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Understanding the Complexity of the two Advanced E-Government Integration Models - Vertical versus Horizontal Integration

Master's thesis

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Kahe täiustatud e-valitsuse integratsioonimudeli keerukuse mõistmine - vertikaalne versus horisontaalne integratsioon

Magistritöö

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

Implementing electronic services both for private and governmental institutions had evolved over the years as different researchers aim to provide an absolute integration model for e-government systems and services. Not having a universal integration modal has resulted in many trials and error as different government tried to implement services that are not suitable for them. In the process of discovering a universal model, Layne and Lee came up with the four developmental stages of e-government. In the four developmental stages of e-government, horizontal and vertical stages are the most advanced stages however, these stages did not provide a definite answer to the existing problem. This research then focuses on comparing horizontal and vertical stages to understand the complexity and able to differentiate the actual need for either of the two. To resolve this problem, this research used the systematic literature review to select the relevant articles that provided the data that was used to answer the research questions posed by the research problem. Due to this research, it possible understanding the complexity of both horizontal and vertical integration and future area of study was suggested to constantly improve the available knowledge on this topic.

Keywords: Vertical integration, horizontal integration, e-governance, systems, complexity, measurement, models, e-government

This thesis is written in English and is 48 pages long, including 5 chapters, 6 figures and 9 tables.

List of abbreviations and terms

SLR	Systematic Literature Review
IC	Inclusion Criteria
QC	Quality Criteria
PS	Primary Study
S	Selection

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Introduction

Electronic Government

The redesigning government movement argued for a fundamental shift away from bureaucratic government and toward an entrepreneurial, creative, catalytic, purpose-driven, and results-oriented government in the early nineteenth century. In the United States, imaginative use of information technology has become inextricably tied to innovation. Government agencies' early efforts to rethink work processes and support them with new technology applications centred on client requests rather than agency needs or structures. The phrase "electronic government" was coined during this phase when politicians promised that residents would be able to access government services online instead of waiting in queues (Dawes, 2008).

According to Moon (2002), Electronic government is the future for providing services to clients and citizens, according to developed countries and global organizations around the world. As a result, e-government has become the trendiest topic in government. e-government, like many other managerial theories and practices in public administration, such as strategic management and participatory management, developed from private-sector adoption of alleged e-business and e-commerce. Several attempts have been made to develop a common concept for e-government. To some extent, though, e-government means various things to different governments around the world. Moon (2002) defined electronic government as the use of all information and communication technologies to make government processes more efficient for this study. However, similar to e-commerce, the general perception of e-government is that it is exclusively an internet-based activity that improves citizen access to government information and services to ensure citizen engagement in and satisfaction with the government process. E-government is often seen as the government's continued commitment to improving the connection between the private citizen and the public sector by providing better services, information, and expertise at a lower cost. Despite the ongoing drive toward e-

government, little is known about how it is created, implemented, and used at the local level.

E-government programs seek to improve government performance in general, with appropriate implementation resulting in improved governmental services for citizens and the private sector, higher government work effectiveness internally, and increased citizen participation in decision-making. Several studies, however, demonstrate that a significant majority of E-government systems around the world failed to reach their claimed goals. In reality, there is widespread agreement that more research is needed to uncover the true causes of this failure. Even though many E-government programs have failed to meet their objectives around the world, there is widespread agreement that E-government efforts can still deliver on their promises. However, a complete approach is required to harness the underlying potential of these programs (Almarabeh and Abuali 2010).

Adopting e-government is not easy and cannot be finished in a short amount of time; rather, it requires an integrated architectural framework approach to putting government information and services online. As a result, many developing-country governments are still in the early stages of implementing e-government. Furthermore, the delay is because e-governments require considerable changes in organizational infrastructure, which may be met with resistance. As a result of these variables, the authors created an integrated architectural framework for the adoption of e-government (Ebrahim and Irani 2005).

Layne and Lee's four developmental stages of e-government

The topic of the study revolves around the e-government system and its services. Though the concept exists historically, there has been some complexity in the system, which can be known as a four-stage model that includes the catalogue stage, transaction stage, vertical integration stage, and the horizontal integration stage, as described in Karen Layne and Jungwoo Lee's research. Developing a fully functional e-government revolves around these four stages. Each stage ascends in order, while the next stage can be attained due to the system's exponential growth from the previous stages.

According to Layne and Lee's research, briefly defining each stage is necessary for a contextual understanding of this research. The catalogue stage is when government builds a website due to feedback from its citizens, and this type of e-government service is usually created for accessing state information. E-government services at this stage provide the least proportion of functionality. The continuous addition of data to the catalogue stage will present the opportunity and the need to expand the services to ascend to the next stage (Layne and Lee 2001, p. 126). Layne and Lee described the transaction stage as when an e-government service has evolved to the point where citizens want to perform specific sine qua non-online rather than visiting a distinct building to perform a paper-based process. Using e-government as a transaction stage, the government becomes an active respondent, communication becomes a two-way action, and the service functionality increases.

The third and fourth stage is where the complexity becomes notable, as Layne and Lee described. The vertical and the horizontal integration are the two stages where the transformation of government processes occurs. The vertical integration is the stage where government services are being transformed rather than simply digitizing their processes because local systems are aligned with higher systems with similar functionalities. Making government electronic involves much more than simply putting existing government services on the internet. What ought to happen are extremely durable changes in the public processes themselves and perhaps the idea of government itself. At the same time, horizontal integration is the stage where e-government maximizes the maximum capacity of information technology functionalities since datasets across various regions will interact with each other to share data, so data acquired by a specific institution will proliferate all through all governmental capacities. (Layne and Lee 2001, p. 130-132).

Although there are four stages of e-government integration, as described by Layne and Lee, all four stages come with different complexity. The first two stages come with minimal implementation complexity that the government can easily handle because the government is new to e-government and requires less functionality from e-government at these stages, while the subsequent stages are when the government is aware of the potential of having fully functional e-government. The complexity is much more difficult at these stages because it is an improvement on the previous stages. E-government at these

stages is revolutionary as there are changes to the initial processes, and maximum functionality is required from e-government.

According to Layne and Lee, this thesis will compare the two most advanced stages of e-government, which are vertical and horizontal integration. This will provide an overview of the implementation complexity in integrating e-government systems and services. The research study will use a systematic literature review and knowledge collected to determine the complexity of the vertical and horizontal integration of e-government systems and services.

Significance of the research

Historically, academics and literature claim that managing e-government programs has been difficult due to the involvement of multiple governmental institutions. Nevertheless, there are steps to developing functional e-government. However, Karen Layne and Jungwoo Lee's research suggests that there are four stages. Karen and Jungwoo used a four-stage implementation strategy to simplify it because of the difficulties. Their article depicted the many stages of e-government development and proposed a developing model for fully effective e-government. These insights accompany both the technical and organizational issues; this article describes both e-government and traditional public administrative structures. More study is needed so that developing countries can simplify their implementation process choices during the early phases of e-government growth.

The phenomena of building a fully functional e-government utilizing the four-stage model are very new in e-government literature. They have yet to become a topic of academic research in e-government. The difficulty that this thesis seeks to answer is comprehending vertical versus horizontal integration in the context of Layne and Lee. According to the article that serves as the foundation of this study, deploying e-government services is difficult. Before the implementation stages can be completed, several obstacles must be overcome. The literature reported on the experience of difficult-to-manage e-government efforts, and the development of online transaction services is in its infancy. On the other hand, the government has recently begun e-government projects (Layne and Lee 2001). To further clarify the complexity of implementing e-services, the paper divided the complexity of e-service execution into four stages: horizontal

integration, vertical integration, transaction, and catalogue. Other research studies acknowledge that deploying e-services is difficult.

This idea is critical to the research because it is necessary to determine the degree of complexity and which integration procedure is more compatible for various governments. In this sense, e-government appears to be a collection of keywords, such as e-presence, e-auctions, and the associated success, failure, and new business models of commercial and federal colleagues (Layne and Lee 2001). As a result, it is difficult not to join the e-government trend. In conclusion, the literature suggests that the deployment of e-services is difficult and that this research will employ stages of integration to answer the research questions.

Problem Statement

Previous research in e-government implementation and integration has not taken the time to examine the available models in various scenarios to grasp the complexity of e-government integration. Generally, numerous e-government ideas are fundamentally trying to change the semiotics of governmental institutions and society. The implementation and comprehension of such projects create a complex prerequisite (Jones et al., 2007). However, the research is not fully focused on the integration models but rather on other aspects that make the process more complex.

The majority of e-government service failures in developing countries can be understood in the literature review created by Dada which states that "a major reason for these failures is the mismatch between the current reality and the design of the future e-government system. The chances of failure increase as the gap grows. The problem that often arises with developing countries is that there is frequently a mismatch between the current and future systems due to the large gap in the physical, cultural, economic, and various other contexts between the software designers and the place in which the system is being implemented" (Dada, 2006). This problem can be overcome by understanding the existing integration models and making an informed decision. Therefore, this research will compare the two most complex integration models, horizontal and vertical integration. The subsequent studies will help raise awareness about integration and the appropriate models for specific contexts.

Research Topic

This study is being conducted to compare two integration models of e-government development, the horizontal and vertical integration, to determine the complexity of each model. To do this, this study will use a systematic literature review to collect data about the two models and use the summary of selected articles to answer the research questions.

Research questions

The research method provides the possibility of comparing data collected on both vertical and horizontal integration to determine the integration complexity. According to yourdictionary, (2022), "the definition of a complexity is a difficulty, or a stat of being confusing or complicated" (Complexity Definitions | What does complexity mean? | Best 7 Definitions of Complexity, 2022) Since this research is based on understanding the complexity of the two mentioned integrations models, these research questions below will help achieve that:

- What is the complexity of both vertical and horizontal integration?
- How can the complexity of both vertical and horizontal integration be measured?
- Which of vertical and horizontal integration is more complex than the other?

Research outline

The study is divided into five chapters. The first chapter talks about the topic of the research and details regarding past papers and the current changes and gaps available in the industry. Chapter two is a critical review of previous studies known as an academic literature review on which the whole study idea will be constructed. This chapter consists of relevant theories, case studies, ideas, and concepts that support the topic of the study. These ideas and theories are from the latest journal articles, which provide reflective information about the topic is "The complexity of vertical versus Horizontal Integration of e-Government systems and services." The study will focus on the complexity of the vertical integration and horizontal integration of e-government systems and services. Chapter three is for the research methodology, and this section uses the systematic literature review to select the specific articles that will be important to help answer the research question. The fourth chapter will create a summary of the selected studies from chapter three, enabling us to understand the study's results more effectively. Finally,

based on chapter four findings, the researcher concludes in chapter five with the recommendations for future use.

Background Literature Review

Introduction

With the rise in technological transformation in the economic industry and digitalization, the concept of e-government is also rising all over the world. Governments are also making sure to use information technology and communication technology in their systems to make their processes faster and more satisfactory for their population. The concept is used to increase communication between the government and the public because the increase in public issues and not being able to reach the government easily increase tension among the people, which causes problems for the government. With the help of the internet /web-based network, the government now have access to the public and some issues which used to stay unknown. This facility also gives the public a chance to create a connection with the government and share their social concerns more easily and at any time. The E-government is making sure to provide services to citizens of the country and businesses at any time of the day. It makes an effort to reach out to every person and organization, especially those in rural places. It aspires to operate smoothly across government departments and agencies. It seeks to improve overall effectiveness and efficiency, and it desires to have real-time information at its disposal to make sound judgments (Jayshree & Marthandan, 2010).

The distinction between the three domains of electronically mediated interactions is a prominent approach to conceiving e-government. First, the use of technology to improve the internal efficiency of public bureaucracies, such as the digitization of mundane operations and the quick exchange of information across departments and agencies, is referred to as government-to-government contacts. In most government-to-business transactions, the Internet is used to minimize the costs of buying and selling goods and services from businesses. Finally, the use of the Internet to provide public services and transactions online and enhance the design and delivery of services by including rapid electronic feedback methods such as instant polls, Web surveys, and e-mail are examples of government-to-citizen interactions. This straightforward method of defining e-

government is more challenging; the field is constantly evolving, and a vast "grey literature" of white papers, consultation documents, consultancy reports, corporate brochures, and league tables has sprung up. There are also various national interpretations of the phrase. However, it unquestionably crosses borders with surprising ease, making it one of the most widely adopted public-sector reform ideas in history.

1.1 E-government Stages and their various models

According to the study, e-government is not just one step process or implementation. It is a process that involves various stages. These stages are evolving with time and demand for the system's efficiency. By involving various stages and, in some cases, phases, ensure the e-government systems are effective and fulfil the current period's demands. To make the system of e-government possible several methods have been proposed, which will be discussed below. These methods were introduced by the United Nations, the world bank, the Gartner group, the e-ASEAN task force, and some individuals who researched in this area and came up with their methods like Hiller and Belanger in 2001, Layne and lee in 2001, and Moon in 2002.

The very first model is the World bank three stages model. These three stages are defined as publishing, interaction, and transaction. Publish; Although the design and layout of e-government systems vary greatly, developing countries can often begin the process of e-government by putting government material online, initially with legislation and requirements, paperwork, and applications. Interact; E-government can incorporate citizens in the governance process by allowing them to communicate with officials at all layers of government throughout the policy cycle. Increasing civic involvement helps to increase public trust in government. Transact; governments create platforms for citizens ease to conduct transactions online through websites. This encourages cost-saving, accountability with the help of information logs, and, most importantly, productivity (Jayshree & Marthandan, 2010).

UN's Five stages model was established in 2001. The United Nations and American society for public administration (UNASPA 2001) suggested five stages; emerging presence, enhanced presence, interactive presence, transactional presence, and seamless or fully integrated presence. Emerging presence is the stage where government-initiated

websites provide limited and formal basic information, and enhanced is a more advanced version compared to the first stage. This stage offers a website with updated daily information, which is more dynamic and specialized. The third stage is interactive presence, and here the government is offering a connection to build with its public. These websites become the source of connection as they act as a portal to provide service and create interaction. This level is the more sophisticated level of all. The 4th stage is transactional, and here public has the facility to make a transaction to get formal processes complete like a renewal of passport or visa, making national identity card, etc. the last stage Is fully integrated presence, this involves one website for all processes which can also be known as a universal website (Jayshree & Marthandan, 2010).

Gartner's four-stage model is about web presence, interaction, transaction, and transformation. Starting from the basic website with limited information, the next stage involves interaction between the government and the public to solve general issues in their locality. The third stage involves at home facilities for the public, which involves payments like id cards, passports, etc. in the fourth stage, transformational comes in, which means the government is reconsidering its function and making it more enhanced and efficient in the area of e-government. This also talks about integration on all levels, whether it is integration in the website or the government process (Jayshree & Marthandan, 2010).

Deloitte's six-stage model consists of six stages named information publishing/dissemination, official two-wat transaction, multi-purpose portals, portal personalization, clustering of common services, and full integration and enterprise transaction. This model starts with the government welcoming the public with information and access to that information; in a two-way method, agencies are involved in creating a connection between two parties (government and public). For example, electronic signatures are needed when opening a bank account, and here comes the agency providing the service. The multi-purpose portal is about one-stop for various services, including multiple departments. The fourth unique step here is customizing the portal, and this is the step for the public who has the facility to customize it according to their needs and desires. Clustering of common services is about enhancing the processes and collaborations and making sure to reduce third parties for processes in order t provide

unified service. Lastly, full integration is a complete one-stop portal to provide integrated information for all kinds of public needs (Jayshree & Marthandan, 2010).

Layne and Lee's model is known as an evolutionary phenomenon. First, these stages involve a catalogue delivering basic information, and the transaction involves online transactions for various services. Second, vertical integration is all about transformation rather than automating the government processes. Third, the integration is about government functions on different levels like local government. Lastly, horizontal integration is about the integration of government functions from different areas and systems of government to provide unified service (Jayshree & Marthandan, 2010).

According to (Sun et al., 2015), the e-Government concept outlines how governments collaborate, exchange information, and provide solutions to internal and external stakeholders. It uses information and communication technologies (ICTs) to enhance interactions with residents and businesses and across government institutions. As a result, decreased corruption, greater openness, increased flexibility, more significant income, and lower expenses could be advantages. E-Government 2.0 now refers to user-oriented portal services incorporated into and supplied through a single portal site using Web 2.0 technologies such as RSS, blogs, social networking sites, and others and are available through a range of sources. Building E-Government 2.0, on the other hand, is difficult since the shift from E-Government to E-Government 2.0 should be a process of organizational integration, not just a technological one. To provide more productive and better operations, the governments are now starting to focus on the bigger and more comprehensive challenge of innovativeness. However, according to (Al-Khouri, 2011), despite significant investment in e-government systems worldwide, such projects have yet to satisfy promises and anticipated objectives fully.

In another study (Alshehri & Drew, 2011), despite their variation in the number and nomenclature of suggested stages, these stages share many similarities. For example, despite the various labels given to it, providing government information is usually viewed as a first step toward establishing e-government (i.e., publish, cataloguing, presence, emerging, and information publishing). Another usual step is when all payments are completed online. This stage is also known as transacting, financial, and transaction. Furthermore, as observed in the (United Nations Division for Public Economics and

Public Administration, 2001; Gartner Research, 2003; Center for Democracy and Technology, 2002) models, two-way interaction between government and other stakeholders is a typical later stage. Although tacitly, Layne and Lee (2001) also mention this level when they declare that individuals can communicate with the government digitally in their transaction stage.

However, there are some distinctions between these approaches. For example, the United Nations Division for Public Economics and Public Administration (2001) only mentions an upgraded stage, which aims to expand the number of websites and the updating process. As a result, it concentrates solely on the expansion of e-government websites during this stage of development. This illustrates the significance of the internet in the establishment of e-government. According to Layne and Lee (2001), integration is divided into vertical and horizontal stages. In the vertical stage, regional, state, and federal governments are linked for various government operations or facilities, so people can access services at higher levels of government (state and federal) from the duplicate entry as the municipal portal because local systems are directly linked to upper-level structures. However, "systems are interconnected across multiple resources and activities" at the horizontal stage. For example, if a citizen conducts a business in one government department, an automatic check against data maintained in other government departments will be performed (Layne & Lee, 2001). There is no set number of stages of e-government because it varies from one researcher to the next and, apparently, from one nation to the next for a range of technical, societal, organizational, economic, and political purposes. What can be determined is that e-government is a multi-stage or phased development method rather than a one-step one (Alshehri & Drew, 2011).

Challenges

Numerous obstacles and barriers can stymie e-government implementation. The variety and complexity of e-government efforts around the world indicate a wide range of obstacles and constraints to their implementation and administration. Based on a survey of existing research, this section will quickly explain the most essential and prevalent obstacles and barriers. Some of the barriers that the researcher will be discussing are technical, ICT infrastructure barriers, privacy issues, security problems, Organizational

Barriers, Top management support, Resistance to change, problem in collaborations, social, cultural, digital gaps, and financial issues.

Technical barriers

Implementation of e-government is not considered an easy and fast solution because, for it to work smoothly, it is important to have an integrated setup and technical barriers or difficulties arrive here. Some of the technological challenges such as a lack of agreed standards and comparable infrastructure among departments and agencies. Furthermore, citizen worries about confidentiality are significant impediments to the introduction of e-government. A government guarantee will not work unless complemented by technology solutions, operational transparency, and independent monitoring.

ICT Infrastructure

One of the most significant challenges for e-government deployment is a lack of or insufficiency in ICT infrastructure. Internetworking is required for appropriate information interchange, establishing new contact points, and delivering new solutions. For the transition to e-government systems, a technological and operational architecture is necessary, i.e., a guiding set of concepts, paradigms, and rules. Having a digital literacy gap is one of the reasons many developing countries are unable to implement the e-government system. In order to use and benefit from e-government implementations, people must also have e-readiness and ICT literacy. For efficient e-government, education, freedom, and a willingness to access information are all required. It is assumed that the higher the level of social progress, the more likely citizens will embrace and use e-government services. As a result, governments and businesses should work together to establish a modern infrastructure that will allow disparate groups and individuals to connect. Infrastructure is one of the primary roadblocks to e-government implementation.

Privacy issues

In both developed and developing countries, confidentiality is a significant concern when it comes to e-government deployment. According to Layne and Lee (2001), privacy and secrecy are significant roadblocks to e-government development. When dealing with the privacy issue in the context of e-government, both technical and policy remedies may be necessary. The challenge of maintaining individual privacy can be a significant impediment to the introduction of e-government. Furthermore, to boost citizens' faith in

the usage of e-government programs, it is necessary to deal appropriately with privacy issues in e-networks. Successful e-government programs demand citizen trust in the confidentiality and cautious treatment of any sensitive information supplied by government organizations. Because privacy precautions are difficult to apply after an e-system has been built, privacy considerations must be integrated into e-government system planning and design. A comprehensive privacy policy should define citizens' privacy rights and ensure that personal data be collected and used only for lawful purposes. It is critical to remember that different countries have distinct legal and cultural meanings of privacy. This emphasizes the necessity of the section on information security that follows.

Security problems

According to numerous research, one of the most significant impediments is security. Security refers to the protection of all information and systems from unauthorized access, alteration, or destruction. Thus, it relates to protecting information systems and assets and the control of information access. Furthermore, it is a necessary component of the citizen-government relationship of trust. Therefore, security issues may be a major hindrance to the development of e-government services. As a result, resolving these concerns requires security guidelines and norms that are in line with community expectations (Sharma & Gupta, 2003). In order to achieve security objectives in e-government implementations, Smith (2002) emphasized the importance of using cybersecurity such as digital signatures, encoding, user names, passwords, unique customer figures, bank account numbers, and others transmitted over the internet stored electronically. Furthermore, information security, often known as cyber security or computer security, is a major e-government risk, according to Seifert and Bonham (2004).

Organizational barriers

The deployment of e-government is more of an organizational issue than a technical one. The organization's issues include
- lack of senior management support,
- opposition to transition to electronic methods,
- lack of cross-sector and cross-departmental collaboration, and
- a shortage of skilled staff and training.

E-government, in addition, means reducing the human force in performing tasks more rapidly because which organization and its employees might resist its implementations. For example, some employee might lose their job because of minimizing the operations or steps in fulfilling tasks and orders of the government.

Lack of top management support

The government's leaders and top management support are required to implement e-government successfully. Top management support refers to leaders' promises to welcome, promote, and use e-government devices and techniques. As a result, it is crucial for e-government adoption and execution. Leadership is critical for e-government deployment since it is one of the most crucial driving elements behind any new and creative project or attempt. The involvement of high-level executives and operatives is vital to the growth of e-government, the acquisition of required resources and training, and the cooperation and coordination between partners and stakeholders for the success of e-government implementation.

Resistance to change

Workers and also the public are settled and immune to the old process that when it comes to change in process or system, they show resistance towards it as it will require them to learn a new system, steps, process and procedures in order to get things done when it comes to government. Though educated people require more ease, and when it comes to them, they show less resistance than the people who are older and feel frustrated towards learning more technical things. According to (Alshehri & Drew, 2011), e-government is a new occurrence in many locations, and it refers to the transition from manual to electronic work methods in the workplace. These modifications will generate a new advanced environment that will be radically different from what has been employed in government agencies for many years. Many employees regard the deployment of e-government as a danger to their jobs, and they are afraid of losing their jobs and influence. Employees must comprehend the importance and significance of e-government systems and be assured that their jobs are not in jeopardy to reduce resistance to e-government systems. Employees might be reassigned to new roles through retraining and skill development. Furthermore, it is critical that e-government leaders identify opposition areas and devise a strategy for dealing with them.

Problem in collaborations

To achieve a successful e-government system, collaboration and cooperation between all partners or stakeholders are vital to the implementation process. Importance of public-private sector collaboration in providing resources, strategies, skills, and experiences that the government might not otherwise have. All sectors should be encouraged to participate in the implementation and growth of e-government.

Social

The use of e-government technologies by a wide range of people is crucial to social issues. This indicates that the interface must be helpful to all branches of administration, including the general public. Many variables contribute to social barriers, including the digital divide, culture, education, and wealth.

Cultural

The biggest impediments to e-government adoption are technological and based on the cultural implications of new technologies (Feng, 2003). The culture was defined as a set of fundamental assumptions, ideas, and values shared by all members of a society (Sathe,1983). This suggests that any change that runs counter to societal norms is more likely to face criticism. "Culture is difficult to examine partly because it is not an easy notion to describe," writes Davison and Martinson (2003). Individual behaviour patterns and cultural variables influence the acceptance and use of new technology (West, 2001). Chang (2002) distinguishes several cultural variables, including social structure, education, language, religion, economic philosophy, and political philosophy. Swartz (2003) discovered that cultural factors had hampered the acceptability and deployment of e-government systems in various developed countries such as the United Kingdom and Japan. However, because a cultural issue is not clearly visible, it requires additional planning in order for technical change to be executed successfully (Weisinger & Trauth, 2003). This means that e-government acceptability will only begin to gain traction if offered in a culturally appropriate manner. Adoption may necessitate constant yet moderate persuasion to integrate innovation into a culture and raise public awareness of its importance.

Digital gap

The digital divide pertains to the disparity in chance between those who have an internet connection and those who do not. Those who do not have internet connectivity will be unable to use e-government products. Thus, the digital divide is defined as "the gap between those who have access to computers and the internet and those who do not" (Allen, 2022). As a result, not everyone has appropriate access to computers and the internet, whether due to a lack of funds, requisite skills, or internet connectivity. Making computers available in public places like libraries, post offices, and shopping malls could help bridge the digital gap. The most significant impediment to the development of e-government was deemed to be a lack of internet connection in society.

Financial issues

According to Moon (2002), a significant barrier to the introduction of e-government in many nations is a lack of financial backing. To fulfil the goals, it is vital to assure the availability of present and anticipated financial resources. The most serious and important hurdle to e-government adoption is a shortage of funds; e-government deployment is costly. Because every government budget is currently overburdened with every potential expense that budgetary writers can fit into it, the idea of spending the significant sums that excellent e-government will cost is a non-starter, both in fiscal terms and in budgetary politics (OECD, 2003). According to Carvin et al. (2004), many countries struggle to support e-government initiatives due to the increasing price of computer system deployment and maintenance, even when a government body has a plan for successful and available e-government. According to Feng (2003), a key impediment to e-government, particularly in developing nations, is a shortage of cash for capital investment in new technologies. According to West (2001), Budget constraints limit government agencies' ability to provide services online and employ technology for democratic accessibility. Finally, the entire cost, which includes the high cost of system hardware and maintenance, software, training, and education, is always viewed as a key impediment to agencies and governments adopting the technology.

Advantages

For both rich and developing countries, the advantages and benefits of implementing e-government are the same (Ndou, 2004). On the other hand, it benefits e-government apps

for citizens, corporations, and government agencies in a variety of ways. People, businesses, and government sectors can use e-government applications to access available government information 24 hours a day, seven days a week, improving these services' quality (Ndou, 2004). According to Seifert (2003), E-government deployment will lower costs and components of organizational procedures by simplifying and restructuring operating systems. Furthermore, the use of e-government technology will improve the performance of the government agencies and will provide effective and efficient public service to all clients (Rubin & Wang, 2004). Furthermore, according to Cohen and William (2002), e-government provides numerous advantages for reducing and improving government service operations, including efficiency, lower transactional costs, enhanced transparency, and increased citizen services. Furthermore, the Australian Government Information Management Office (AGIMO), formerly known as the National Office for the Information Economy (NOIE), defines e-government benefits as follows:

- Individuals' and enterprises' time, effort, and expenditures are reduced
- Improved service delivery and citizen satisfaction; increased ICT skills, internet knowledge, and computer usage among users; and the establishment of new business and employment prospects. Furthermore, the organization for economic cooperation and development (OECD, 2003) noted a number of benefits of e-government deployment, including the following:
- Enhances government organizations' data processing efficiency • improves services by gaining a deeper understanding of consumers' needs, resulting in seamless online services
- Aids a government's economic policy goals by promoting increases in productivity inherent in ICT and e-commerce
- Improves transparency and accuracy, and facilitates information transformation between government and customers by sharing information and ideas across all government agencies and departments to create one mega database
- By utilizing internet-based tactics to engage citizens in the policy process, demonstrating government openness and accountability aids in the development of trust between governments and citizens, which is a critical component of good governance.

Methodology: Systematic Literature Review

The scientific method adopted in this research to answer questions posed in chapter one is Systematic Literature Review (SLR). SLR is a way of finding, analyzing, and drawing insights from research publications relevant to answering questions or building facts concerning a topic of interest. Adopting this methodology aims to build a research case based on previous credible work without bias, which is adjudged to be trustworthy.

To perform the SLR with absolute clarity, this section adopts the processes in an article by Kitchenham (2007) called "guidelines for performing systematic literature reviews in software engineering" as a guide to conduct the review. This research will use the five stages below to adequately find the required data that chapter four of this research will use to answer the research questions:

1. Search strategy: This helps to include search terms, selected databases to search from, and the search result.

2. Study selection criteria: This determines which of the studies to remove and how the studies will be processed for further assessment.

3. Quality assessment to develop a checklist that determines the overall quality of the studies.

4. Data extraction: is the method chosen to extract information from the chosen studies.

5. Data synthesis: the results from the review process and analysis.

Search strategy

The review process begins with a search for materials to be analyzed. The reason for having a search strategy is to identify preliminary keywords from the research questions presented, create variations of certain terms, and create a combination of the keywords that are likely to be contained in a review. Then, the research creates a search string to apply in advanced search using Boolean operators. The strategy served as a guide to properly execute and document these steps, following Kitchenham (2007) guideline.

The researcher explains the processes below.

Search terms

The search terms adopted in the systematic review were derived from the identified research questions from chapter one. The researcher identified synonyms of the keywords selected, such as "complexity". Also, with a preliminary Google search, The researcher discovered that several research papers used terms like vertical 'process' integration, which made us expand the search string with the keyphrase "horizontal process integration" and "vertical process integration". The researcher dropped these phrases after discovering that it significantly dilutes the quality of search results generated. Finally, the researcher used the key terms generated to look for relevant research articles, focusing primarily on Scopus, and Google Scholar.

The researcher also followed the guidelines provided by Kitchenham (2007) to construct the search string. The steps the researcher took are highlighted below:

1. Identify search terms based on research questions.
2. Search previous studies for synonyms of search terms and reshuffle terms based on the search result quality.
3. Link search terms with their synonyms by using the Boolean "AND" and "OR".

The table below contains a list of all primary and secondary keywords the researcher identified and the corresponding search string.

Primary Search Keywords	Vertical integration, horizontal integration, e-governance systems.
Secondary Search Terminology	Complexity, measurement, models, difficulties, development, data, process, e-government.
Search String	("Vertical integration" OR "horizontal integration" OR "e-governance systems") AND ("complexity" OR "measurement" OR "models" OR "difficulties" OR "development" OR "process" OR "e-government")

Table 1. Search keywords and search string identified

Databases

After creating the search string, it was used to search for relevant articles in two academic databases (Scopus and Google Scholar). There was no restriction to the publication year of each study as the research aims to understand the complexity or disparities between vertical and horizontal integration of e-government systems and services. Therefore, the researcher began to review each study that explains the necessity of the model of integrating functional e-government systems and services.

While the researcher were able to filter through the Scopus database because of its advanced search feature, filtering irrelevant materials on Google scholar was quite challenging. Nevertheless, the number of articles from the search result is 30,320. The breakdown of the numbers is shown below:

Academic Database	Number of Documents
Scopus	10,720
Google Scholar	19,600

Table 2. The results of the search by database

Study Selection

To ensure the relevance of the articles found to the research questions, The first ten pages of each of the databases were manually previewed on each of the databases (200 articles in all). It was discovered that some of the articles had the search keywords selected but did not relate to the subject of e-governance. Through the advanced search on Scopus, the researcher was able to narrow down the result considerably. Unfortunately, Google Scholar did not have this feature, so the researcher resorted to tweaking our search string by selecting articles that had "horizontal integration" or "vertical integration" but must contain e-governance. Hence, the researcher narrowed the search down to articles relating to e-governance alone. A total of 3,860 articles: 3,792 articles from Scopus and 68 articles from Google scholar.

Selection Phase 1: Inclusion Criteria

The next process was the selection process to determine the more relevant articles for analysis. This was done by independently reviewing each article based on the criteria listed in table 3 below. The primary selection criteria had sets of inclusion and exclusion criteria defined. A total of 172 articles fit this criterion and were used for the primary study.

Criteria ID	Defined Criteria
IC1	The article describes vertical and horizontal integration in relation to e-governance
IC2	The article explains the complexity involved in both vertical and horizontal integration processes
IC3	The article references point to more work that can contribute to existing knowledge
IC4	The article provide further knowledge about vertical and horizontal integration in e-governance
IC5	The article suggests alternatives to horizontal and vertical integration

Table 3. Defined search inclusion criteria

Selection Phase 2: Quality Check Criteria

To further validate the quality of the materials selected for thematic analysis (to be discussed in the next chapter) after using the inclusion criteria, it is necessary to check the quality of the research according to the guidelines for performing a systematic literature review used in this methodology (Kitchenham, 2007). After the quality assessment criteria, 8 articles were selected for the next review phase. The criteria selected for the quality check are in the table below.

Criteria ID	Quality check criteria
QCID1	Is the research purpose clearly stated?
QCID2	Does the research clearly explain the concept of horizontal integration and vertical integration?

QCID3	Are the definitions of horizontal and vertical integration consistent in the documents?	
QCID4	Does the research indicate other e-governance models and systems?	
QCID5	Was the outcome of the research reasonable when compared with the research framework?	

Table 4. Defined search inclusion criteria

Quality assessment

This phase intends to determine the relevance of selected studies while limiting bias in the study selection process. In this phase, the assessment was made by answering the questions presented in Table 4. For each article, specific choice answers 'Yes', 'Maybe', or 'No' were assigned weights of 1, 0.5 and 0, respectively. Each question in table 4 above was answered for each of the 8 articles and then added to obtain a weighted sum. The studies that scored 2.5 and above were selected for data synthesis. Table 5 presents the weighted sum of the remaining 8 primary studies that met the quality assessment criteria. Table 6 presents the titles of the studies and the publication types.

Article ID	QC1	QC2	QC3	QC4	QC5	Total Score	Selection ID
PS3	1	1	1	1	1	5	S1
PS12	1	0.5	1	1	1	4.5	S2
PS33	1	0	1	1	1	4	S3
PS58	1	0.5	1	1	1	4.5	S4
PS93	1	0	1	1	1	4	S5
PS107	1	1	1	1	1	5	S6
PS148	1	1	1	1	1	5	S7
PS160	1	1	1	1	1	5	S8

Table 5. The quality score of selected articles

Selection ID	Document Title	Publication Type
S1	E-government: a strategic operations management framework for service delivery	Journal Article
S2	Monitoring Methods of e-Governance Development Assessment: Comparative Analysis of International and Russian Experience	Conference Paper
S3	Study on the design of port logistics information platform	Conference Paper
S4	A Three-Dimensional Model for E-Government Development with Cases in China's Regional E-Government Practice and Experience	Conference Paper
S5	Sixty Years of Development of E-governance in India (1947-2007): Are There Lessons for Developing Countries?	Conference Paper
S6	Comparison of popular e-government implementation models	Conference Paper
S7	E-Government Research: A Review via the Lens of Structuration Theory	PhD Thesis
S8	e-Government Maturity Model Based on Systematic Review and Meta-Ethnography Approach	Journal Article

Table 6. Final selected articles

Data Extraction

The process of data extraction is to highlight the contributors and other information regarding the selected articles in the synthesis. Some pieces of information such as article title and publication type are highlighted in Table 6, while others are highlighted in table 7 below.

Extracted Data Item	Item Description
Document titles	See Table 6

Author(s)	See Chapter 4
Year	See Chapter 4
Publication title	See references
Publication type	See Table 6
Source/publisher	See references
Contribution	See Chapter 4

Table 7. Data extracted from selected documents

Data Synthesis

This phase is to provide a summarized report of the contribution of selected articles in answering the research questions postulated in chapter one. It will discuss this in detail in the next chapter, where the researcher run a thematic analysis, a method of recognizing patterns (or themes) in a stack of data (Braun & Clarke, 2006).

Summary of Selected Studies

Affisco J. F. et al., (2006)

This article proposed a framework for the more strategic execution of e-governance. It explored different e-government models and posits that they are not advanced enough for fast and efficient execution. The framework is built as an extension of Heskett's work in improving service delivery in e-governance. The framework is a culmination of seven building blocks - four basic elements being *market segmentation*, *service mode development*, *operations to strategy redesign*, and *service delivery*, and three integrative elements: *differentiation*, leverage of value and alignment of strategy and system.

The authors believe that owing to the resource scarcity available to governments, the ever-increasing internet adaptation by citizens, the existing relationship between different levels of government and the organizational history of the job, and there must be a more strategic way to think about the implementation of e-governance. Their proposed model is shown in Figure 1 below, and each level is described in Table 8. Finally, it concludes that the success of this model can be measured through customer loyalty.
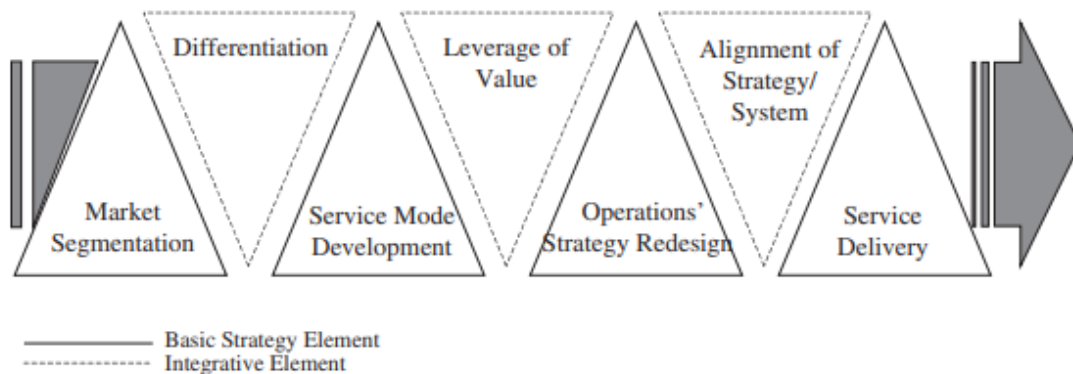

Figure 1. The seven stages of the proposed strategic operations management framework

Stage	Description
Market Segmentation	The framework begins with identifying the different target segments in the e-government service delivery, which are Government to Business (G2B), Government to Consumer (G2C), and Government to Government (G2G). Governmental relations with its employees are also considered to be under the G2G segment. The researchers argued that though other models considered clients, there are clear differences in the interactions with each target segment.
Differentiation	This involves creating a differentiating strategy for e-government operations. It sends a signal of commitment and a consumer-first mentality to the target market. The differentiating factors could range from allowing remote access, offering services round-the-clock, removing bureaucracy, and creating a unified service channel.
Service Mode Development	This stage is the summary of other e-government models posited by Baum and DiMaio (2001), Balutis (2001a), and Layne and Lee (2001). It summarized this stage in four forms: publishing, interacting, transacting, or transformation. While publishing, interacting and transacting are customer-facing forms that involve interfacing with clients, transformation is the inherent implementation of restructured operational strategy in government operations internally.
Leverage of Value	Leveraging value comes off the back of service mode development as the stage where government operations are finetuned to accommodate eventual progress. It could begin with making available online information that would normally be delivered by paper and end with expanding their services for increased traffic on their websites.
Operations Strategy Redesign	This involves retraining and reorientation of government operations personnel at all levels to align with the new reality of the e-government system.
Alignment of Strategy/System	At this stage, communication of the value of the e-government model is communicated to the target market.

Service Delivery	This is the point of implementation or delivery of service.

Table 8. The proposed strategic operations management framework is explained

Bershadskaya L. et al., (2012)

This article did comparative research on the qualitative and quantitative themes of the United Nation's e-government index. The result was that however detailed the models are, some countries of the world face challenges in the implementation of e-governance. The authors believe that to implement e-governance correctly, and there needs to be expert consultation to find solutions to varying challenges that the models cannot solve.

Using Russia as a case study, the researchers surveyed the impact of current e-government models, and the underlying issues found. The respondents proposed a solution, all highlighted in Figure 2. They concluded that in adequately evaluating the position of e-government practices in a country, expert opinions forming qualitative and quantitative data should be adopted.

No	Issue	Solution
1	Unachievable deadlines for goals (3,8 points)	▪ Targeting must comply with the SMART criteria (Specific, Measurable, Achievable, Realistic, Timely)
2	Lack of e-legislation development coordination (3,8 points)	▪ The need to create a separate authority with responsibility for e-government and information society development and regulatory base formation
3	The practice of e-government development doesn't match development standards of large information systems (3,7 points)	▪ Coordinated, coherent and consistent state policy conducting with vertically integrated control system ▪ 4 major components of online service providing standardization on the base of e-government architecture ▪ Usage of positive international experience

Figure 2. Proposed solutions to e-government problems in Russia

Wang L. et al., (2009)

This research sought to solve the lingering logistics problem by creating an integrated system comprising horizontal and vertical integration models with supply chain management principles. Horizontal integration of different platforms involves sharing all relevant information between the ports, thereby promoting business cooperation. Layered on this is the vertical integration of the various systems across geographical differences to provide the services for the cooperative ports to achieve multidirectional cooperation. The researchers believe that because of the complexity of China's port system, connecting all aspects from financial, cargo, e-port and e-government systems to the professional logistics platform could form the base of a modern logistics system.

Chen J. et al., (2011)

This study proposed a 3-dimensional e-government model (see Figure 3) to enhance the development of e-government, based on the knowledge of the previous models proposed by Layne and Lee (2001), Wescott (2001), and the United Nations (2001).

Based on a 10-year experience studying the e-government system across different regions in China, the proposed model comprises catalogue, transaction and vertical integration. In addition, the researcher considered the three main factors that determine the effectiveness of e-governance: the current level of implementation of e-governance, the level of functionality and adoption of the e-government systems, and the strength of the deployed e-government systems.
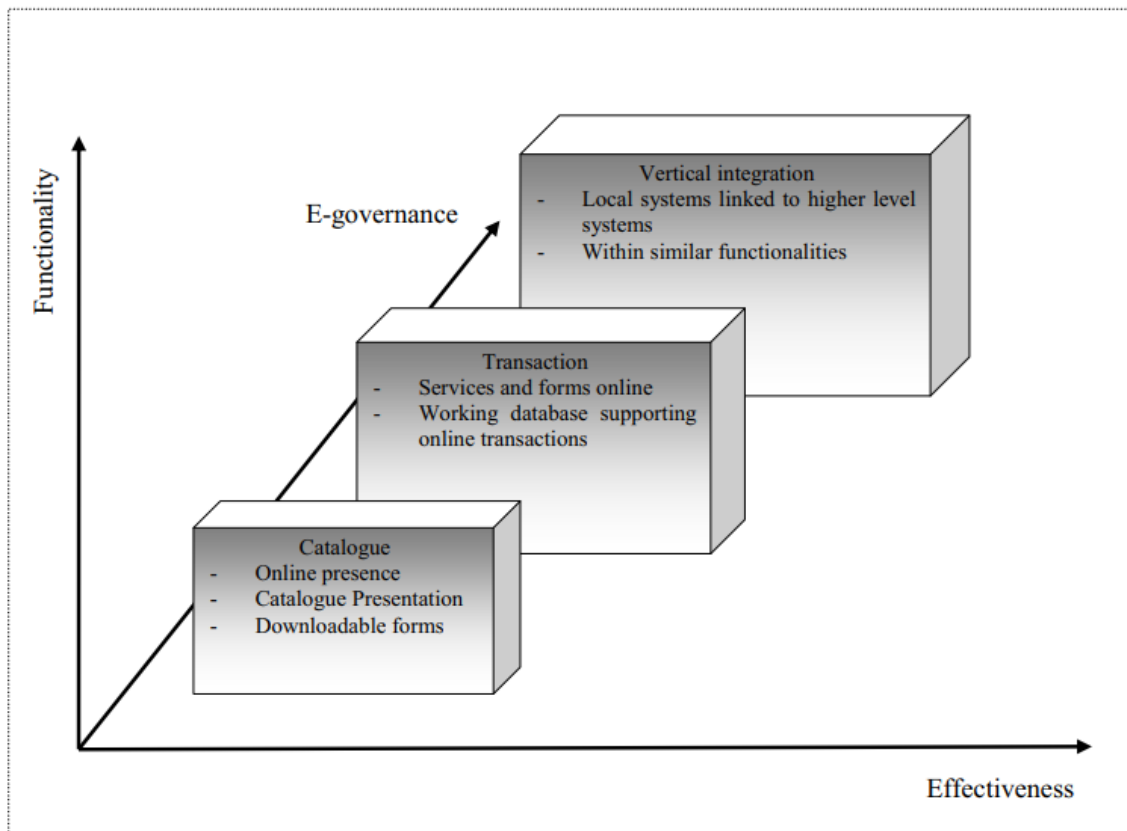
Figure 3. Proposed 3-Dimensional e-government system proposed by Chen J., et al. (2011)

Abdullah M. S. et al., (2011)

This paper posited that the different e-government models have conflicting stages at different levels of implementation and proposes four comprehensive stages of e-government implementation. It compares the United Nations five-stage model, Gartner's four-stage model, Hiller and Belanger's five-stage model, and Asia Pacific's six-stage model (see the comparison in Figure 4). The researchers proposed a 4-stage e-government model, which is deemed effective in government implementation. The model includes; information spread, effective 2-way communication, systems integration and e-democracy where the core government functions like voting, public polls and public forums are done electronically.

Models	Setup		Initial		Intermediate		Advance	
	Emerging and Information Dissemination		Two-way Communication		Integration		E-democracy	
Layne and Lee's Model		Cataloguing		Transaction	Vertical integration Horizontal integration	Full integration		
UN's Model	Emerging web presence	Enhanced web presence	Interactive web presence	Transactional web presence		Seamless/ Networked web presence		
Gartner's Model		Information	Interaction	Transaction		Integration		
Hiller and Belanger's Model		Information dissemination	Two-way communication	financial transaction	Vertical and horizontal integration		Participation	
Asia Pacific's Model	Setting up an email system and internal network	Enabling inter-organizational and public access to information	Allowing two-way communication	Allowing exchange of value			Digital democracy	Joined-up government

Figure 4. A comparison of 4 existing e-government models

Heinze N. and Qing H. (2005)

This research viewed e-government models through the lens of the Structuration Theory. It opined that existing research focused a lot on the technological and strategic perspectives without taking into account the social and organizational dynamics of the people. Therefore, the researchers evaluate the three-way relationship between technology, government and the people (as seen in Figure 5), taking into cognizance the positive and negative impact of the theory on the operations of the system (see Figure 6). They conclude that while more research on e-governance is beneficial, it is imperative to consider the negative impact on the relationship between technology, the government and the people.
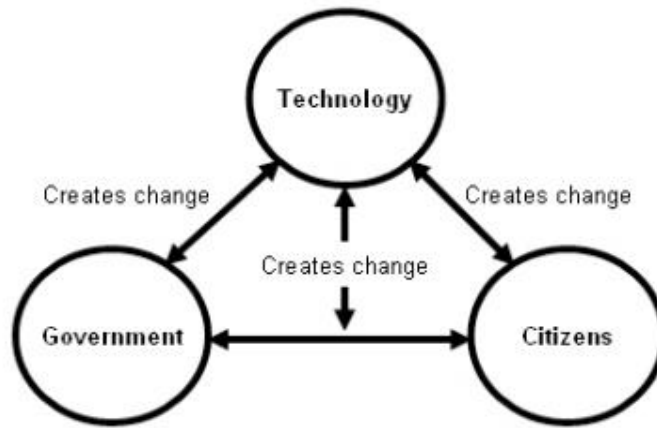
Figure 5. The 3-way relationship that e-government systems create

Technology	Activities and Actions Enabled	Unintended Consequences
Government web sites and portals	Citizen access to information and services: • Tax filing (Wang 2002) • Access to government information (Cullen and Houghton, 2000) • Vehicle registration (Allen et al. 2001) • Business license application and renewal (Layne and Lee, 2002)	• Identity theft (Jaeger 2003) • Illegal use of citizen information (Jaeger 2003) • Privacy violations (Friedman 2000)
	• B2B transactions (Devadoss et al., 2002)	• Private-public conflict (Heeks 2003) • Narrowed field of possible business partners • Standardization problems
	• Online voting (O'Looney 2000)	• Voting fraud and tampering (Zetter 2003) • Voting problems due to system blackout • Shift in the balance of political power • Digital divide expansion (Edmiston 2003)
Government databases	• Quicker search times (Allen et al. 2001) • Increased collaboration among government agencies (Layne and Lee, 2002) • Increased safety (Dean 1999) • Improved medical care (Orentlicher and Healy 1998)	• Identity theft (Jaeger 2003) • Illegal use of citizen information (Jaeger 2003) • Privacy violations (Friedman 2000)
Voter databases	• More personalized campaign marketing (Onselen and Errington, 2004)	• Privacy concerns (Onselen and Errington, 2004) • Increased spam
Political web sites	• Citizen access to information (Bowers-Brown and Gunter, 2002) • Increased citizen political involvement (Gibson and Ward, 2000)	• Digital divide expansion (Edmiston 2003) • Technology-influenced voting choices (Bowers-Brown and Gunter, 2002)
RFID	• Tracking student location and class attendance (Sullivan 2004) • Verifying government employees (Strickland and Hunt, 2005)	• Privacy violations (Strickland and Hunt, 2005) • System abuse (Strickland and Hunt, 2005)
GPS	• Tracking terrorist activity (McCullagh 2003) • Crime prevention (Crouch 2001)	• Privacy violations (McCullagh 2003)

Figure 6. Structuration Theory highlighting the negative impact of e-government models

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Napitupulu D. (2016)

The research sampled 111 maturity stages in e-government implementation from 25 different methods and applied for a systematic review with Meta-Ethnography qualitative approach. This resulted in a 7-stage model which comprises web presence, interaction, transaction, vertical integration, horizontal integration, full integration, and open participation (details in Table 9). They conclude that this model encompasses the 111 stages proposed by the 25 models analyzed.

S/N	Stage	Description
1	Web presence	Open display of governmental information online
2	Interaction	Electronic copies of information are disseminated in form of e-mails, e-journals, and search portals
3	Transaction	Government enables electronic transaction channels for citizens to pay bills and taxes online seamlessly
4	Vertical Integration	Data information shared between different levels of the government
5	Horizontal Integration	Database connectivity between different agencies with parallel functions
6	Full Integration	All government functions are connected through a single portal
7	Open Participation	Public involvement in policymaking and government participation, such as e-voting.

Table 9. 7-Stage Maturity Model from Meta-Ethnography Analysis

Sedek K. A. et al., (2011)

This paper studied the architecture of current e-government portals to learn how to improve e-government portals, especially in terms of interoperability. It investigated the architectural style, quality indicators, and outcomes toward higher interoperability levels using Systematic Literature Review (SLR). The researchers opined that instead of research improving on existing systems whose architecture does not support other systems, the focus should be on the ability to connect different e-government models to become interoperable.

Discussion

Based on the summaries of all the selected articles, the goal is to propose answers to the research questions posed in chapter one.

RQ1: What is the complexity of both vertical and horizontal integration?

Obviously, e-government adaptation and implementation differ from one government to the other. Therefore, the level of complexity of horizontal and vertical integration may differ. However, based on the previous research from the selected documents, both are essential beyond their inherent models proposed by Layne and Lee (2001). The complexity of both integration stages is dependent on the change management strategy adopted by the government and the level of adoption/training of the government personnel.

RQ2: How can the complexity of both vertical and horizontal integration be measured?

It is difficult to measure the complexity of vertical integration and horizontal integration in isolation as it is hugely dependent on the level of implementation. However, there are indicators to measure its success or failure once implemented. Some of them are Employee readiness assessment results, employee buy-in and engagement levels, usage level, and the duration of integration.

RQ3: Which vertical integration or horizontal integration is more complex?

While vertical integration is between different hierarchies of government, horizontal integration is cross-agency. There is a level of cooperation between different levels of government (depending on the system of government) that may ease the process of vertical integration, especially from the top tier of government to the bottom tier. However, with cross-agency integration, it is dependent on several factors, as pointed out in summary (see sections 4.4 and 4.5). Also, the interoperability of the existing systems in the agencies will determine the complexity of horizontal integration (see section 4.8). Therefore, vertical integration can be easier to implement than horizontal integration.

Conclusion and Recommendations

As it is stated earlier, the process of e-government system implementation may be daunting and rigorous due to the complexity of the process, this research has shown that the complexity is not peculiar to vertical integration and horizontal integration. It spreads throughout the entire process and to other models as well. As Heinze N. and Qing H. (2005) stated, there is a three-way relationship between technology, government and the people, which is a complex relationship. This relationship is inherent across all e-government models, including the process of vertical integration and horizontal integration as posed by Layne and Lee (2001).

One of the vital lessons learnt from this research is the implementation of e-government models requires a change management process. It would be interesting to further research the change management processes involved in the implementation of different e-government models, the complexities involved and the effects of the process in the implementation as a whole. Also building on the knowledge of this research, further research should be done to assess the level of complexity of Layne and Lee's five-stage model in different regions where it is applied, the factors causing these complexities and how they can be abated.

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