT strategy and their integration projects have been running for an average of more than 20 months and involve an average of seven system" (Koetzle *et al*., 2001). Despite all that, it is a remarkable effort for Ireland in their initiative towards a common framework for integrated service, which is called the Public Service Broker (Accenture, May 2004). Germany had recently refined their e-government strategies as presented by Deutschland Online (http://www.deutschland-online.de/) that now truly focuses on integration (Accenture, 2004). Looking at the admired bold steps taken by these examples, it demonstrates how integrated services becomes an important agenda for e-government.

Interoperability with automated information flow that cut across multiple systems provides the integrated service. Having the services integrated limits the face-to-face interactions that usually are the platform for taking advantage over the "valued resources" (Heeks, 1998). Interoperability can reduce red tapes and improve cross agency delivery system (Heeks, 1998; Janssen *et al*., 2006). The impact of interoperability can help bring transparency in the delivery of service.

Hence, unleashing ICT is key in meeting interoperable e-government application. Information systems (IS) is central to the core operation of an organization in which it automates the processes to perform the functional operations through which the IS can influence organizational structure, culture and practices (Bryant, 1998). Heeks (2000) stated that the planning and design of IS is immensely important to recognize the areas where interoperability can be achieved when there is link between the e-government applications for a seamless information flow that will increase accountability.

ICT is not the sole panacea for achieving transparency. Government agencies exist fragmented in nature and it is autonomy to perform its specific service(s). The investment in ICT is usually governed by the organizational boundaries and resulted to a heterogeneous environment that could impede interoperability (Janssen *et. al*,2006). Furthermore, despite the capabilities of ICT as the enablement for the interoperable e-government applications, the public sector is also bounded with legislative and procedures that may limit the provision of electronic data to public at large (Heeks, 2000). Apart from legislative factors, there are other aspects of human factors need also to be accessed and determined if it could be a barrier to technology adoption (Schedler and Schmidt, 2004).

In information systems planning, identify the required interface points; the information flow and the process flow in determining the scope and design of interoperability of the e-government applications. Early in the information systems

design stage, it is vital to look at the existing and new integrated e-government system for any system architecture incompatibilities (Davis *et al*., 2000).

Thus, unleashing ICT to meet the requirement for interoperable e-government applications is also dependable on what is pragmatic and what can bring impact to transparency in public delivery system that has to be reconciled.

2.7 Conclusions

The public sector revolution is a continuous process as there is consistent surge for efficient public delivery system. Internet brings unprecedented benefits and ICT is the enabler for the many innovative ways for e-government to reinvent the public delivery system. The diffusion of e-government from the worldwide scenarios, are to meet the demands for efficient public delivery system. They exists with vary degrees of successes and failures. There is demand for better governance that drives accountability and transparency in public delivery system. This drives the need for the e-government applications to be consistently evaluated against the e-government maturity model. Brought to fore by the demand for more transparent public delivery system, e-government needs to evolve into an interoperable e-government in supporting cross-agency collaboration.

Technology is there to support the e-government progression. SOA is suitable for building interoperable e-government especially in the government complex architectures.

SOA allows orchestration of services and business process. SOA drives new technology standards based on open standards. The standard language for the service execution and orchestration is BPEL.

ICT strategy for e-government entails proper planning and design to meet the required expectation and demand for transparent and efficient service. The execution of this should not compromise on pragmatism and legislation.

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 Introduction

This research is to support the primarily aim to study the interoperable e-government factors based on the level of intensity of services, the level of streamlined services, the degree of convenience provided and the degree of sophistication of the service delivery mechanism against improving transparency in public delivery system. This research is an empirical study to specifically address the research questions. This research looks at interoperability in supporting interconnected systems, integrated information flow and information exchanges, seamless process coordination and collaboration within government agencies and cross-agencies that ultimately improves transparency in the public delivery system. The research needs to analyze the intrinsic interoperable e-government factors as determinants to transparency in public delivery system.

This research, which is a quantitative proposed research methodology, is to support the pertaining research questions as follows:

1. Does interoperable e-government in Malaysia measured by the level of intensity of services offered, significant in improving transparency in public delivery system? (Survey Analysis).

2. Does interoperable e-government in Malaysia measured by the level of streamlined services offered, significant in improving transparency in public delivery system? (Survey Analysis).

3. Does interoperable e-government in Malaysia measured by the degree of convenience provided, significant in improving transparency in public delivery system? (Survey Analysis).

4. Does the interoperability in e-government in Malaysia measured by the degree of sophistication of the service delivery mechanism significant to improving transparency in public delivery system? (Survey Analysis).

5. What development framework can be adopted for the development of an interoperable e-government application that can help in improving transparency public delivery system? (Experimental)

3.2 The Sample

The stakeholders of public delivery system comprise of the general public/citizen, the business people and the public sector themselves. Thus, they are the identified whole population of samples. Since this research is on the Malaysian e-government, therefore the samples have to be chosen from present population in Malaysia. Thus, to represent the whole population, appropriate population were selected carefully based on random

stratified samples, who combines stakeholders constituting from the general public/citizen, the business people and the government themselves and directly involved in G2C, G2B and G2G services respectively. As represented in Figure 1, the random stratified samples are made of the three different strata. They are the general public/citizen, the business people and the government themselves. In ensuring acceptable sample size and hit rate, a process of identifying at 450 people to represent the three different stakeholders was conducted. These are the people who are likely to provide meaningful responses for data collection. Ideally, it would be exceptionally good to have an exact amount of 150 responses from each strata type. The random stratified sample is modelled below:

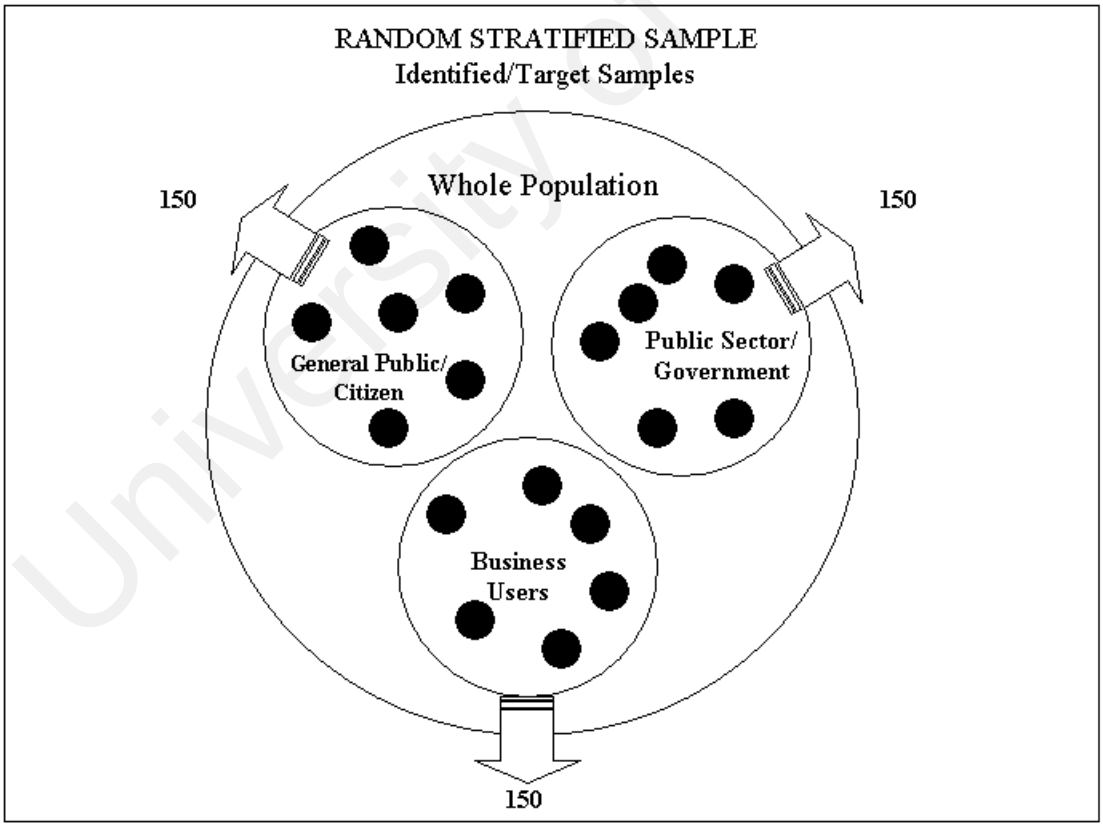

Figure 1 - Random Stratified Sample

3.3 The Instruments

The instrument used for data collection or data gathering is survey. The survey questionnaires are based on Likert-scale in order to perform factor analysis. The survey is divided into four-part questionnaires, which covers Section A to Section D. Section A is the introductory section whereby the questionnaires are to qualify the respondent experience with the e-government public delivery system and the participating role that the respondent will seek to undertake. Section B is the demographics section to understand the respondent's background. Section C is the section with questionnaires to solicit feedback on the e-government public delivery system through rating of scale 1 to 5 with 1 being strongly disagree and 5 being the strongly agree. The last section i.e. Section D is on other related questions. In this section it is based on non-mandatory open-ended questionnaires to gauge feedback on the respondent's opinion of e-government public delivery system.

3.4 Research Design

The research is a quantitative research. It is based on empirical study using survey as the means to get data from respondents. The proposed research methodology to be carried out is as illustrated below:

1. Perform frequency analysis to understand demographics background.
2. Review rankings of the interoperability e-government factors.

3. Perform adequacy test to ensure data is adequate.
4. Conduct Pearson correlation to test on the 4 hypotheses.
5. Perform factor analysis to test significance of interoperable e-government factors or any reclassifications of factors based on the rotated component matrix.
6. Test on reliability using Cronbach's Alpha to ensure survey questionnaires are consistent and stable against the variables or factors.
7. Conduct Pearson correlations to determine the level of significance between the independent variables and the dependent variables.
8. Model the regression to measure the impact or influence of the independent variables against the dependent variable.

3.5 Conceptual Framework

The main purpose of this study is to assess empirically the interoperable e-government factors as determinants to transparency in public delivery system. These factors include the level of intensity of services provided, the level of streamlined services offered, the degree of convenience provided and the degree of sophistication of the service delivery mechanism. These are the independent variables and these factors are determinants to transparency in public delivery system. Thus, transparency in public delivery system is the dependent variable. This study is to test if the independent variables are significant to improve transparency in public delivery system. The research

conceptual framework that relates to both the independent variables and dependent variable is as depicted in Figure 2.

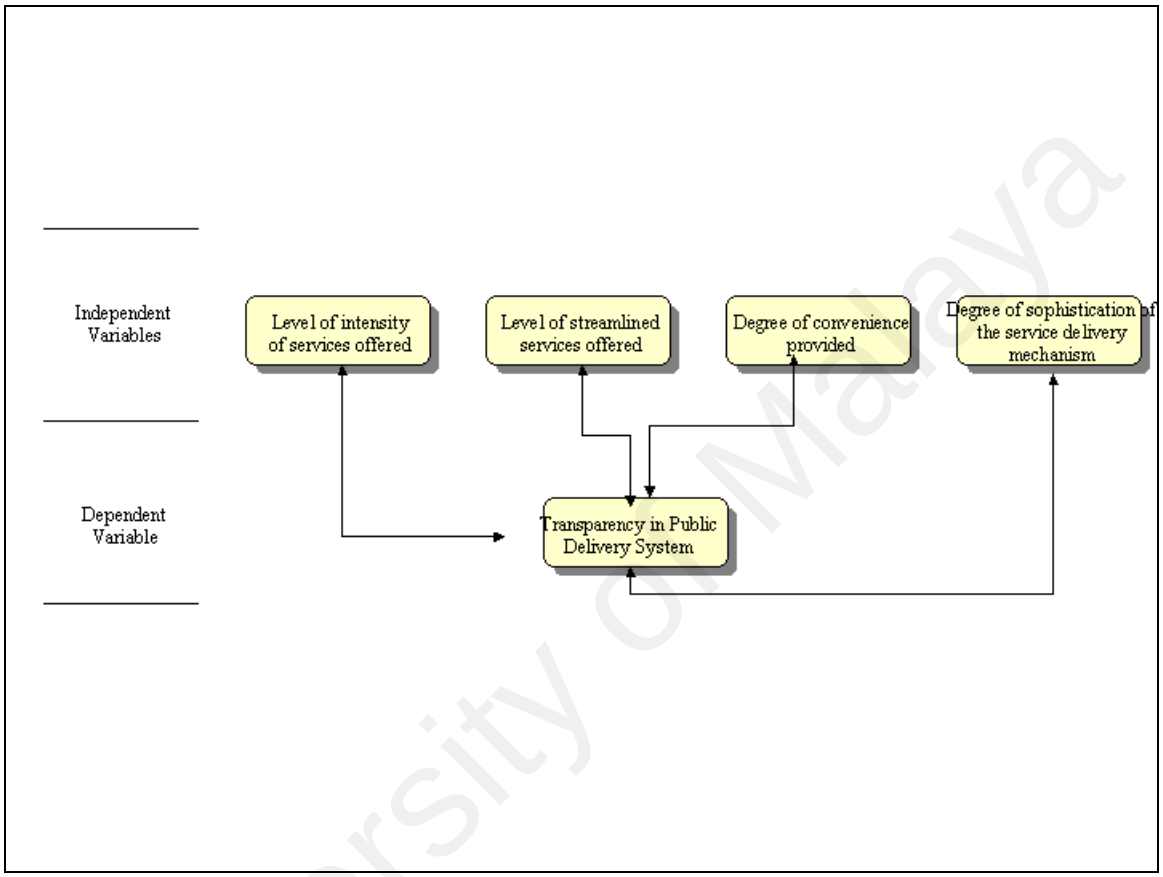

Figure 2 - Conceptual Framework : Independent Variables and Dependent Variable

3.6 Research variables

Figure 3 presents the research conceptual framework specifies the component or factors, which are the area of research interest. The independent variables can be the determinants for the dependent variable. Attributes for each component are shown for clarity and focus.

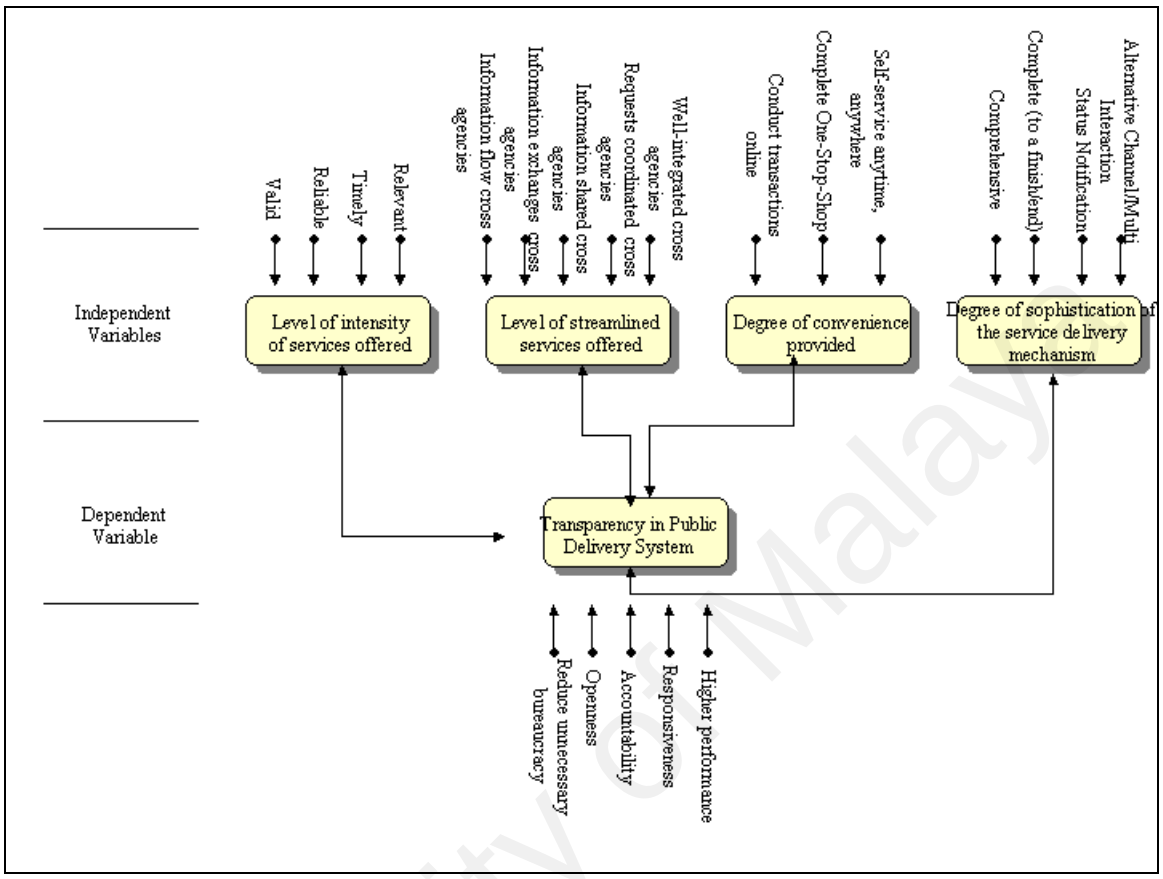

Figure 3 - Research variables

3.6.1 Level of Intensity of Services Offered

Making e-government accessible anytime or any place is imperative to increase the level of intensity of public services offered (Siddiquee, 2006). Level of intensity of services offered is an important factor for an interoperable e-government. The affect of the level of intensity of services offered on transparency in public delivery system is measured by its research variables. The research variables are tested through survey

questionnaires, with responses on five-point Likert scale. Figure 3 lists the variables pertaining to the level of intensity of services offered.

3.6.2 Level of Streamlined Services Offered

Level of streamlined services offered is an important factor for an interoperable e-government. The affect of the level of streamlined services offered on transparency in public delivery system is measured by its research variables. The research variables are tested through survey questionnaires, with responses on five-point Likert-scale. Figure 3 lists the variables that are measured for the level of streamlined services offered.

3.6.3 Degree of Convenience Provided

Degree of convenience provided is an important factor for an interoperable e-government. The affect of the degree of convenience provided on transparency in public delivery system is measured by its research variables. The research variables are tested through survey questionnaires, with responses on five-point Likert-scale. Figure 3 lists the variables that measure for the degree of convenience provided.

3.6.4 Degree of Sophistication of the Service Delivery Mechanism

Degree of sophistication of the service delivery mechanism is an important factor for an interoperable e-government. The affect of the degree of sophistication of the

service delivery mechanism on transparency in public delivery system is measured by its research variables. The research variables are tested through survey questionnaires, with responses on five-point Likert-scale. Figure 3 lists the variables that measure the degree of sophistication of the service delivery mechanism.

3.6.5 Transparency in Public Delivery System

This study looks at what determine the transparency in public delivery system is determined by the interoperable e-government factors. The domain transparency in public delivery system is the dependent variable. Figure 3 shows the transparency in public delivery system measured by its research variables. The research variables are tested through survey questionnaires, with responses on five-point Likert-scale.

3.7 Hypotheses tests

This study assumes that all the interoperable e-government factors should be positively related to transparency in public delivery system. Thus, it is hypothesized that:

H1. The interoperability in e-government based on the level of intensity of services offered is significantly related to improving transparency in public delivery system.

H2. The interoperability in e-government based on the level of streamlined services offered, is significantly related to improving transparency in public delivery system.

H3. The interoperability in e-government based on the degree of convenience provided is significantly related to improving transparency in public delivery system.

H4. The interoperability in e-government based on the degree of sophistication of the service delivery mechanism is significantly related to improving transparency in public delivery system.

The hypotheses are summarized in the research model depicted in figure 4.

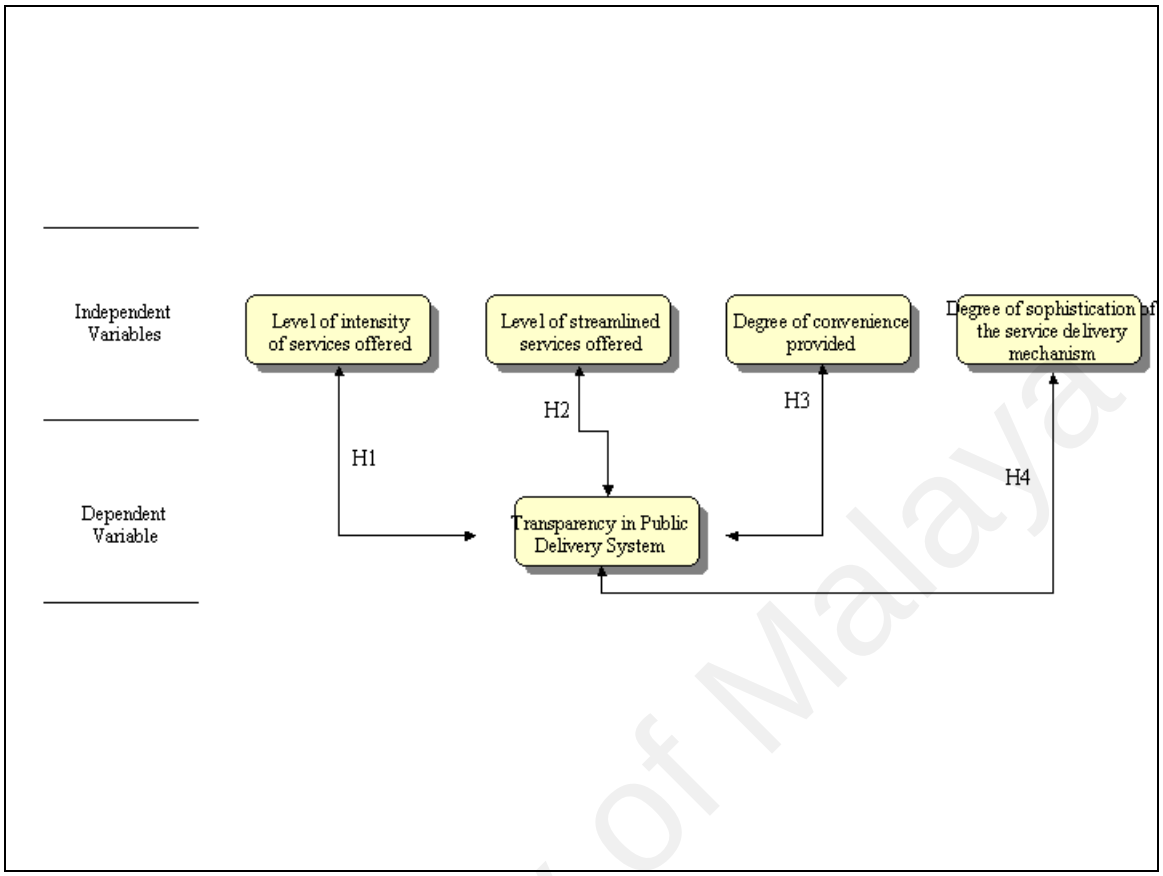

Figure 4 - Four Hypotheses

3.8 Methods

3.8.1 Survey Procedure

Survey was the instrument used for data collection. Both traditional survey mechanism and online survey (e-survey) were conducted. Initially, the mechanism originally used during the one-month pilot run was through traditional means, which is using hardcopies and softcopy distributed manually and over emails. During the pilot run, there were feedbacks received from the pilot samples. Firstly, there were some suggestions for the usage of the word 'e-government' can be misinterpreted as the e-

government flagship applications and also many are not familiar or able to clearly distinguish the e-government applications. The recommendation is to replace with something more laymen to the audience. Secondly, there are requests made for online survey so that respondents can respond at their convenience. These feedbacks were taken up constructively. The end of the pilot run had resulted in modifications made with "government online delivery of public information and services" in replacement of e-government. With the aim to increase the response rate, the development of the online survey or e-survey was done using PHP programming language. The e-survey questionnaires were posted online on the Internet for one-month data collection duration.

3.8.2 Measurement

The five-point Likert-scales were used for measuring the research variables. The scales ranging from 1 for very low value representing strongly disagree to 5 for very high value representing strongly agree. On the e-survey, these appear as radio buttons.

3.9 Conclusions

This chapter has outlined the clear objectives of this research and stipulated the research questions, which will be approached as an empirical study using survey as the instruments. The research design took a holistic approach that sets as the overall framework and strategy for the research methodology. Both the independent variables and dependent variables were determined and 4 hypotheses were formulated.

The affirmative decision on the 450 target samples based on the random stratified samples is based on the key stakeholders including the public at large, businesses and civil servants as they are involve in one way or another in the overall approach of the G2C, G2B and G2G services. The instrument was piloted and modifications were made at the end of the pilot run. An e-survey was developed to host the questionnaires on the Internet for a one-month data collection. The base of the questionnaires was the five-point Likert-scale to support factor analysis.

CHAPTER 4 - FINDINGS OF THE STUDY

4.1 Introduction

The approach taken to this research study is based on quantitative methods through direct source of data from respondents. Frequency analysis is performed to review and understand the demographics of the respondents. Variables are investigated based on respondents ranking. Hypothesis implied are tested. With evidence of validity, data analysis and interpretation allows the discovery of significant relationships that exist between the dependent variable and independent variables using factor analysis. Correlation was performed to test for positive and negative relationships and the strengths of the relationships that exist. Regression was modelled to test the influence of the independent variables against the dependent variable. All this leads to some accurate conclusions.

4.2 Sample Characteristics

Data collection is taken from the respondents' feedback. Respondents come from the random stratified samples from within the e-government stakeholders in Malaysia. They are altogether about 450 people whom were identified and chosen as potential respondents from these random stratified samples. They were informed and invited via emails to participate in the e-survey. In the email, the cover letter and URL of the e-survey on the Internet were supplied. Respondents simply had to click on the URL and

launched the e-survey. Respondents entered their responses and click on the radio buttons to respond to the five-points Likert scale. The data collection was observed for a period of about one month. The e-survey had 155 respondents but 23 were discontinued due to not having any experience using any e-government application. Based on the balanced of 132 respondents, the e-survey managed to get a total rate of response of 29.3%. This percentage is an acceptable sample size for data analysis to proceed. Data collected online are then pumped into a statistical package for quantitative research method to take place.

4.3 Analysis and Discussion

4.3.1 Understanding the Samples

The initial part of Section A is to perform a base qualification on the respondent's experience on the e-government public delivery system and the role that respondents will respond as. The research examines the respondents experience on e-government. The assessment of the respondent's experience is based on the respondent's attempts on e-government whether it was only once or several times or never uses e-government services. Never use disqualifies respondents from continuing the survey. Single attempt indicates that respondents do not have much Internet exposure or simply a novice Internet user or did not have a good initial experience on e-government and thus never made a comeback for further services. Respondents with several times experience on e-government indicates that respondents could be Internet or computer savvy or frequent Internet user or have used e-government as an alternative channel to get services. Those

whom have not attempted e-government could probably did not have any computer at home or work or was not aware or confident of the e-government services. A total of 155 respondents altogether out of which, 66.7% of respondents had used e-government services more than once. This shows a great level of Internet adoption and awareness of such services. Another 15.9% had attempted e-government at least once while 17.4% of 23 respondents had never attempted to use e-government and were disqualified from continuing the survey. This leaves only 132 valid respondents. Please refer to Chart 1 for details.

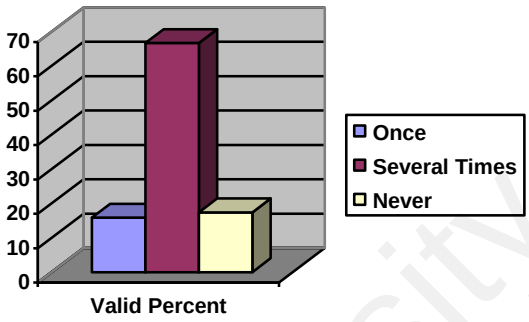

Chart 1 - E-Government Experience

The other initial qualification is the role they choose to respond the survey, which can either as public user to respond on G2C or as business user for G2B or as government/civil servants to respond on G2G. Based on the Chart 2 below, an overwhelm response rate of 56.8% of respondents gave feedbacks on G2C services, 25% responded on the G2B services and while the response rate from civil servants to feedback G2G is relatively low and attributed by only 18.2% of respondents. This perceived 'lack of corporation' might be attributed from legislative reasons.

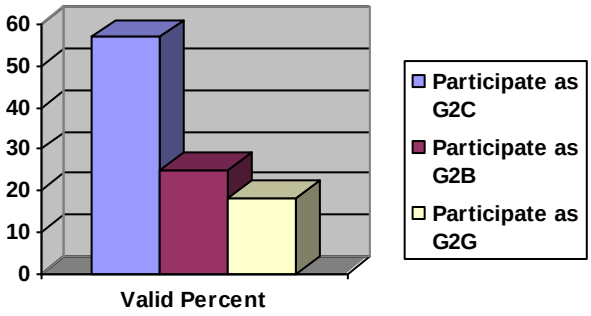

Chart 2 - Participate As

The frequency analysis was performed in order to have an understanding of the respondents' demographics background. The other questions are pertaining to demographics. This includes age, gender, profession and education level attained. The age groups of the respondents are analysed. Based on Chart 3 below, amongst the highest respondent's age groups are between 35 to 44 years and 25 to 34 years at 40.2% and 33.3% respectively. These are the age groups that use more of the e-government services. These age groups are in general at the peak carrier age and working level people whom utilizes e-government at the most. It is observed that 25% are in the age group between 45 and 54 years and only 1.5% of respondents are between the ages of 20 to 24 years.

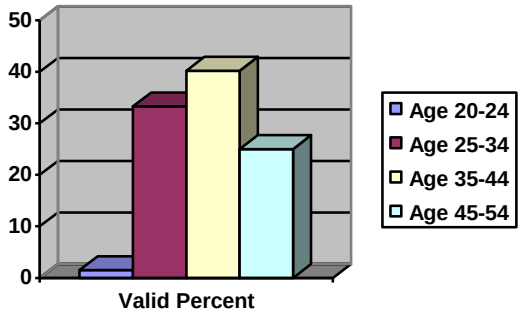

Chart 3 - Age Groups

From the samples, 58.3% of the respondents are male and 41.7% of the respondents are female. This can be concluded as somewhat balanced gender between male and female. Please refer to Chart 4 below.

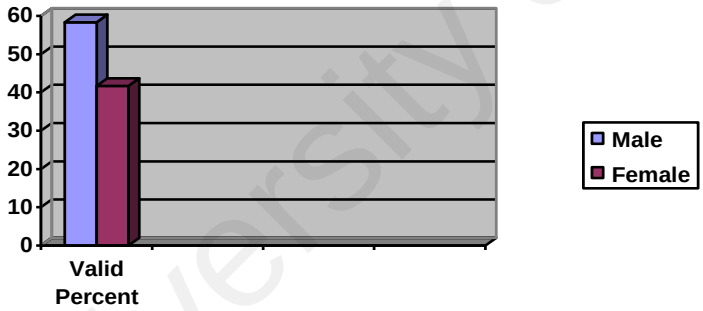

Chart 4 - Gender

The sample's profession demographics are also observed. From the Chart 5, it asserts that 51.5% of the respondents are professional/technical people and 29.5% are in the holding administrative or management positions. This signifies a contribution to the quality responses. Another 7.6% of the respondents are in sales, 3% are in clerical work,

while business, entrepreneur and students each at 1.5%. The balance 3.8% falls into other category.

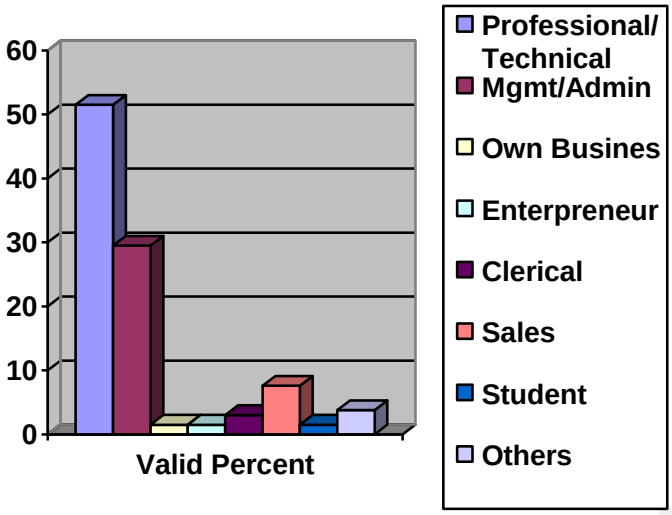

Chart 5 - Profession

4.3.2 Ranking the Factors

Question 12 of the survey questionnaires in Section D was posed to determine the results of what appears to the respondents as the most important factor that contributes to transparency in public delivery system. These factors are:

- Level of intensity of services offered
- Level of streamlined services offered
- Degree of convenience provided
- Degree of sophistication of the service delivery mechanism

Based on the results, the highest i.e. 49.2% of the respondents assert that the degree of convenience provided is the main factor of an interoperable e-government. The

level of streamlined services offered came second with 18.9%. The degree of sophistication of the service delivery mechanism and the level of intensity of the services offered at came third and forth positions with 16.7% and 15.2% respectively as the other factors of an interoperable e-government. Respondents rank these factors as the most important factor that is determinant to transparency in public delivery system. This is explained in Chart 6 below.

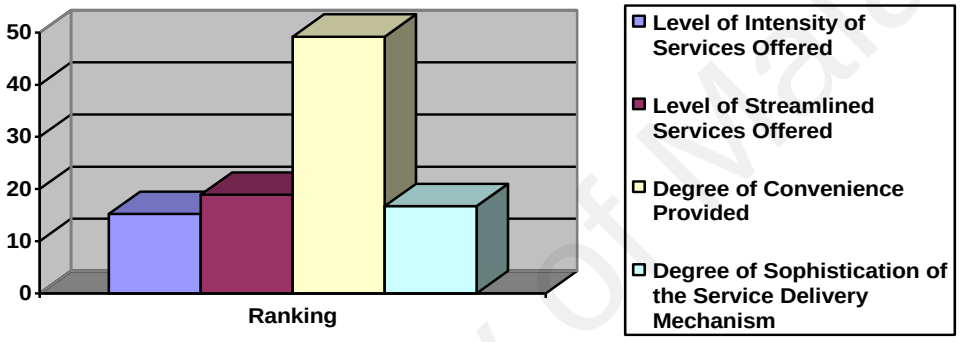

Chart 6 - Ranking the Interoperable E-Government Factors

When extrapolating the results from question 13 of the survey questionnaires in Section D, which is to rank the interoperable e-government factors that can affect transparency in public delivery system in the order of importance from most important to not important, the respondents' feedback is also very consistent with the analysis above. The majority 58 respondents rated degree of convenience provided as the most important interoperable e-government factor. With the corresponding 43.9%, this makes degree of convenience provided ranked as the most important factor.

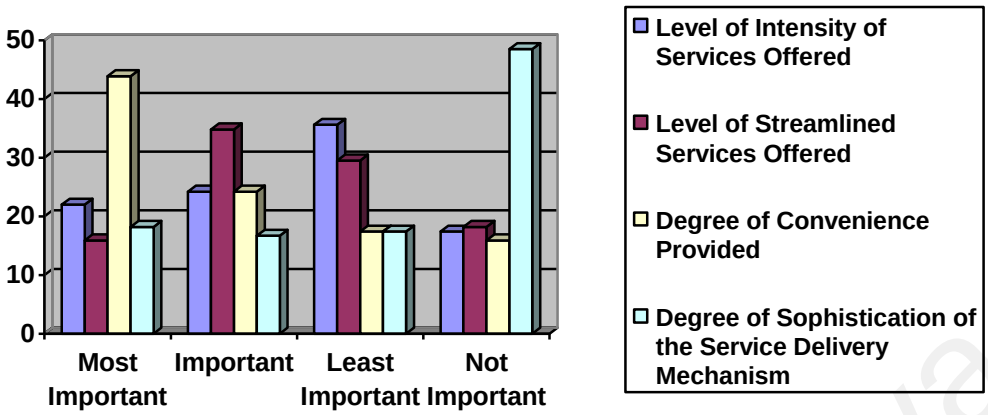

Chart 7 - Overall Ranking Interoperable E-Government Factors

The other factors that affect the interoperable e-government are further observed. Majority of respondents ranked the level of streamlined services offered as second most important with 34.8%. The level of intensity of services offered is ranked third by the respondents with a leading 35.6%. Thus, leaving degree of sophistication of the service delivery mechanisms ranked by respondents as the least importance factor of an interoperable e-government that is able to enhance the transparency in the public delivery system. Please refer to the details in Chart 7 above.

Ranking from the most important to not important, the degree of convenience and streamlined services are the top most important interoperable e-government factor.

4.3.3 Determining the Adequacy

The data gathered from Section C were tested using the KMO and Bartlett test in order to measure sampling adequacy for the factor analysis to take place. Based on the KMO and Bartlett's test, the measure 0.902 is near to 1, which indicates that the sample is adequate enough to perform further analysis. Please refer to the Table 1 below for details.

Kaiser-Meyer-Oikin Measure of Sampling Adequacy		.902
Bartlett's Test of Sphericity	Approx. Chi-Square	1933.065
	df	210
	Sig.	.000

Table 1 - KMO and Bartlett's Test

4.3.4 Confirming the Hypotheses

There are four hypotheses formulated based on the interoperable e-government factors. They are tested for probabilities that they are true.

Hypothesis 1 measures the relationship of interoperability in e-government based on the level of intensity of services offered against transparency in public delivery system.

H1. The interoperability in e-government based on the level of intensity of services offered is significantly related to improving transparency in public delivery system.

The survey results were tested to ascertain if transparency in public delivery system is attributed from the level of intensity of services offered. On this factor, 4 questions were asked with responses on a five-point Likert-scale. Hypothesis 1 measures the relationship of interoperability in e-government based on the level of intensity of services offered against transparency in public delivery system. Based on this, the 4 questions that were scored individually and the overall average score were calculated. The Pearson coefficients of correlation were used to test the hypothesis and the results are as per Table 2 below.

	Intensity of services offered	Average Score	Pearson Correlations
1	Valid services	3.36	0.440
2	Reliable services	3.16	0.485
3	Timely services	2.96	0.505
4	Relevant services	3.27	0.493
	Average Score	*3.1875*	*0.571*

Table 2 - Average Score and Pearson Correlations – Hypothesis 1

All show a significant positive correlation between the level of intensity of services offered and transparency in public delivery system. Furthermore, the average scores of the 4 questions have a significant positive correlation of 0.571 against transparency in public delivery system. Thus, it is concluded that the interoperability in e-government based on the level of intensity of services offered is significantly related to improving transparency in public delivery system.

Hypothesis 2 measures the relationship of interoperability in e-government based on the level of streamlined services offered against transparency in public delivery system.

H2. The interoperability in e-government based on the level of streamlined services offered is significantly related to improving transparency in public delivery system

The survey results were tested to ascertain if transparency in public delivery system is attributed from the level of streamlined services offered. On this factor, 5 questions were asked with responses on a five-point Likert scale. Based on this, the 5 questions that were scored individually and the overall average score calculated. The Pearson coefficients of correlation were used to test the hypothesis and the results are as per Table 3 below.

	Level of streamlined services offered	Average Score	Pearson Correlations
1	Information flows	3.09	0.269
2	Information exchanges	2.98	0.309
3	Seamless information shared	3.07	0.443
4	Seamless coordinate request	2.90	0.528
5	Well integrated	2.62	0.436
	Average Score	*2.9333*	*0.495*

Table 3 - Average Score and Pearson Correlations – Hypothesis 2

All show a significant positive correlation between the level of streamlined services offered and transparency in public delivery system. Furthermore, the average scores of the 5 questions have a significant positive correlation of 0.495 against transparency in

public delivery system. Thus, it is concluded that interoperability in e-government based on the level of streamlined services offered is significantly related to improving transparency in public delivery system.

Hypothesis 3 measures the relationship of interoperability in e-government based on the degree of convenience provided against transparency in public delivery system.

H3. The interoperability in e-government based on the degree of convenience provided is significantly related to improving transparency in public delivery system.

The survey results were tested to ascertain if transparency in public delivery system is attributed from the degree of convenience provided. On this factor, 3 questions were asked with responses on a five-point Likert scale. Based on this, the 3 questions that were scored individually and the overall average score calculated. The Pearson coefficients of correlation were used to test the hypothesis and the results are as per Table 4 below.

	Degree of convenience provided	Average Score	Pearson Correlations
1	Online transaction	2.93	0.489
2	One-stop-service	2.80	0.396
3	Self-service anytime and anywhere	3.06	0.432
	Average Score	*2.9293*	*0.506*

Table 4 - Average Score and Pearson Correlations – Hypothesis 3

All show a significant positive correlation between the level of streamlined services offered and transparency in public delivery system. Furthermore, the average scores of

the 3 questions have a significant positive correlation of 0.506 against transparency in public delivery system. Thus, it is concluded that the interoperability in e-government based on the degree of convenience provided is significantly related to improving transparency in public delivery system.

Hypothesis 4 measures the relationship of interoperability in e-government based on the degree of sophistication of the service delivery mechanism against transparency in public delivery system.

H4. The interoperability in e-government based on the degree of sophistication of the service delivery mechanism is significantly related to improving transparency in public delivery system.

The survey results were tested to ascertain if transparency in public delivery system is attributed from the degree of sophistication of the service delivery mechanism. On this factor, 4 questions were asked with responses on a five-point Likert scale. Based on this, the 4 questions that were scored individually and the overall average score calculated. The Pearson coefficients of correlation were used to test the hypothesis and the results are as per Table 5 below.

	Degree of sophistication of the service delivery mechanism	Average Score	Pearson Correlations
1	Comprehensive services	2.75	0.413
2	Complete to an end services	2.71	0.478
3	Status notification	2.83	0.505
4	Alternative channel	2.85	0.531
	Average Score	*2.7841*	*0.588*

Table 5 - Average Score and Pearson Correlations – Hypothesis 4

All entries show a significant positive correlation between the degree of sophistication of the delivery mechanism and transparency in public delivery system. Furthermore, the average scores of the 4 questions have a significant positive correlation of 0.588 against transparency in public delivery system. Thus, it is concluded that the interoperability in e-government based on the degree of sophistication of the service delivery mechanism is significantly related to improving transparency in public delivery system.

Hence, all four hypotheses are proved to be true. All 4 intrinsic interoperable e-government factors proved to be significant and relates positively to transparency in public delivery system.

4.3.5 Determining the Factors

Factor analysis is conducted to identify the variable or the factor that can illustrate pattern of correlations within the factors. For this purpose, the sample data from all the research variables have been analyzed tested against rotated component matrix to delineate common factors for interoperable e-government. Rotation is a step that is used to perform factor analysis. Table 6 represents the loading factor of every variable

towards the component or factor after rotation. The loading factors > 0.5 are in bold and italics. The higher loadings of >0.5 is used for further analysis. As indicated in Table 6, the loading factors for these variables are aligned in accordance to the component factor.

	Degree of Convenient (Component 1)	**Level of Intensity** (Component 2)	**Level of Streamlined Services** (Component 3)
Valid services	0.204	***0.804***	0.303
Reliable services	0.179	***0.840***	0.303
Timely services	0.422	***0.726***	0.057
Relevant services	0.293	***0.715***	0.175
Information flows	0.263	0.171	***0.841***
Information exchanges	0.298	0.209	***0.771***
Seamless information shared	***0.543***	0.291	***0.549***
Seamless coordinate requests	***0.697***	0.347	0.237
Well integrated	***0.647***	0.271	0.330
Online transaction	***0.545***	0.385	0.317
One-stop-shop service	***0.641***	0.339	0.364
Self-service anytime, anywhere	***0.713***	0.106	0.347
Comprehensive services	***0.714***	0.211	0.246
Complete to an end services	***0.805***	0.236	0.284
Status notification	***0.665***	0.433	0.215
Alternative channel	***0.668***	0.227	0.231

Table 6 - Loading Factor

The high loading factor of variables for the degree of convenience factor indicates that this factor is a strong factor with the variables has strong correlation. Notably, loading factor of variables for the level of intensity and level of streamlined services can be combined as a single factor as it becomes a strong factor and more significant correlation when they are regrouped for reclassification. From this analysis, taking the above understanding when performing the factor analysis and the factor score, had attributed to the formation of new reclassification of interoperable factors that improve

transparency in public delivery system. Please refer table 7 below on the factor reclassification.

Convenient service delivery Component 1	**Intensely Streamlined Services** Component 2 and 3 (Combined)
Information shared	Valid services.
Coordinate request	Reliable services.
Well integrated	Timely services.
Online transaction	Relevant services.
One-stop-shop service	Information flows
Self-service anytime, anywhere	Information exchanges
Comprehensive services	Status notification
Complete to an end services	
Alternative channel	

Table 7 - Factor Reclassification

The findings delineate that there are only two clearly significant and independent factors. All other factors, which are not strong and significant, are now reclassified under degree of convenient delivery service (component 1) and level of intensely streamlined services (component 2 and 3 combined).

Referring to the ranking by respondents on the importance of the interoperable e-government factors analyzed through resulted frequency analysis asserts a majority of 49.2% with degree of convenience provided is the most important factor. The factor analysis with placement of degree of convenient service delivery as an independent and strong factor signifies consistency with the ranking given by the frequency analysis.

4.3.6 Confirming the Reliability

Reliability test is conducted to identify consistency and stability in the survey questionnaires and respondents' understanding of the questionnaires. The reliability test is conducted using Cronbach's alpha, which will identify a positive correlation of each variable. The value of the Cronbach alpha nearer to 1 indicates that the questions are more consistent and stable. Based on the Table 8 below, the Cronbach's alpha was 0.925 and 0.848 for the new reclassified factors of convenient service delivery and intensely streamlined services respectively, indicated that they are reliable measure of implementation. Its dependant variable transparency in public delivery system shows significant positive value and is consistent and stable whereby its Cronbach's alpha value is 0.870 also near to 1.

Variables	Cronbach's Alpha	No. of Items
Convenient service delivery	.925	9
Intensely streamlined services	.848	7
Transparency in public delivery system	.870	5

Table 8 - Cronbach's Alpha Value

Table 9 below shows the detail of the factor convenient service delivery where the Cronbach alpha value is close to 1.

Cronbach's Alpha	No of items
.925	9

Variables	Cronbach's Alpha if item Deleted
Seamless information shared	.916
Seamlees coordinate request	.915
Well integrated	.917
Online transaction	.919
One-stop-shop	.914
Self-service anytime anywhere	.916
Comprehensive services	.917
Complete to an end	.909
Alternative channel	.922

Table 9 - Reliability Statistics – Factor Convenient Service Delivery

Table 10 below shows the detail of the factor intensely streamlined services where the Cronbach alpha value is close to 1.

Cronbach's Alpha	No of items
.848	7

Variables	Cronbach's Apha if item Deleted
Valid services	.810
Reliable services	.815
Timely services	.817
Relevant services	.822
Information flow	.843
Information exchanges	.836
Online notification	.845

Table 10 - Reliability Statistics – Factor Intensely Streamlined Service

4.3.7 Undertanding the Correlations between Factors

The Table 11 below represents the correlation using Pearson Correlation, significant values and amount of data analysed. The Pearson Correlation indicates that the data are evenly spread. The Pearson Correlation value sits in between – 1 to 1. The positive and negative Pearson Correlation values indicate positive and negative relationship between the variables. When the correlation value is closer to 1 then it shows that the strong positive correlation between each dependent variable and vice-versa.

The significant value is the measurement of the linear relationship between one another. If the significant value is smaller than 0.01, the correlation is significant and each variables has linear relationship between one another. If the significant value is larger than 0.01, the correlation is not significant and each variable do not have linear relationship between one another.

In this research, the dependent variable is transparency in public delivery system and the independent variables based on factor scores are level of intensely streamlined services and degree of convenient service delivery.

		Intensely Streamlined Services Component 2 and 3 (Combined)	**Convenient Service Delivery** Component 1	**Dependent Variables**
Intensely Streamlined Services Component 2 and 3 (Combined)	Pearson Correlation	1	.797	.587
	Sig. (2-tailed)		.000	.00
	N	132	132	132
Convenient Service Delivery Component 1	Pearson Correlation	.797	1	.582
	Sig. (2-tailed)	.000		.000
	N	132	132	132
Dependent Variables	Pearson Correlation	.587	.582	1
	Sig. (2-tailed)	.000	.000	
	N	132	132	132

Table 11 - Pearson Correlation

From the above analysis, it shows a positive correlation between the factor intensely streamlined services and the factor convenient service delivery with the dependent variable transparency in public delivery system. Table 11 shows that the correlation between intensely streamlined services towards transparency in public delivery system has a strong positive correlation with a Pearson value of 0.587 and it is significant with 0.000. This illustrates that the factor intensely streamlined services has strong positive correlation towards transparency in public delivery system. Table 11 also shows that convenient service delivery has a positive correlation towards transparency in public delivery system with Pearson value of 0.582 and it is also significant with 0.000. Both factors demonstrate strong and significant correlation towards transparency in public delivery system. When comparing between the two Pearson Correlation values, we can clearly deduce that the factor intensely streamlined services and convenient service

delivery has strong positive correlation relationship towards transparency in public delivery system.

4.3.8 Modeling Regression of the Factors

Regression analysis is conducted to measure or assess the relationship between the dependent variable with the pool of the independent variables. In regression analysis, factor scores are preferred over raw scores as the factor scores provide more condensed and parsimonious information. The regression models can depict the outcome or influence of the independent variables that affects the dependent variable. In this research, the dependent variable is transparency in public delivery system and the independent variables based on factor scores are intensely streamlined services and convenient service delivery.

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	Df1	Df2	Sig F Change
1	.582[a]	.338	.33	.595	.338	66.506	1	130	.000
2	.617[b]	.380	.371	.578	.042	8.721	1	129	.004

a. Predictors: (Constant), Convenient service delivery

b. Predictors: (Constant), Convenient service delivery, Intensely streamlined services

Table 12 - Regression

Table 12 illustrates the regression model to explain the regression phenomenon to ascertain the effect or outcome of the independent variables to transparency in public

delivery system. Model 1 shows the effect of a single interoperable e-government factor measured by convenient service delivery gives a value 0.582 in column R and this factor is significant to 0.000. This shows that factor convenient service delivery brings 58.2% impact or influence towards transparency in public delivery system. In Model 2, both the factor intensely streamlined services and convenient service delivery are put together in order to study the impact or effect of these factors towards the transparency in public delivery system. The value in column R in Model 2 shows the value of 0.617 and it is significant with a value close to 0.000. This clearly suggests that when the factor of intensely streamlined services is added into the model, this fact raises to 61.7% in transparency in public delivery system. The increase is 3.5% in improving transparency in public delivery system.

4.4 Conclusions

The data analysis is conducted by performing the following the series of analysis including frequency analysis, ranking analysis, sample adequacy test, hypothesis tests, factor analysis, reliability test, correlation and regression. There are several key findings emerged from this research.

With a total rate of response of 29.3% for data collection is quite an achievement but largely facilitated by the development of the e-survey. This was attained over a one-month data collection period. Based on Cronbach's alpha values, the respondents'

feedback qualities are good as majority constitutes technical/professional and management/administration levels.

There are four intrinsic factors identified that are inherent in an interoperable e-government. Based on this the hypotheses were formulated. The hypotheses on these factors proved to be true and significant to transparency in public delivery system.

1. Interoperable e-government in Malaysia measured by the level of intensity of services offered is significant in improving transparency in public delivery system.
2. Interoperable e-government in Malaysia measured by the level of streamlined services offered is significant in improving transparency in public delivery system.
3. Interoperable e-government in Malaysia measured by the degree of convenience provided is significant in improving transparency in public delivery system.
4. Interoperable e-government in Malaysia measured by the degree of sophistication of the service delivery mechanism is significant in improving transparency in public delivery system.

Further analysis showed that the most significant interoperable e-government factors that bring impact to transparency in public delivery system are the degree of convenient service delivery and the level of intensely streamlined services.

CHAPTER 5 - ADOPTING A DEVELOPMENT FRAMEWORK

5.1 Introduction

This research takes one step ahead in looking at the possible software development framework that can be adopted to build an interoperable e-government application. This framework, which can be viewed as a tactical action, is the foundation for building government strategic advantage information systems and progress through the e-government maturity model.

Some other system development frameworks were analyzed and evaluated. Each of these system development methodologies has its strengths and weaknesses. Dynamic Systems Development Method for example is a rapid, incremental and iterative approach in system development. Rapid Application Development (RAD) is faster development methodology that rapidly builds prototype and evolves into a finish application. Waterfall model is a sequential development model that develops systems in phases. The approach is non-flexible and lengthy. Object-oriented analysis and design is more on object-oriented modelling that uses use cases to address business requirements.

The technology has evolved and the development methodology like Service-Oriented Architecture (SOA) has spanned into a framework for more interoperability applications. SOA development framework is chosen as best to adopt interoperability e-government over the other software development approaches. The other software

development method is traditionally quite monolithic. It is monolithic as it builds applications in meeting its modular requirements and in most cases, application codes are very tightly coupled with the system. SOA is based on service-oriented approach and leverages on web services. SOA can expand from the other system development methodology. This means that using the SOA software development framework, services can originate from existing systems. Services can combine and worked as a composite service. SOA allows the "reuse of existing IT infrastructures" (Kim and Kim, 2007). With SOA, integrated services can be built autonomously from loosely coupled systems that exist in enterprise architectures (Kim and Kim, 2007).

SOA addresses the enterprise architecture complexity that prevails in public sector. The government has complex and fragmented enterprise architectures as traditionally; the investment in ICT and information systems is done in an autonomous fashion by the agencies to perform the specific needs or purpose of the agencies' operations. SOA is suitable for building interoperable e-government because it can support the heterogeneous environments that are already there in government enterprise architectures (Janssen *et al*., 2006).

SOA is an evolution in systems development that brings a paradigm shift to how systems should be developed. SOA looks meet new business requirements from the perspectives of services. Functionalities of existing systems from an agency can be exposed as services. Any new requirements by the agency can be addressed by creating new services. These services can be integrated and inter-operate. This allows for a new

concept of composite services that combines these exposed services from the various different agencies orchestrated in a complete process flow.

Adopting SOA as the system development framework, services in e-government can be made integrated and inter-operate by virtually removing the organizational boundaries. This makes e-government services more convenient supporting the collaboration of all the various systems within the agencies and cross agencies collaboration. By making e-government intensely streamlined, it would remove the unnecessary bureaucracy and improves the transparency in the public delivery system.

5.2 The SOA Development Framework

The SOA development framework adopted for an interoperable e-government is derived from the Oracle SOA capabilities as illustrated in the Figure 5 below. The software development framework is made up of the following components:

1. Information services
2. Service orchestration
3. Integration services
4. Message/routing services
5. Web services

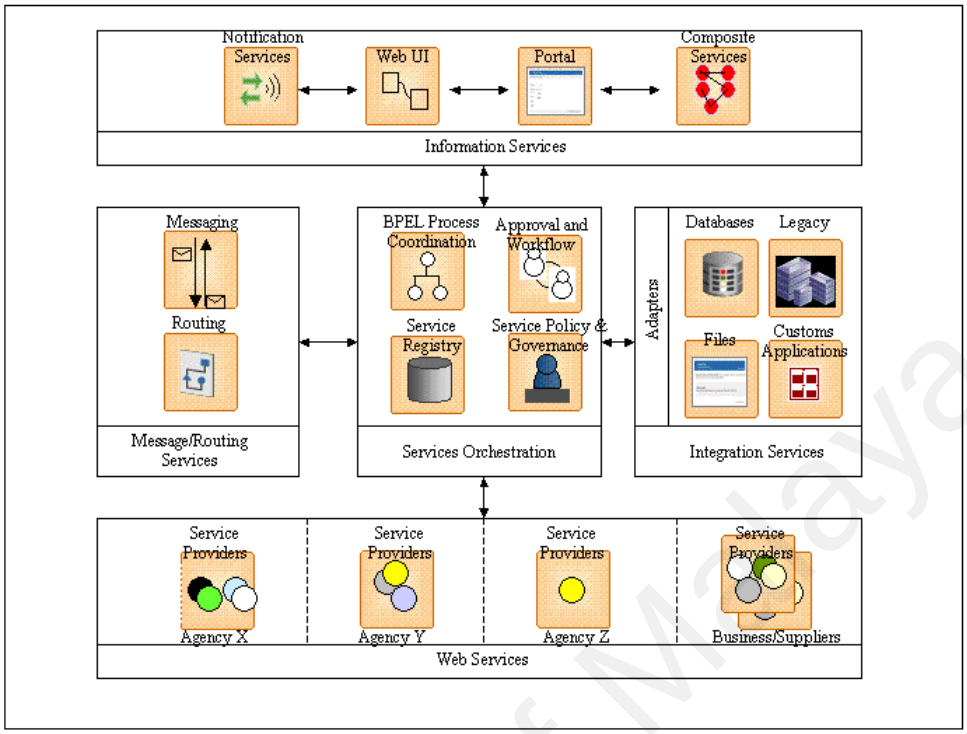

Figure 5 - Development framework for Interoperable E-Goverment based on SOA

5.2.1 Information Services

Information services component is the top-most layer of the SOA development framework, which is the presentation layer or user interface layer. Within this component, the e-government portal is developed that provides the gateway to the rest of the public information resources and services. The portal can incorporate links to other services including any other web applications, notification services or composite services.

5.2.2 Service Orchestration

Underpinning the SOA development framework is the service orchestration component. The heart of service orchestration is the BPEL, which is based on open standards. Through BPEL, services that are constructed will be coordinated in the defined process flow that could cut across systems within an agency or cross agencies. This coordination of services may entail the transport of information or exchanged of information synchronously or asynchronously (Janssen *et al*. 2006). For composite services, BPEL will orchestrate the coordination of these services.

Hand-in-hand with the coordination of services, service orchestration component can also incorporates the workflow for approval process ((Janssen *et al.*, 2006). In an e-government where this is an important task especially when it involves cross agencies collaboration, the coordination of the approval levels, workflow is centrally orchestrated.

In performing its role in orchestrating the service, the service repository registers all the available services centrally. The BPEL will lookup into the service repository to identify the source and categories of the service in fulfilling the task to coordinate the service.

Where dealing with government data and services in government can be a more sensitive, having the service repository of published services cannot compromise on security. Service policy and governance can be defined centrally in ensuring that service orchestration is in accordance to the governance requirements.

5.2.3 Integration Services

Integration services are the component that supports the integration requirements of the e-government. In meeting the capabilities for interoperable e-government, the integration services allow the integration to various source systems including databases, legacy systems, files or any custom applications. In most cases, due to the diverse nature of the fundamental technology within these source systems, adapters are required to bridge the different technology. SOA allows the development framework to also incorporate standard based adapters available in the market or developing custom-made adapters.

5.2.4 Message/routing Services

Without undermining the various different systems that is already present in government enterprise architecture, SOA development framework also incorporates the need to integrated with other systems based on routing or messaging technology. Similar to the integration services, SOA allows the development framework to also incorporate standard based adapters available in the market or developing custom-made adapters to support the routing and messaging.

5.2.5 Web Services

As SOA looks at system development from services perspectives, web services can be developed and published. Government agencies or business as service providers

can publish web services (Janssen *et al*., 2006). Web services can be developed based on existing systems or create new web services. These web services are built on open standards. These services can be subscribed by others or build as a composite services. Web services component and service orchestration component works together to deliver the services that is presented at the information services component.

5.3 Adopters of SOA Development Framework

SOA is also chosen because it is a proven framework and implements best practices in ICT.

According to InfoWorld, Sabre Holdings, in travel business, implements SOA that integrates many complex source systems including legacy and messaging systems while achieving efficiency and performance in business (Erlanger, 2005).

Janssen *et al*. (2006) named a few SOA implementations for service orchestration in government cross agencies services based on SOA. They include pilot in Dutch Chamber of Commerce Region South-Holland, the Dutch Taxes and Office of Management and Budget, United States.

Kim and Kim (2007) had proposed SOA for service delivery in the Operations Support Systems for the telecommunications industry. The adaptability of SOA makes it a good potential to be expanded to other diverse service provisioning areas. There are

many more SOA implementations across a range of industries and regions, delivering improved services and removing impediments in interoperability.

5.4 Conclusions

SOA is the development framework suitable for building interoperable e-government applications due to many good reasons. SOA is based on service-oriented where services can be created, services can combine and worked as a composite service. The services are orchestrated by the BPEL in a coordinated process flow. The development framework for SOA is simplified with these architecture components:

1. Information services
2. Service orchestration
3. Integration services
4. Message/routing services
5. Web services

SOA has gained a lot of traction in e-government to address the rising demand for interoperability in e-government. SOA is now implemented at mainstreams, as it is able to address the underlying complex enterprise architectures with new perspectives of service-oriented capabilities.

CHAPTER 6 - DEVELOPING A SYSTEM

6.1 Introduction

A system called e-Tourism was developed to illustrate the possible capabilities of building an interoperable e-government application with all the different facets of interaction. The system adopts the development framework that is based on SOA. This system can be a model for an interoperable e-government that can innovate public delivery system into a more transparent and efficient public service.

6.2 System Overview

E-Tourism, a web-based application, anchors Ministry of Tourism Malaysia as the main orchestration of the e-government services. With the growing demand for transparency in the public delivery system, applications with interoperability framework like e-Tourism will make Malaysia e-government progressing in the accordance of e-government maturity model.

6.3 System Objective

This objective of the system is to illustrate an interoperable e-government application based on the SOA development framework.

This system is developed to deliver the promise for convenient service delivery and intensely streamlined services that breaks the organizational boundaries and brings improvement for transparent public delivery system.

6.4 System Scope

The e-Tourism system is an interoperable e-government application that offers G2C, G2B and G2G services via several modules. The modules incorporated include Package Booking Services for G2C, Application for License Services for G2B and Internal Approval Services for G2G. The scenarios depicted in e-Tourism are day-to-day scenarios that can be an onerous experience if the dealings with the government were to be conducted in the traditional way.

The e-Tourism system is not merely publishing static information but also offers integrated capabilities for an interoperable G2C, G2B and G2G services. These are customer-oriented services that evolve with the e-government maturity model and bypass the boundaries of a single agency. With information systems, the whole experience is a new paradigm whereby the e-government services can be now a single click away.

6.5 Users of the system

As an interoperable e-government can span across G2C, G2B and G2G services, main stakeholders of public delivery system would be the public at large/citizen, business users and government users. The G2C services are the e-government services targeted for citizens, the G2B services are government services for businesses and G2G are government services for inter and cross-agencies services.

6.6 System Development Methodology

SOA itself is a new paradigm in software development methodology. The software development methodology used for e-Tourism system development is based on the SOA and coupled with the iterative development with spiral methodology. The approach is to build rapid prototyping of the system based on the requirements and design and iteratively refined as the program is enhanced or new requirements are added. This approach is chosen as this gives the flexibility to start small and continuously evolve incrementally and iteratively. Uniquely, to meet the aim of this research, the system development also looked at the business requirements from services perspectives.

System analysis was based on the elicitation, evaluation and analysis of users' requirements for an interoperable e-government. Some study on present e-government services like e-Services at http://www.gov.my was also conducted to understand the type

of services offered and to ascertain the level of e-government maturity model these services are at this point in time.

6.7 System Configuration

The development platform used for the system is Oracle 10g Database for managing the information and Oracle 10g JDeveloper for the interactive development environments (IDE) for building Java applications. Oracle 10g JDeveloper with BPEL Designer extensions is also used to design the BPEL process-orientation modules. Oracle 10g BPEL Process Manager for Developers which is a standalone BPEL process manager is used for development purpose. It also includes the web server, portal, JSP and Servlets deployment and BPEL process orchestration. The deployment platform requires the same software used for the development except for the Oracle 10g JDeveloper as this is used only for development. Any Internet browser is also required in order to run the e-Tourism application over a web browser.

The above-mentioned software is supported on many platforms including UNIX, LINUX or Windows. The system configuration required to run them is at least 1 GB RAM, 20 GH Hard disk and at least one 1 GHz processor on the supported operating system. For the development of e-Tourism, Windows XP with the similar system configuration was used.

6.8 System Design

The functions included in the development of the interoperable e-government are depicted in the following systems design. Figure 6 below depicts the Package Booking Services in e-Tourism whereby public users/citizen can access the e-Tourism portal and presented with the variety of package booking services made available as added value services from the e-government application for G2C. Public user/citizen can choose the services available and book those services online. The e-Tourism will notify the requestor on the completion of the booking. It also involves great collaboration in a G2B scenario with the capabilities for the e-government application to subscribe to any publish services provided by any service provider.

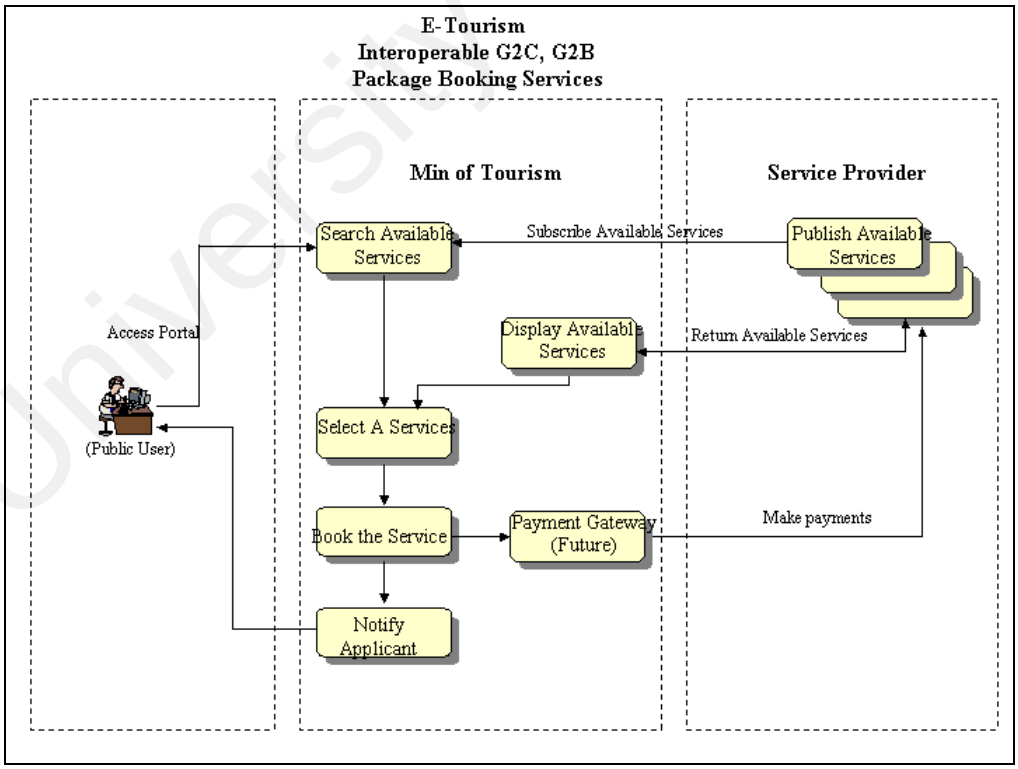

Figure 6 - E-Tourism : Package Booking Services

The following Figure 7 below depicts the Application for License Services where business users can access the e-Tourism portal to make an online application for license. The applicant can submit the company registration number and contact information and the system will automatically check the type of licenses offered and creates integrated cross-agency process via web services to search for the registered business information from Suruhanjaya Syarikat Malaysia (SSM) as the custodian. When an application is made, the system will raise a Service Request ID for the application for any future interactions with the ministry.

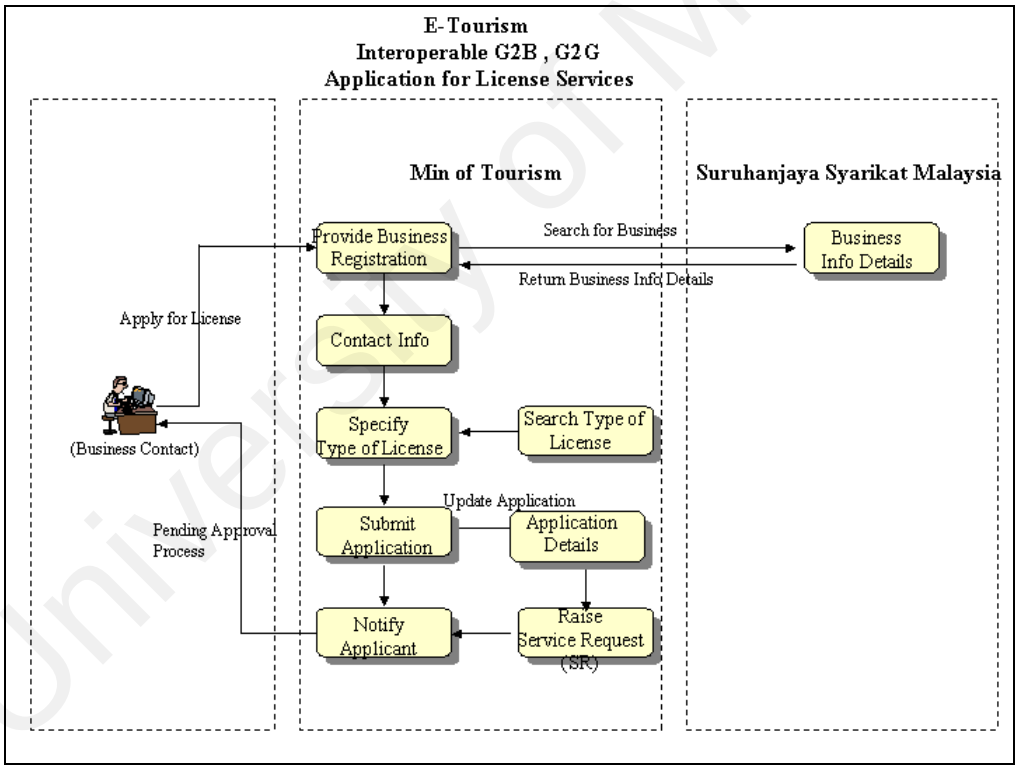

Figure 7 - E-Tourism : Application for License Services

The following Figure 8 below depicts the subsequent interaction from an applicant to the ministry using the Service Request number or identification (ID). By being more well informed, this gives more openness and accountability when dealings with the government.

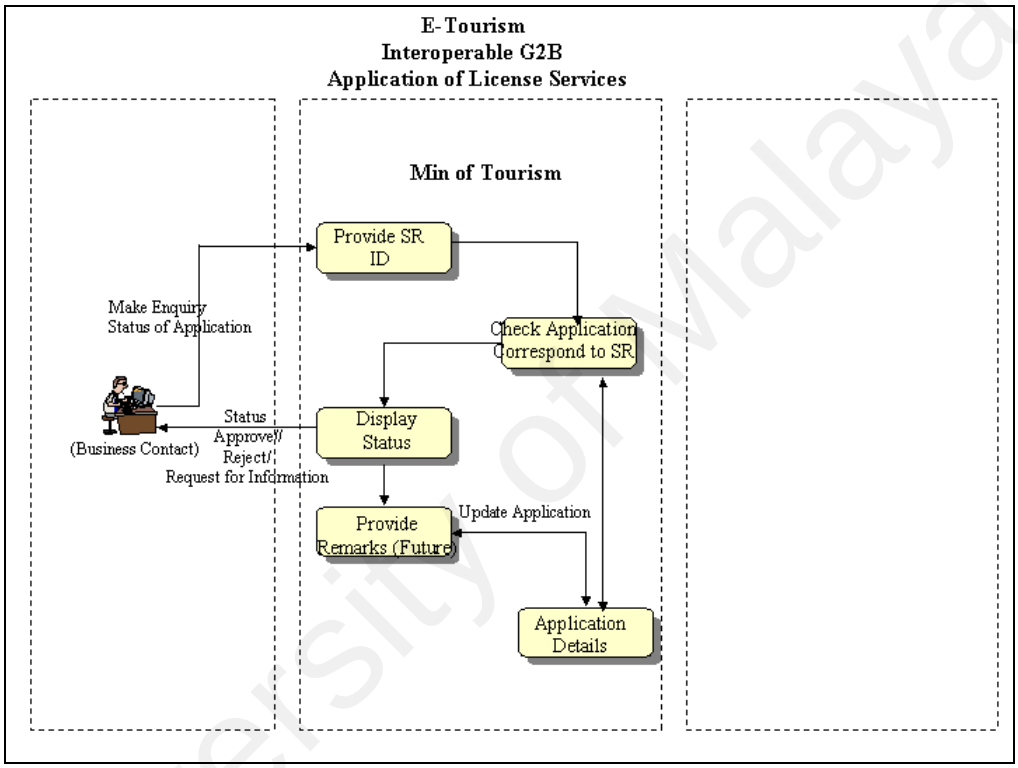

Figure 8 - E-Tourism : Application of License Services (Continuation)

Figure 9 below depicts the Internal Approval Services whereby it allows the government users to login through the e-Tourism portal. Once authentication is made, the user will be presented with the task list that is assigned to him/her. With web services, the user can check the business information details taken directly online from

Suruhanjaya Syarikat Malaysia whom offers this as a web service. This is a chain of process execution facilitates by seamless information flow cross-agencies.

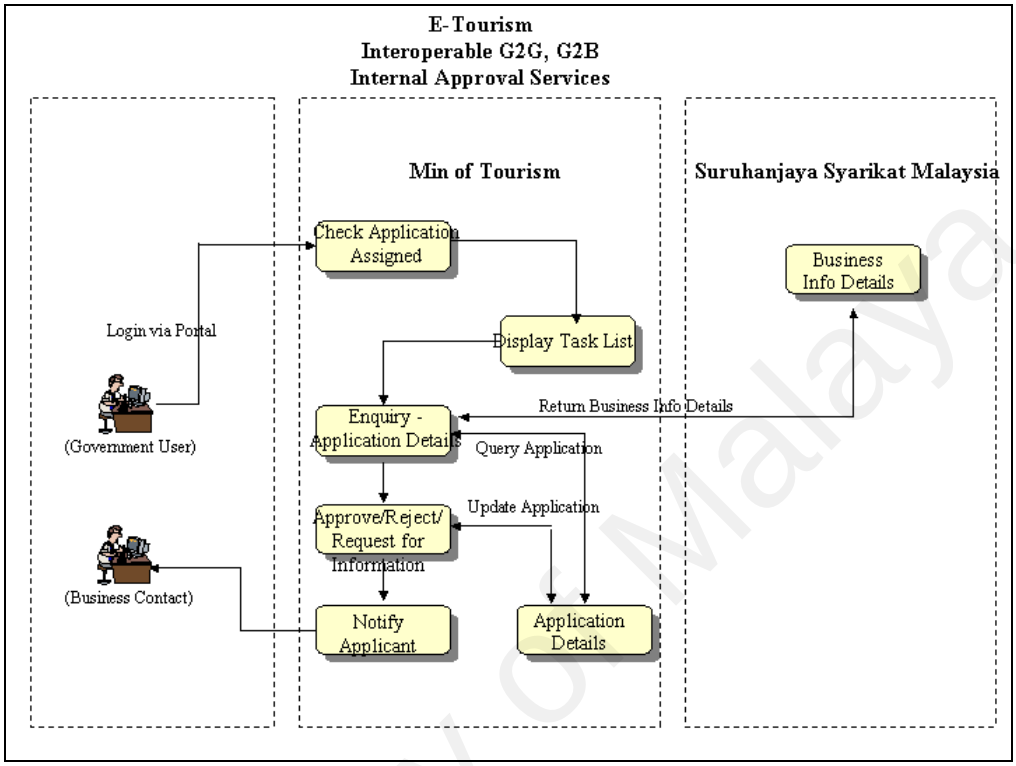

Figure 9 - E-Tourism : Internal Approval Services

6.9 System Development

The development of the e-tourism application is using Oracle JDeveloper to build the servlets as JPSs application. Oracle JDeveloper is an IDE tool. Oracle JDeveloper also provides the platform for BPEL designer. Figure 10 below illustrates the development framework in Oracle JDeveloper. Here is the JSP application for the request license module for the G2B services. The module is for a business user to apply for any particular license from the government by entering the company code or business

registrations. The type of license is displayed as pull-down list. The environment is very interactive by which the application's UI can be designed, logic can be programmed. Figure 10 and Figure 11 below shows the interchangeable capabilities of viewing the source codes in Java programming.

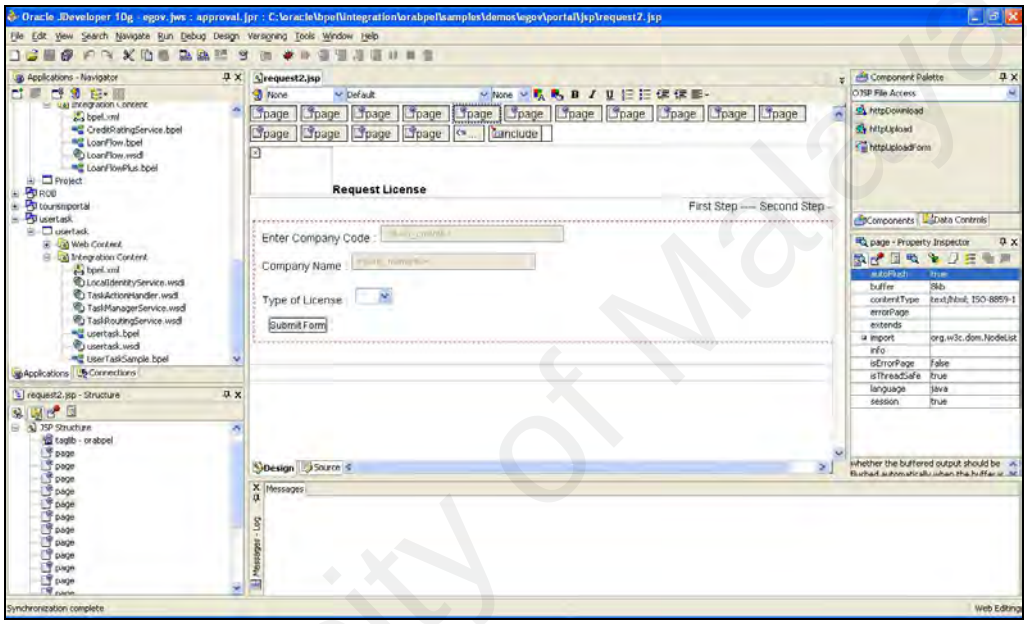

Figure 10 - E-Tourism : Development UI

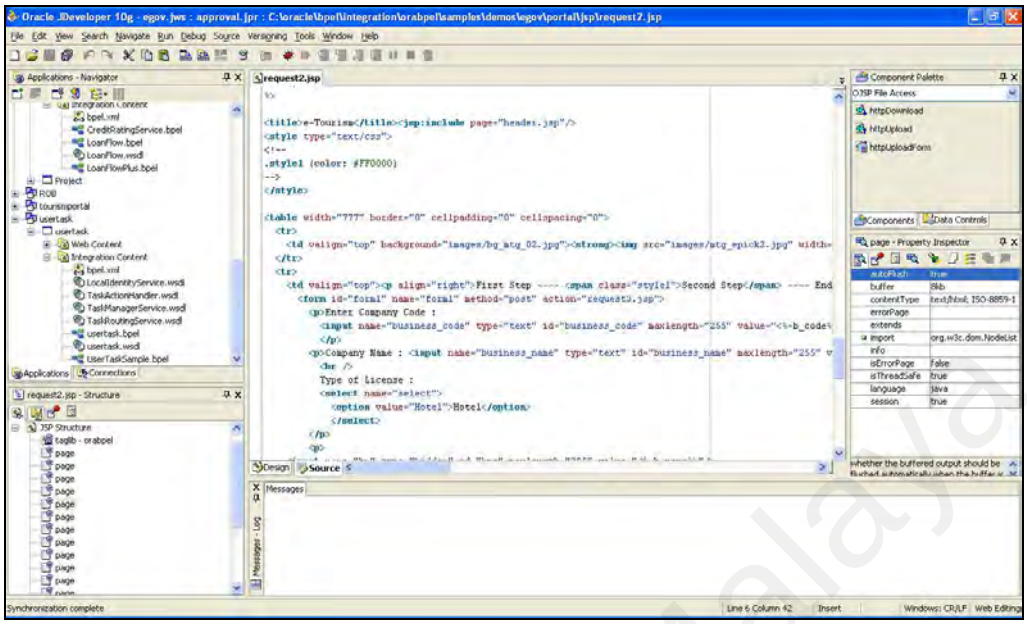

Figure 11 - E-Tourism : Development Codes

Uses Oracle BPEL designer is used to design the BPEL process orchestration. The designer is a graphical tool that makes it easier to design, build, view and modify BPEL processes. Figure 12 below is the BPEL process diagram for the search for the company name from another agency like Suruhanjaya Syarikat Malaysia via web services. This illustrates the information request and information flow from one agency to another offered as service in a G2G under the Application for License Services. Here the e receivesInput process accepts the company registration number and send web service request fromUser to toROB, which is the registration of business under Suruhanjaya Syarikat Malaysia. The FromROB is the information sent back from Suruhanjaya Syarikat Malaysia to the ministry and displays the company details on the portal.

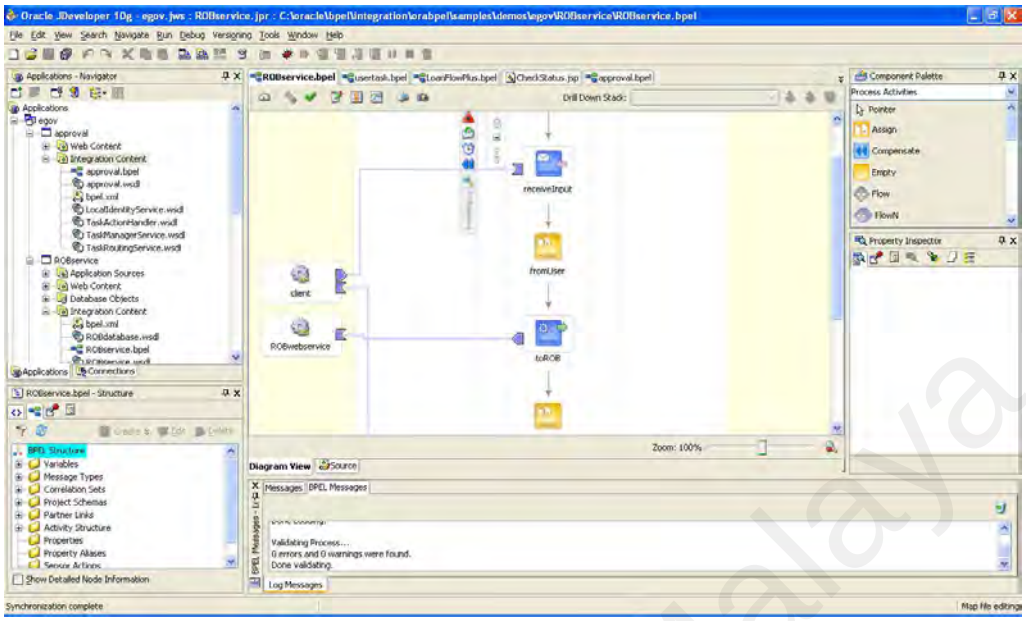

Figure 12 - E-Tourism : BPEL Process Diagram

Figure 13 below is the business logic that performs the web service orchestrated by BPEL.

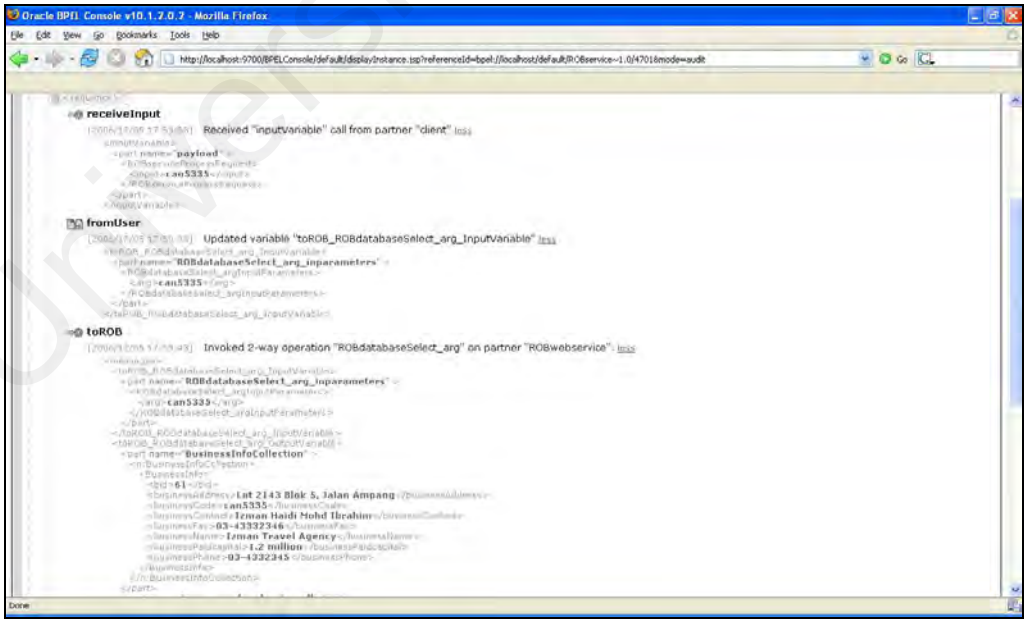

Figure 13 - E-Tourism : BPEL Process Codes

Figure 14 below is the BPEL process designer for the Internal Approval Services. The process is first model with BPEL designer to perform the BPEL approval structure. The codes are in accordance to the approval structure i.e. to accept, approve or request for more information from the applicants.

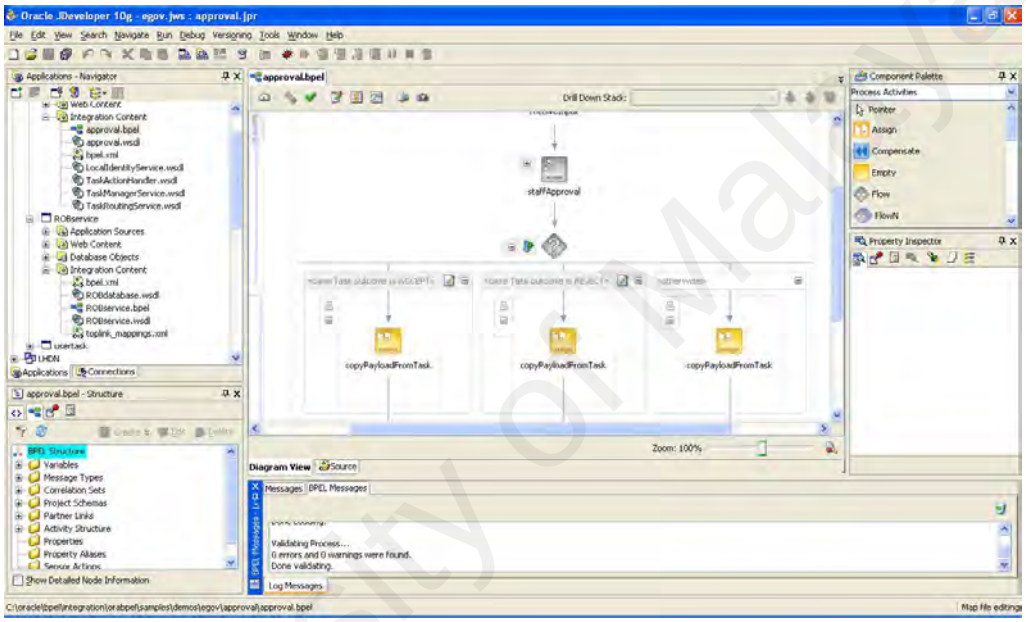

Figure 14 - E-Toursim : BPEL Approval Process

6.10 System Testing

There were several stages of testing that takes place throughout the rapid prototype development. Initially unit tests were conducted to test each unit as performed for each scenario for in the G2C services, G2B services and G2G services.

In every iterative modification and enhancement of these modules, unit testing will be conducted to test the capabilities incorporated. Following these unit tests, system tests were also conducted to test the information flow and exchanges of information for the G2C, G2B to G2G services inclusive in order to test its cohesive integration between module to module in performing the services within the agency and the simulated cross-agencies integration.

6.11 System Overview

The e-Tourism is a web application, developed is an interoperable e-government that supports G2C, G2B and G2G interactions based on the system scope defined earlier. The various services provided include Package Booking Services for G2C, Application for License Services for G2B and Internal Approval Services for G2G.

The followings are the screen snapshots of the e-Tourism system that provides the step-by-step system overview.

Figure 15 illustrates the main portal for E-Tourism. The portal includes the various tabs that group services together. The portal is made intuitive and informative, incorporating numerous content on tourism in Malaysia.

Figure 15 - E-Toursim : Main Portal

Figure 16 is the e-Tourism G2C services. In this case, the option is to select the holiday package available. With the e-government portal subscribes to the web services, the published services are incorporated in to the system.

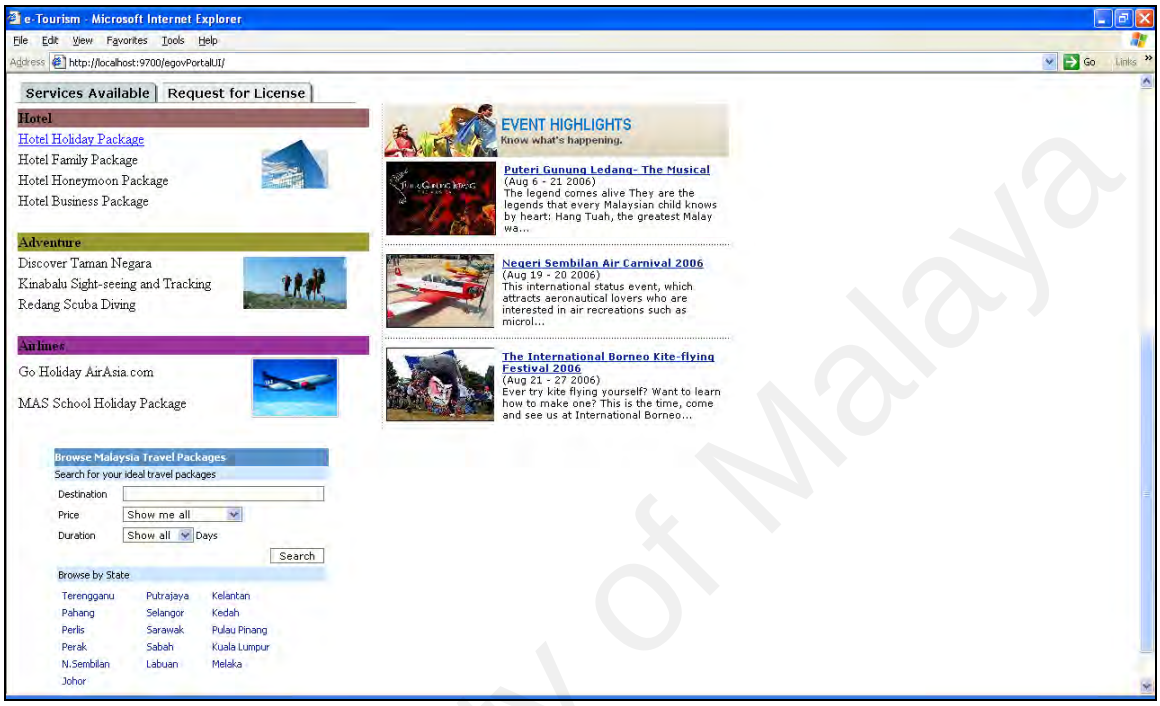

Figure 16 - E-Tourism : G2C Services

Figure 17 shows that the service chosen is to book a holiday package web services. E-Tourism incorporates this G2C service from available web services. This adds value to the e-government, making information and services readily available for the public.

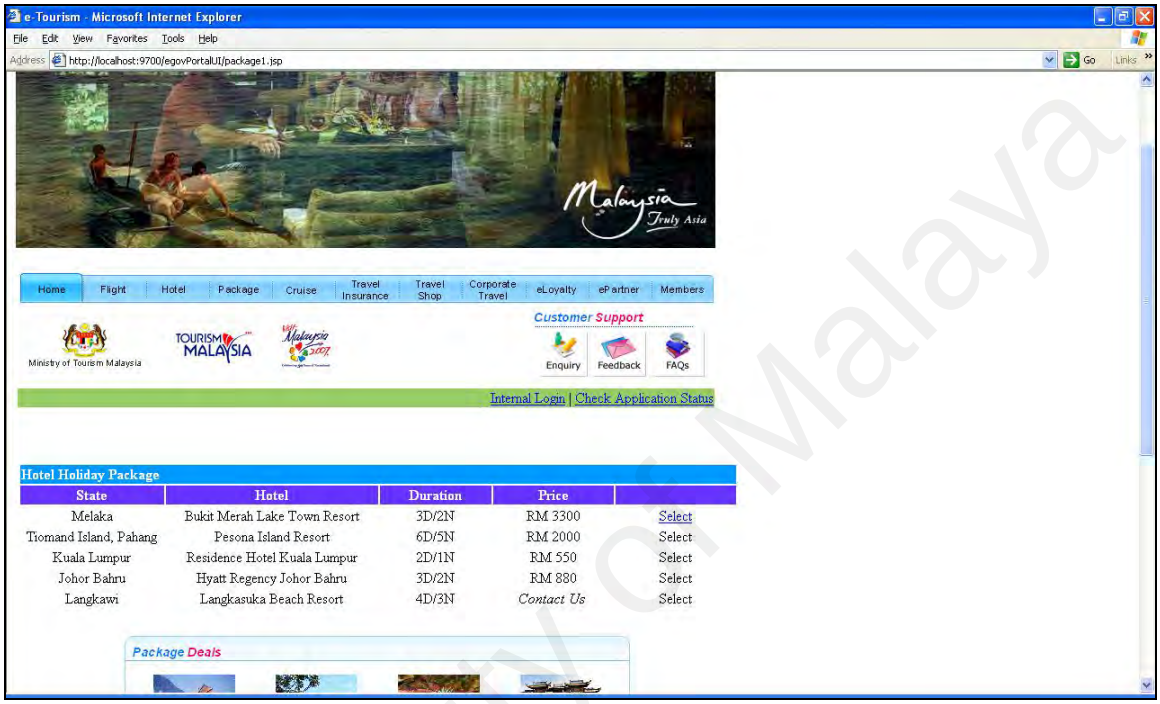

Figure 17 - E-Tourism : Package Booking Services

Figure 18 allows the users to enter the details of the booking. The booking contact details are required an efficient delivery of notification. At the same time, the process orchestrates the execution of the web services in completing the booking.

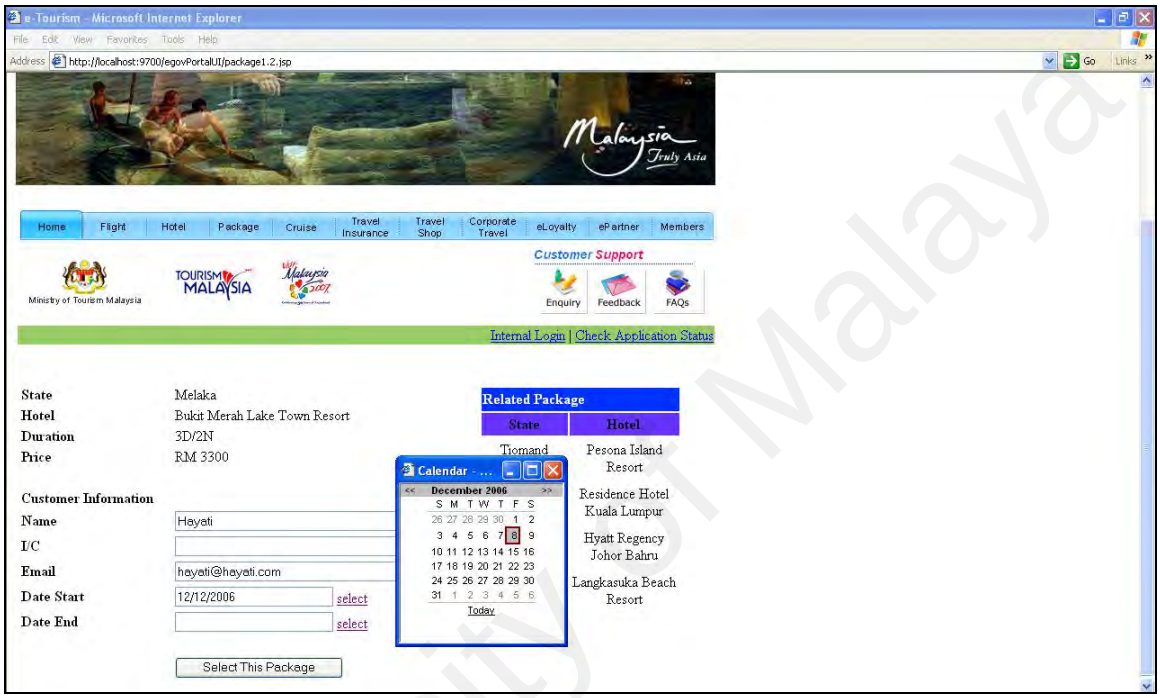

Figure 18 - E-Tourism : Package Booking Services (Continue)

Figure 19 illustrates the service notification of the processing of the booking. This notifies the citizen that the status of the request.

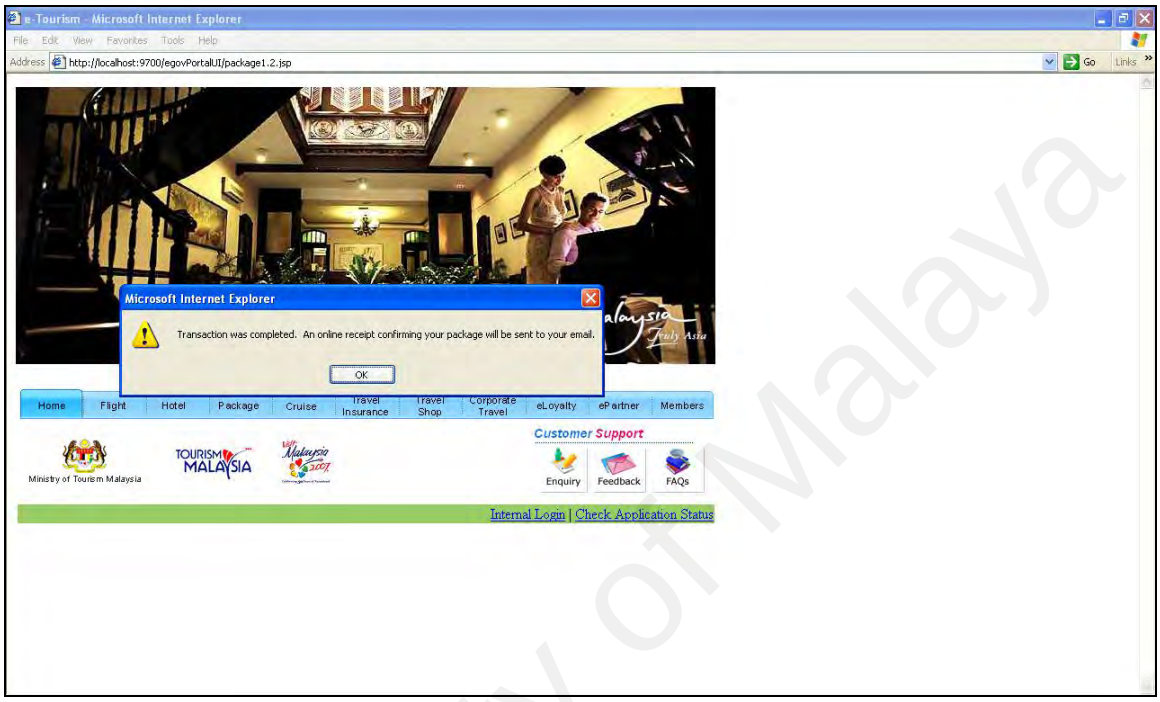

Figure 19 - E-Tourism : Package Booking Notification

Figure 20 depicts the G2B services available from the "request for license" tab. In this example, the ministry gives out hotel licenses to those appropriate. The applicant can request for the application for license services online. This incorporates transact capabilities of an e-government to transact over the Internet.

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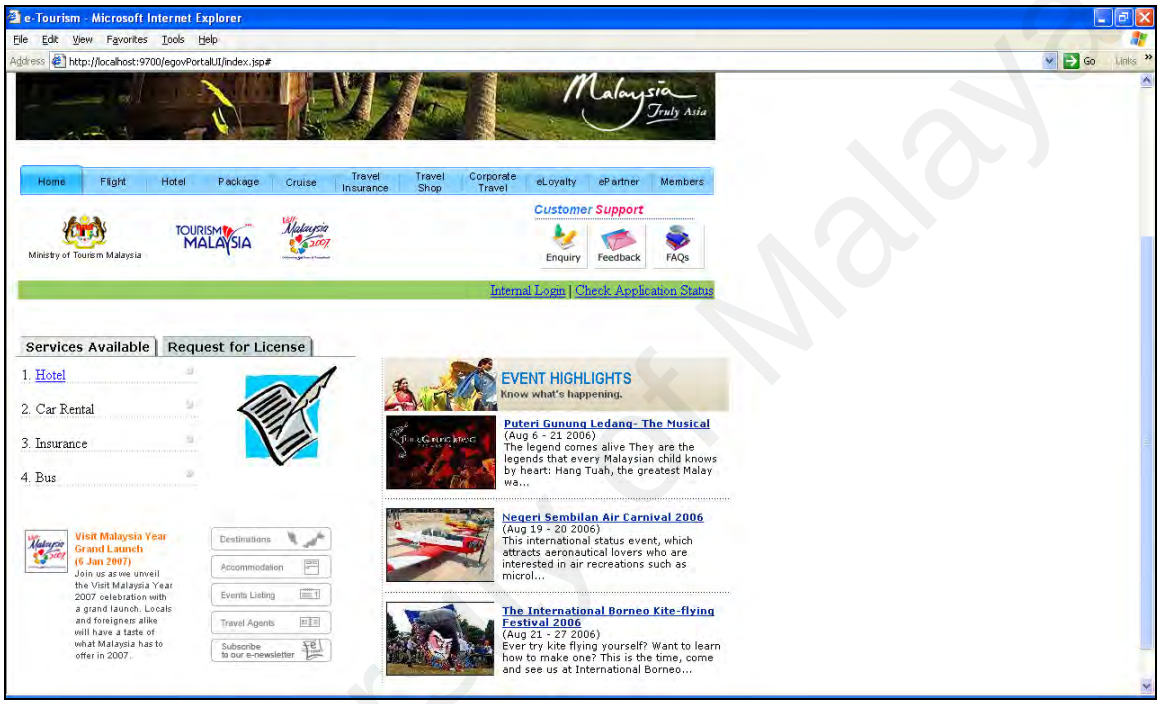

Figure 20 - E-Tourism : Application for License Services

Figure 21 depicts the online form to apply for license. The e-government system incorporates web services to a different agency to search for the company registration details. This is done via web services for synchronous information flow with the back-office systems.

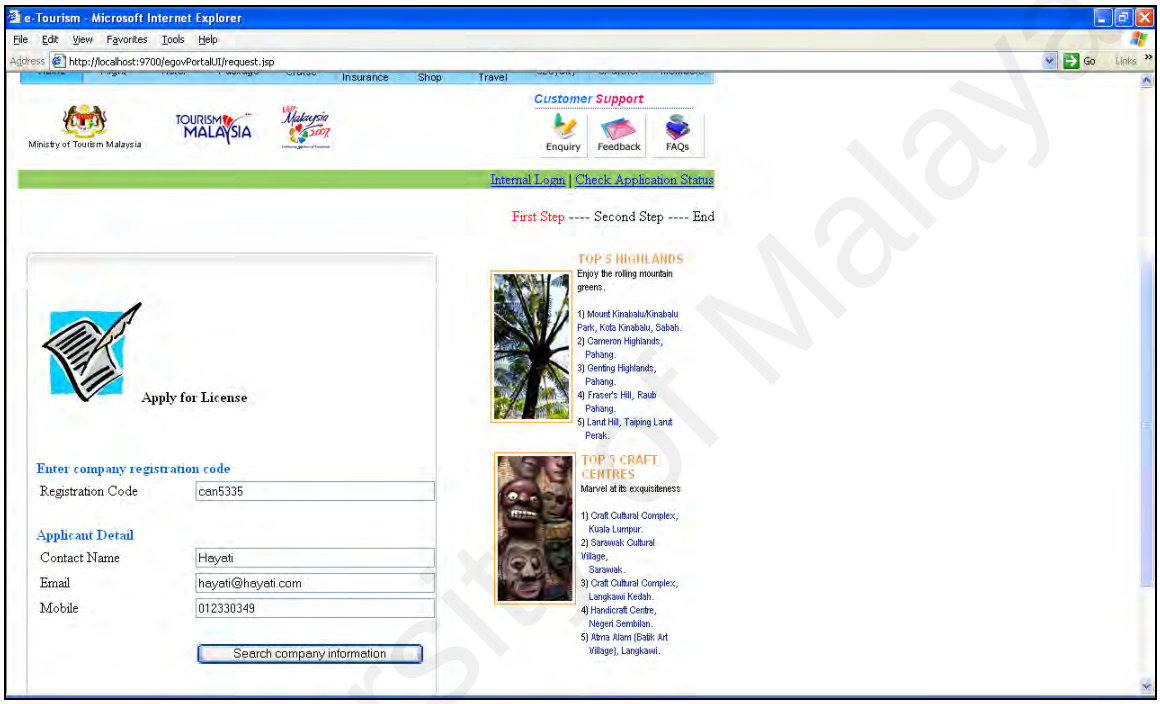

Figure 21 - E-Tourism : Perform Search for Company

Figure 22 shows the company name returned from the participating agency that is facilitated by the web services. The user can submit the application when the details complete.

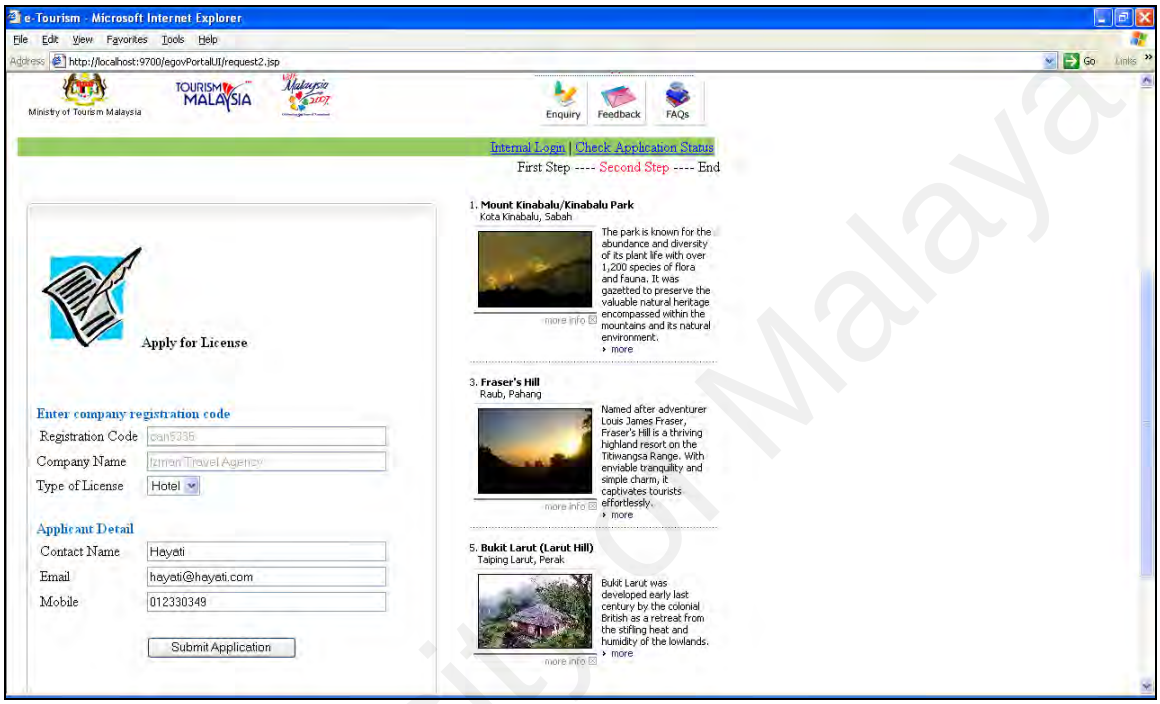

Figure 22 - E-Tourism : Company Search Completed and Submit Application

Figure 23 sends a notification to the applicant on the assigned Service Request (SR) number for future interactions on the application status.

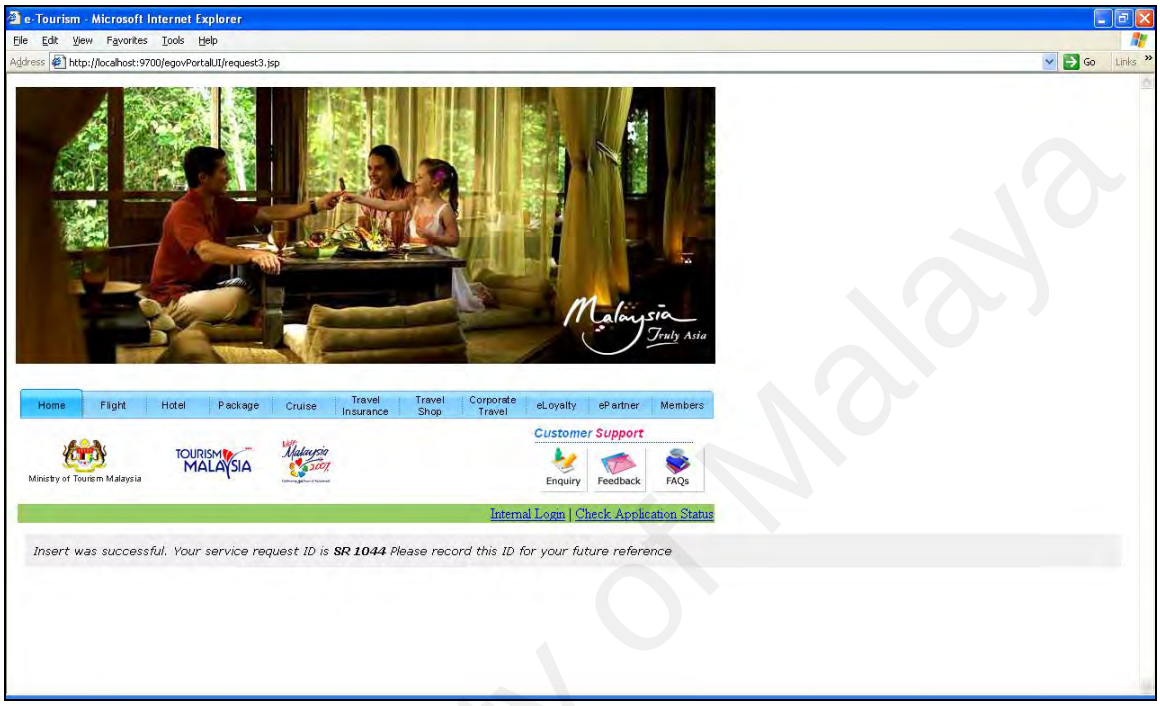

Figure 23 - E-Tourism : Notification on Service Request (SR) Number

Figure 24 is made intuitive which allows the applicant to enquire the application status via the SR number.

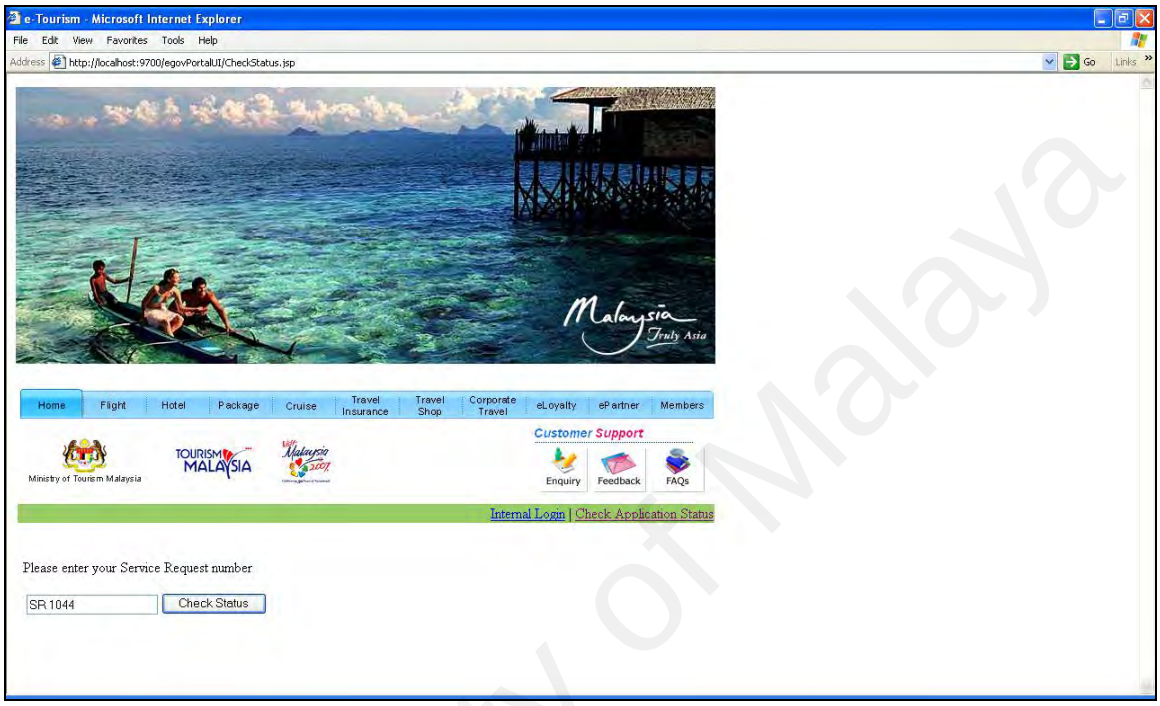

Figure 24 - E-Tourism : Enquiry on based on SR Number

Figure 25 provides the status of the application online. This status is returned based on the enquiry made against the SR number.

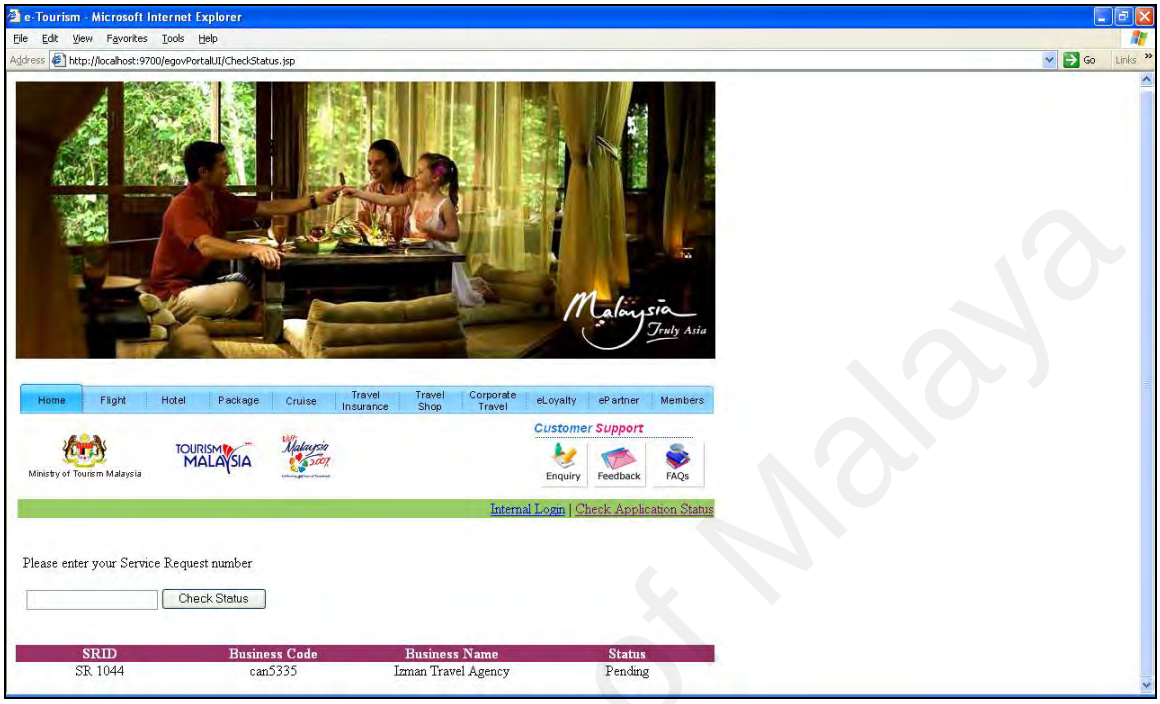

Figure 25 - E-Tourism : Status returned

Figure 26 is to illustrate the G2G services. Here it requires the internal user to login into the system via the main portal.

Figure 26 - E-Tourism : Internal Login from Portal

Figure 27 shows the internal login screen into the system. Users will be authenticated for security purposes.

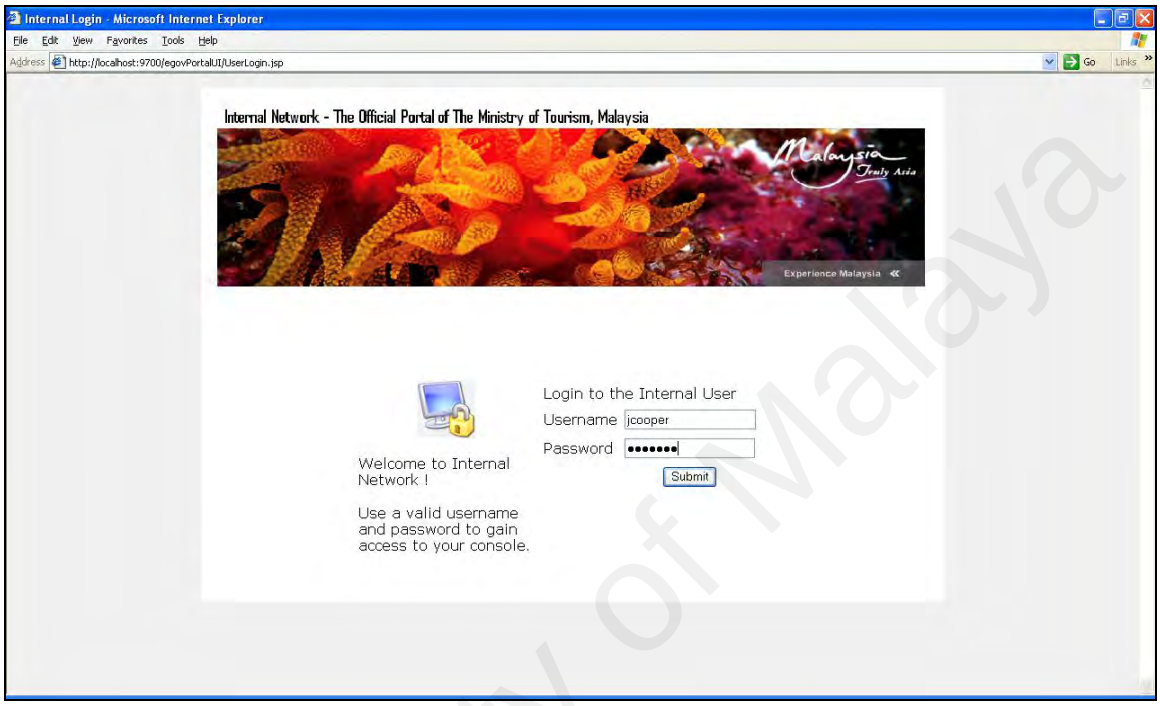

Figure 27 - E-Tourism : Login into Internal System

Figure 28 shows that upon successful login into the system, the task list assigned to the internal user will be displayed dynamically.

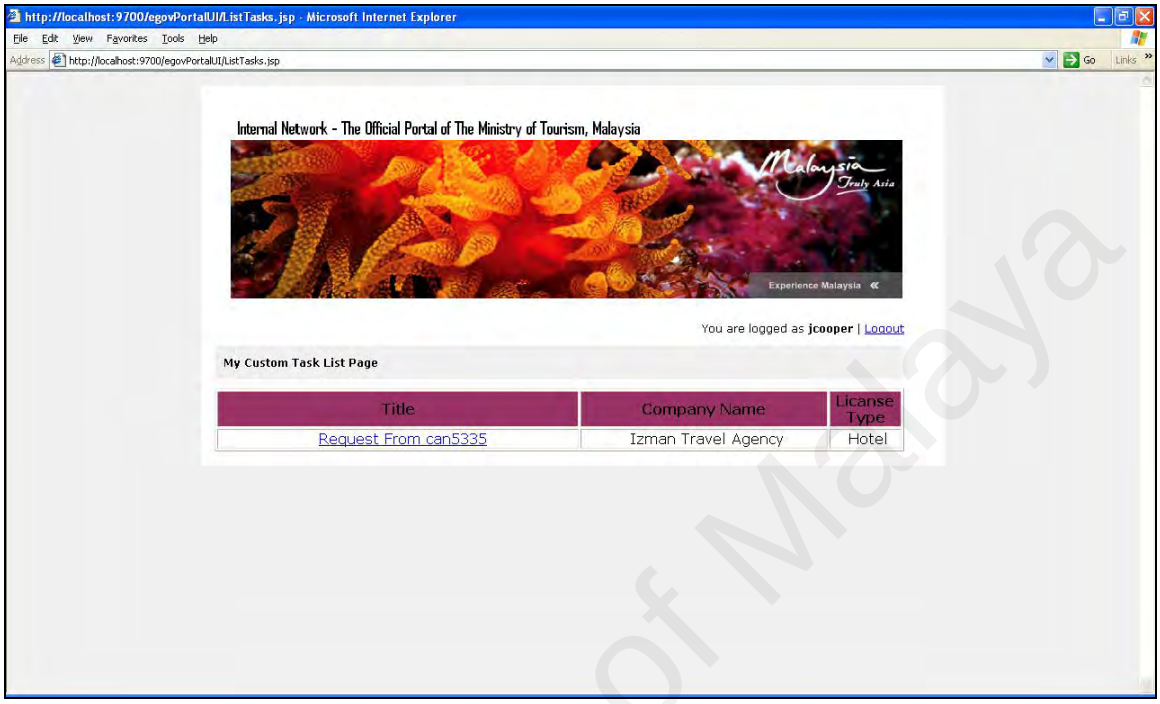

Figure 28 - E-Tourism : Internal Task List

Figure 29 shows the details of the application. The internal user gets to validate the company information based on the web services coordination between the agencies before the approval is made. Based on the information presented, the user can decide to approve, reject or request for more information.

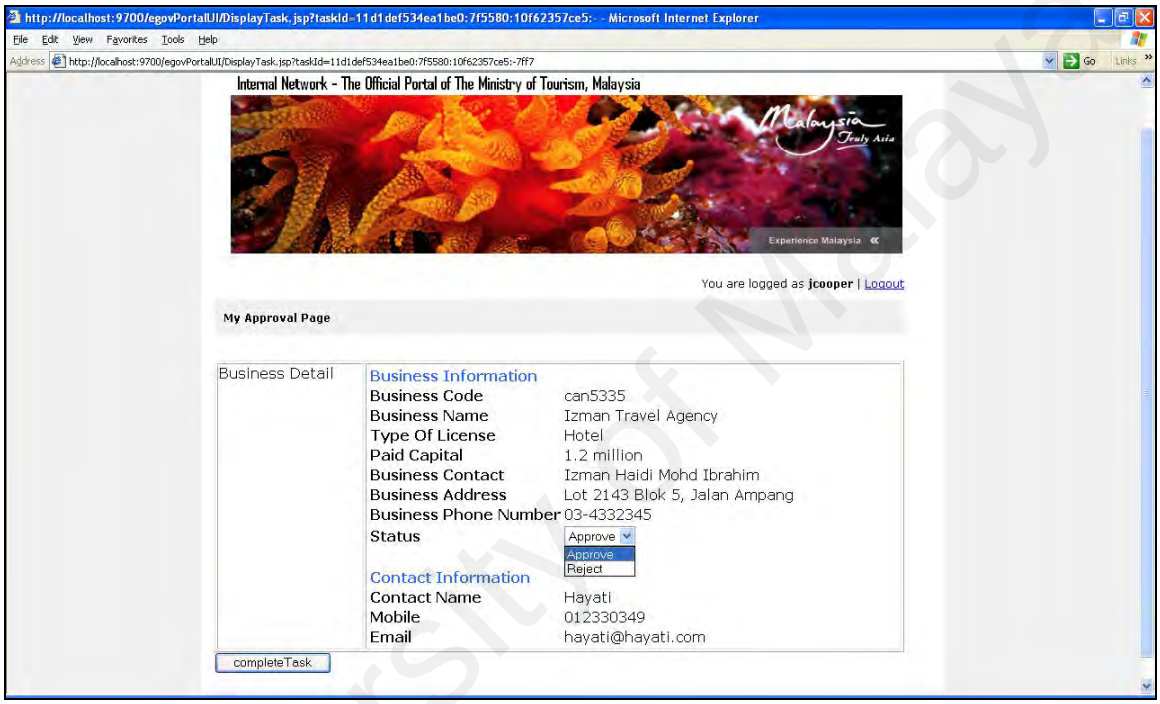

Figure 29 - E-Tourism : View and Approve Application

Figure 30 shows the notification prompted by the system. Corresponding process coordination is executed to notify the applicant regarding the status of the application.

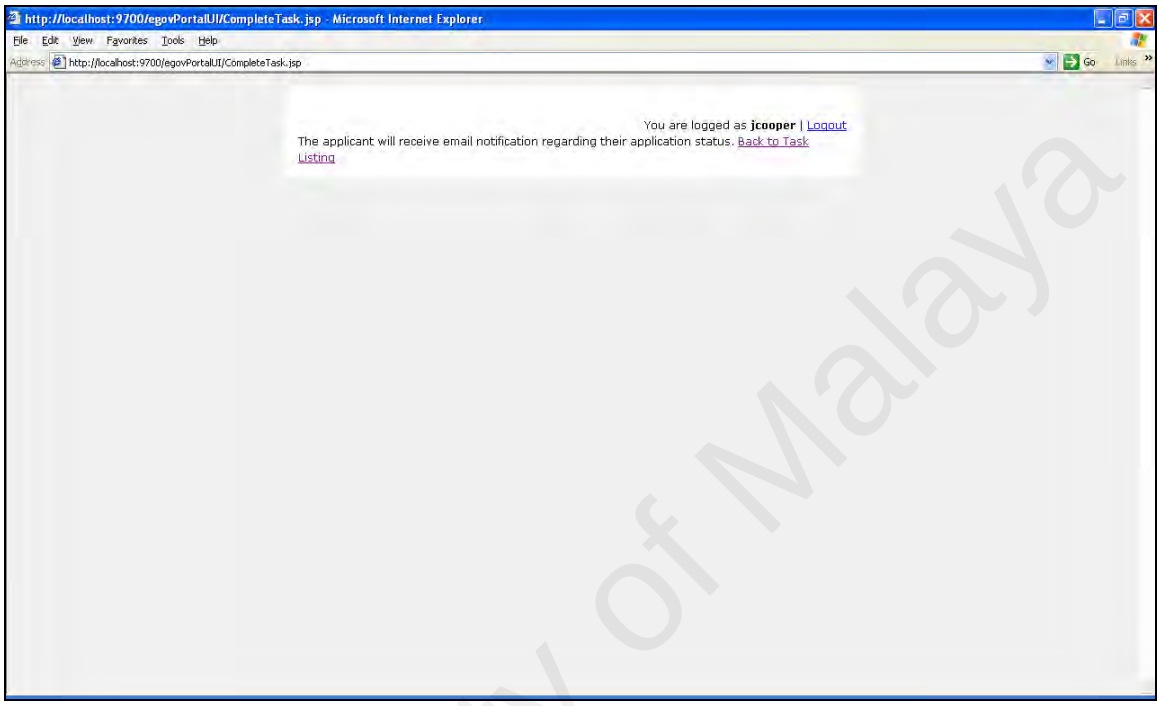

Figure 30 - E-Tourism : Notification to Applicant

Figure 31 shows how the users can return to the e-government portal to check the status of the application using the SR number. Users are well-informed of the status. This makes interoperable e-goverment more open and responsiveness.

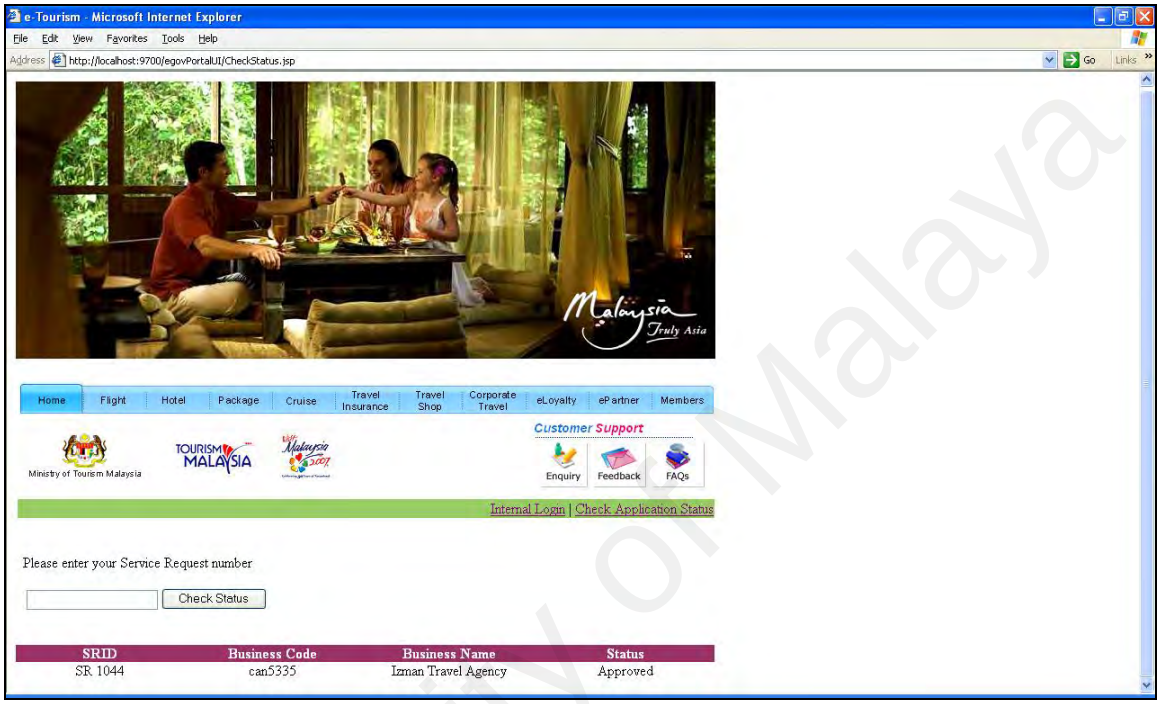

Figure 31 - E-Tourism : Subsequent Enquiry on based on SR Number

6.12 Limitations

There are several limitations from the perspective of an interoperable e-government that can be highlighted with the current work.

Firstly, there is limited capability for the remarks or comments to be entered by the business user that can facilitate the two-way interaction in managing the service requests in the G2B services. Currently the feature allows for the remarks to be displayed

only for the comments entered by the government application approver whom requests for more information during the application approval process.

Secondly, the current prototype does not integrate with any email or SMS server for the seamless routing of email or SMS messages pertaining to the license applications approval process. With the integration to sophistication delivery mechanism like email or SMS, the business applicant can be notified if his/her applications have been approved, rejected or pending decision with request for more information. Making the integration to email or SMS can provide applicants or public at large an alternative channel to be informed on their application status and such proactive services can improve transparency in public delivery system.

Thirdly is to include the payment gateway for a seamless service to support the potential e-commerce capabilities.

6.13 Future work

With the SOA development framework, the scope of the e-Tourism can be expanded to offer much more interoperable e-government services and involving more process-oriented services that spans across more government agencies. This includes the progression of the application to support its current limitation as discussed above.

6.14 Conclusions

E-Tourism is the system developed to experiment the SOA development framework. The prototype demonstrates an interoperable e-government through an architecture that can achieve cross-agencies collaboration while providing the convenience and streamlined services.

CHAPTER 7 - CONCLUDING REMARKS

7.1 Outcome of the Research

This research employed quantitative research method. The findings are reinforced by the empirical analysis on the findings of the factors associated with the interoperable e-government. Diligent efforts were put in place in the research methodology and design confirmed and concluded that the independent factors, the degree of convenient delivery and the level of intensely streamlined services are conclusively evident as the interoperable e-government factors that improve transparency in public delivery system.

SOA is identified as the most appropriate system development framework that is able to meet the technical challenges in building interoperable e-government. Experimenting the SOA framework, the e-Tourism application is built providing the online and electronic services that intertwined G2C, G2B and G2G services.

7.2 Limitation of the Research

It is also inevitable for human, technology or process change will occur in the endeavour towards the improvement of current public delivery system to an interoperable e-government. This is not in the scope of the research.

ICT does not portray any impediments towards developing an interoperable e-government that facilitates cross agency process execution. SOA is the evolution in system development that can be fully exploited for this purpose. There are several functionalities in the e-Tourism system that can be expanded or enhance.

7.3 Future Work of the Research

The research suggests that future work can be carried out to examine how significant can technology advancement capable to overcome the underlying barriers in the implementation of the interoperable e-government.

7.4 Conclusions

Internet has become so pervasive in many walks of life today. ICT plays an important role as a strategic enabler to any enterprise. Malaysia has come a long way in its journey to Vision 2020. E-government has reinvented the public delivery system. Progressing the e-government applications along the maturity model is what the aim is. The need to be transparent in meeting the higher demands for public service makes e-government becomes even more essential in delivering the public service.

Malaysia is looked upon to implement strategic changes in public delivery system. We are poised to explore into new dimension in e-government and move up the ladder to evolve public delivery system to greater heights.

Therefore, with all the research outcomes and findings, this research had fulfilled its objective.