# Electronic government: A development model for Papua New Guinea

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## Abstract

E-government is seen to be providing a way for governments to transform their operational activities to serve their clients more efficiently. With advances in Information and Communication Technology (ICT), it is now time to implement electronic access to government services to the variously located citizens of Papua New Guinea (PNG). In order to do this, this paper examines present models and finds them less than satisfactory to guide e-government implementation in PNG. It proposes a hybrid model from various authors who have tried to model the implementation of e-government. A major factor perceived to be missing for application of these models in PNG is a consideration of a national ICT infrastructure and promotion, awareness and training for e-government. This paper proposes two further stages to the model, examines the national infrastructure and indicates a possible network model. The proposed model could also be used to measure the extent of e-government and, combined with adaptive approaches to systems development; used for effective planning and development.

Key words: clients, electronic government (e-government), information and communication technology (ICT), e-government services, e-services, model, access centre, telecentre

#### Introduction

E-government is seen to be providing a way for governments to transform their operational activities to serve their clients more efficiently (Alshihi, 2006). However, there are issues and challenges to address that arise when adopting e-government initiatives (Layne & Lee, 2001). Those countries which have embraced e-government have used a stage model in their planning and implementation. Some countries have used models proposed by various authors whilst others have used their own models adapted from those found in the literature.

With advances in ICT, it is now time to implement electronic access to government services to the variously located citizens of PNG. In order to do this, this paper examines present models found in the literature. It finds these models less than satisfactory to guide e-government implementation in PNG. This paper proposes a hybrid model from various authors who have tried to model the development and growth of e-government.

A major factor perceived to be missing for the application of these models in PNG is a consideration of a national ICT infrastructure and promotion, awareness and training relating to e-government. To this end, this paper proposes two further stages to the models, examines the national infrastructure and indicates a possible network model. It also discusses how adaptive approaches to systems development can be combined with this proposed model.

# **Development models for e-government**

Various models for the development and growth of e-government have been discussed (Bwalya, 2011; Chandler & Emanuels, 2002; Deloitte, 2001; Hiller & Belanger, 2001; Layne & Lee, 2001; Moon, 2002; UN, 2014; Wescott, 2001). Some models have the same number of stages while others differ. Some models have stages with similar elements while others differ in relation to technological, organisational and environmental perspectives (Daniel, 2014).

Some of these models are discussed below. These models have been proposed by various authors and seek to divide the development and growth of egovernment into various stages based on their degree of technological integration within the government organisation and perceived level of service they provide. They start from a basic form of e-government to more sophisticated levels in terms of the extent of process and service integration, level of interaction with clients and degree of efficiency in service delivery.

## Gartner four-stage model

The Gartner model has four stages: presence, interaction, transaction and transformation (Baum & Di Maio as cited in Bwalya, 2011). This model focuses on the back-end business process integration and extent of efficiency in e-government (Bwalya, 2011) and is described as follows:

- 1. *Presence*: Government establishes an online presence by publishing information such as vision, mission, services and contact details on its site.
- 2. *Interaction*: Two-way interaction between government and clients. Government sites provide downloadable forms to be completed and submitted through email, posts or physical office locations.
- 3. *Transaction*: Government can conduct transactions with clients such as renewing licenses online.
- 4. *Transformation*: Rather than automating, government operational processes, systems and services are integrated and transformed to provide integrated, unified and personalised services.

## Chandler and Emmanuel four-stage model

The Chandler and Emmanuel model has four stages: information, interaction, transaction and integration (<u>Chandler & Emanuels, 2002</u>). It is similar to the Gartner model and is described as follows:

- 1. *Information*: Government provides information about its services, policies and agencies on its site.
- 2. *Interaction*: Government interacts with clients via emails as well as providing downloadable forms to be submitted via email or posts.
- 3. *Transaction*: Government provides transactions of value such as online taxing.
- 4. *Integration*: Government services are integrated into a more unified, client-centric service.

The Gartner and Chandler and Emmanuel models are similar in the number and elements of their stages. The names of the first and last stages differ but the elements do not. They both combine horizontal and vertical integration to enable service transformation. Consideration of political participation is perceived to be missing in these models.

## Layne and Lee four-stage model

The stages in Layne and Lee's model are cataloguing, transaction, vertical and horizontal integration (Layne & Lee, 2001). This model focuses on the integration and efficient provision of government services (Bwalya, 2011) and is described as follows:

- Cataloguing: Government Web site provides information and downloadable forms to be completed and returned via email, posts or physical location.
- 2. *Transaction:* Government serves the clients online. Clients complete and submit forms online while the government responds by providing confirmations or receipts.
- 3. *Vertical integration:* Government moves towards service transformation. Government processes, systems and services at local, state and federal levels with similar departments and functional areas are integrated so that federal services are accessed at local portals.
- Horizontal integration: Integration of services across different departments and functional areas at different levels of government. Government provides a 'one-stop-shop' portal for citizens to access services seamlessly.

Layne and Lee's model contributes to other models by combining the information and interaction stages into one catalogue stage. Furthermore, it breaks integration into horizontal and vertical integration. However, consideration of political participation is perceived to be missing in this model.

## Deloitte six-stage model

The Deloitte model has six stages: information publishing, official two-way transaction, multi-purpose portal, portal personalisation, clustering of common services and full integration and enterprise transaction (Deloitte, 2001). This

model focuses on building long-term relationship with clients by serving them more effectively (Bwalya, 2011) and is described as follows:

- 1. *Information publishing:* Government provide increased access to information.
- 2. *Official two-way transaction:* Bi-directional interaction using technologies such as digital signatures, encryption and secure sites.
- 3. *Multi-purpose portal:* Government provides a Web portal for clients to access services and conduct transactions across multiple departments.
- 4. *Portal personalisation:* Government empowers clients to customise the portal to suit their needs and desires.
- 5. *Clustering of common services:* Transformation occurs as government attempts to cluster services along common lines to deliver services efficiently.
- 6. *Full integration and enterprise transaction:* Government becomes a full service centre, with services personalised to clients' needs and preferences.

This model emphasises personalised services to clients by transforming services and using portals to access these services. Clients view the particular government service centre which can service their needs. Consideration of political participation is perceived to be missing in this model.

#### Hiller and Belanger five-stage model

Hiller and Belanger's model has five stages: information dissemination, twoway communication, transaction, integration and political participation (Hiller & Belanger, 2001). Apart from service integration and efficiency of egovernment service delivery, this model aims to promote online participation in political processes and is described as follows:

- 1. *Information:* Basic form of e-government. Government Web sites publish information for clients
- 2. *Two-way communication:* Government sites allow clients to make information requests online and receives the information by regular mail in paper form or returned by e-mail
- 3. *Transaction:* Government sites allow clients to conduct transactions online with web-based self-service replacing public servants
- 4. *Integration:* Government attempts to integrate its services. A portal is used to these services seamlessly without the need to know which department is providing the service
- 5. *Political participation:* Government allows clients to participate in politics through online services such as online voting, online registration and online posting of opinions.

Hiller and Belanger's model contributes to other models by considering political participation as a separate stage as it involves a high level of privacy and security.

#### United Nations four-stage model

The United Nations model has four stages: emerging presence, enhanced presence, transaction presence and connected presence (UN, 2014). This model combines transactional and interactive stages of its previous five stage model (UN, 2008). It is used to measure the development and growth of e-government in the United Nations member states. The stages are explained as follows:

- Emerging presence: Government sites provide information on public policy, governance, laws, regulations, relevant documentation and types of government services provided to clients. They have links to ministries, departments and other branches of government that allow clients access to archived information.
- 2. *Enhanced presence:* Enhanced one-way or simple two-way ecommunication between government and clients, such as downloadable forms for government services and applications. The sites have audio and video capabilities and are multi-lingual.
- 3. *Transaction presence*: Two-way communication between government and citizens, including requesting and receiving inputs on government policies, programmes and regulations. Governments and clients can perform transactions such as paying taxes online.
- 4. Connected presence: Government provides e-services and e-solutions that cut across departments and ministries in a seamless manner. Governments are now more citizen-centric than government-centric. Government creates an environment that empowers citizens to be active in government activities and decision making.

The UN model combines the integration and political participation stage into one connected presence stage. The emerging and enhanced presence stages are similar to presence/information and interaction stages, respectively.

#### Moon five stage model

Moon's five stage model comprises the stages below (Moon, 2002). This model "reflects the degree of technical sophistication and interaction with users" (Moon, 2002, p. 426). Moon's model is similar to Hiller and Belanger's model and is described as follows:

- 1. *One-way communication:* Government disseminates information by posting on its Web sites.
- 2. *Two-way communication:* Government incorporates email systems as well as technologies for information and data transfer on its sites.

- 3. *Service and financial transaction:* Government provides capabilities for online service and financial transactions.
- 4. *Integration:* Government attempts to integrate its various services vertically and horizontally to achieve efficiency, user friendliness, and effectiveness.
- 5. *Political participation:* Government sites allow citizens to participate in politics by including online voting, online public forums and online opinion surveys.

#### Asia Pacific six-stage model

The Asia Pacific model (Wescott, 2001) focuses on citizen-centric services and functionality. It comprises of the following stages:

- 1. *Setting up an email system and internal network:* Government establishes an internal network with an email system, enabling internal government processes to be more efficient such as using emails for internal collaboration and payroll advice.
- 2. Enabling inter-organisational and public access to information: Government develops systems to convert workflows from paper-based to electronic formats. Clients are able to access information from government sites through the Internet.
- 3. *Allowing two-way communications:* Government sites provide phone and fax numbers and email to allow clients to contact the government office.
- 4. Allowing exchange of value: Government provides more flexible, convenient ways for clients to conduct business transactions with the government.
- 5. *Digital democracy:* Government allows clients to participate in democratic processes such as voting and expressing their opinions over the Internet.
- 6. *Joined-up government:* Government provides a Web portal that allows clients to access integrated service seamlessly without needing to know which government organisations are responsible.

The Asia-Pacific model contributes by considering an internal network within organisations with an email system but it does not seem to consider the national ICT infrastructure. Consideration of an internal network is perceived to be missing in the other models. Digital democracy is similar to political participation in the Hiller and Belanger's model.

These models may only be suitable in certain national settings. One single model may not be applicable in all countries as they may have different technological, cultural and socio-economic conditions. Some factors that are perceived to be missing for application of these models in the PNG context is a consideration of the national ICT infrastructure and promotion, awareness and training relating to e-government which are considered to be essential for successful e-government implementation. The conditions in PNG would require a model that considers these conditions for effective planning, development and growth of e-government. A proposed implementation model for PNG will now be considered.

#### **Proposed model for PNG**

Considering the issues related to service delivery, the current state of national ICT infrastructure and the aims and objectives of various plans and strategies such as *PNG Vision 2050* (Department of National Planning & Monitoring, 2009), a model that is suitable to PNG national context needs be designed to plan for the development and use of e-government services. The models discussed above may be assuming readily available technological environment necessary for e-government. This may be true for developed countries which have well established national ICT infrastructure. However, it may not be the case for developing countries such as PNG, where not all citizens have convenient access to ICT technological facilities and services. It is important for the government to consider national ICT Infrastructure and promotion, awareness and training in its planning towards e-government adoption. The model proposed for PNG considers these major factors (Figure 1) and has six stages discussed below.



Figure 1: Stages of e-government development and growth for PNG

#### Stage 1: Infrastructure

Technological infrastructure is one of the factors influencing implementation and use of e-government services, especially in developing countries (Alshehri & Drew, 2010). Having a national ICT infrastructure that is well established, robust and flexible is essential for services to be made accessible, affordable and available to all government clients. Without a strong and well developed national ICT infrastructure, e-government will not be successful. This infrastructure includes networking and telecommunications, hardware and software, databases and applications, standardisation and interoperability, privacy and security, access networks, and policies and regulations on the use of technology. The three main aspects of this infrastructure are now discussed.

## Internal Infrastructure

Government organisations need to have available the necessary technological infrastructure. A logical diagram for a possible internal network (Figure 2) for a government organisation allows connectivity and resource sharing. This network would be connected to the Internet through service providers such as Telikom to enable connectivity with clients. Government organisations with access to the fiber-optic network could connect through it for Internet access while others who do not could use the satellite or the national telecommunications microwave network (Anderson & Suwamaru, 2011).



Fiber optic cable

**Figure 2:** Logical network for government organisations providing connectivity to the Internet, showing virtualisation and cloud computing. (Adapted from Anderson, 2013)

The internal network would utilise virtual servers with databases and applications mounted on a small number of physical servers to enable effective storage, processing and accessing of information and services. The console connected to the Keyboard, Video and Mouse (KVM switch can be used to configure the servers.

SANs are dedicated high-speed networks (or subnetworks) that provide access to consolidated data storage (Anderson, 2013). The storage devices are interconnected through a mesh network to ensure reliability and availability so

that shared array of storage devices are provided to multiple servers. This allows each server to access shared storage as if it were a drive directly connected to the server.

Standardised hardware and systems will allow different systems to integrate and interoperate. Policies and regulations regarding standards, hardware and software and use of technology must be established for effective implementation, use and management of technology.

## External infrastructure

External technological infrastructure is essential to enable connectivity between the government organisations and clients. A vital component of this infrastructure is a telecommunication network that allows clients to be connected to government organisations. This infrastructure will serve as a backbone to connect government networked systems with private business network systems and access networks and centres used by clients to access egovernment services.

Without this external infrastructure, no connectivity can be established between the government and clients. It is usually provided by telecommunication and mobile phone companies such as Telikom, Digicel and Bmobile. The government needs to work in partnership with these companies to establish and improve the national ICT environment. The present roll out of the fiber optic network is an important development as it will provide the national backbone that will connect all internal networks and access networks (Anderson & Suwamaru, 2011). This fiber network connects the PIPE undersea cable landing in Madang with Lae and the highlands region using the PNG power infrastructure along the National Highway. An Integrated Government Information System (IGIS) is also necessary for successful e-government development (Daniel, 2014).

## Access infrastructure

E-government will not be successful if clients are not able to access and use egovernment services effectively. Internal and external technological infrastructure can be available, but if clients cannot use these technologies to access e-government services, e-government effort could fail. Access infrastructure refers to ICT facilities that clients can use to interact with government services. Clients need to have access to this infrastructure in order to avail of e-government services.

Many developing countries have public Internet access centres, also known as telecentres that provide users with Internet access (Nor, Razak, & Malek, 2012). Citizens can use these facilities to access government information and services. Telecentres would normally have a network connected to the Internet (Figure 3). Figure 3 has been simplified from figure 2 to include only the necessary components required in a telecentre. The government can partner with private businesses to set up such access centres to provide affordable Internet access to clients. Each district could set up a telecentre, serving as a public internet access point where citizens can use computers to access the

Internet for services. These telecentres could also be used to access other eservices such as e-learning where students enrol in online courses can use it to study online.





## **Stage 2: Interaction**

The interaction stage is similar to the stages with two-way communication discussed above where government organisations are able to establish a twoway interaction with their clients (Chandler & Emanuels, 2002; Hiller & Belanger, 2001; Moon, 2002). Government Web sites provide information such as the organisations' mission and vision, services being provided, opening and closing office hours, contact details such as address and email. In addition, the sites include online inquiry forms through which clients can request for more information. Furthermore, downloadable forms can be completed for submission either via email or posts. For instance, the Immigration and Citizenship Service Authority Web site provides forms which can be downloaded, completed and posted with required documents for processing passports (Figure 4).



Figure 4: Passport application form can be downloaded from the immigration and citizenship service authority web site to be completed and posted manually. Source: http://www.immigration.gov.pg/passport.html

#### **Stage 3: Enhancement**

Promotion, awareness and training are factors that also affect e-government success (Alshehri & Drew, 2010) which are perceived to be missing in the models discussed above. ICT infrastructure and government Web sites may be available, but if clients are not aware and do not know how to access those services, e-government effort will fail. Clients must have basic skills and knowledge to access and use those services.

The enhancement stage provides promotion, awareness and training. The government can partner with private training institutions to provide promotion, awareness and training so that clients are aware of those services and be trained to access them. Awareness will inform clients the requirements, benefits and advantages of e-government. Training will equip clients with the essential skills and knowledge on how to use the available technologies to access e-government services. It is important to note that awareness and training are not limited to this stage as they are important components of all the stages.

Lack of qualified employees and their resistance to change are other important factors (Alshehri & Drew, 2010). Employees of government organisations need awareness and training so that they contribute positively to e-government development. They could become resistant to change if they are not properly advised and trained.

#### **Stage 4: Transaction**

The transaction stage is similar to the transaction stage of previous models. Government operational processes that were previously completed manually are automated and performed electronically (Chandler & Emanuels, 2002; Hiller & Belanger, 2001; Layne & Lee, 2001; Moon, 2002). Rather than downloading forms to be posted or emailed, clients are able to complete and submit application forms online. For instance, government Web sites provide capabilities for citizens to apply for their passport or renew their driving licenses online. In addition, businesses are able to renew their registrations online. Furthermore, government organisations and clients can perform online transactions such as renewing their vehicle registration online. Performing transactions online should reduce the amount of effort, time and cost involved in processing these applications.

## **Stage 5: Integration**

Rather than automating operational processes, they are transformed by integration into coherent processes that produce unified, seamless, personalised and client-centric services (Chandler & Emanuels, 2002; Hiller & Belanger, 2001; Layne & Lee, 2001; Moon, 2002). A governmental portal is normally used to access integrated services in a convenient way. A portal is like a gateway to government services. Figure 5 shows the Indian government portal through which its clients can access various types of information and services from one location. The different types of integration are now discussed.



Figure 5: Government portal of India. Source: http://india.gov.in/.

#### Vertical integration

Operational processes, systems and services from similar departments and functional areas from national, provincial and local level governments could be integrated so that transformed client-centric e-services are provided (Layne & Lee, 2001). A licensing system at the provincial level where clients apply for a license is linked to licensing system at the national so that national licensing could done at the provincial level.

#### Horizontal integration

Operational processes, systems and services across different departments and functional areas at the same government level are transformed so that horizontally integrated client-centric services are provided (Layne & Lee, 2001). For instance, processes and systems at the finance and human resource departments at the same government level are integrated so that employees are able to access their financial information in an efficient manner. A government portal is usually developed to provide integrated services to clients through 'a

could make the process more convenient and efficient.

# Full integration

Multiple departments and functional areas at multiple levels of government could also be integrated by combining vertical and horizontal integration. A system from the health department at the national level can be integrated with that of the education department at provincial level. Full integration may also involve integration of systems and services from different provinces. For instance, the Madang and Morobe provincial government systems can be integrated to share information and services related to controlling and minimising crimes.

## **Stage 6: Participation**

The participation stage is similar to the political participation stage of models previously discussed. Governments allow clients to participate in the democratic processes such as e-voting (Hiller & Belanger, 2001; Moon, 2002; UN, 2014). Clients can now discuss with governments through online public forums, online opinion surveys and participate in public policy, law and democratic participatory decision making. This could result in a more transparent government as citizens become active participants in the democratic processes. Furthermore, many issues such as those related to general elections could be reduced.

## Discussion

One single development model for e-government cannot work for all countries due to their different national contexts and settings. In addition, many issues in a country need to be considered and carefully addressed when embarking on egovernment initiatives. A model that is suitable for the PNG contextual setting has to be designed. The model proposed in this paper takes these considerations into account so that e-government can be properly planned.

The model proposed is not strictly rigid or waterfall in nature. One stage does not have to be completed entirely before going to the next. Adaptive approaches such as incremental, iterative and spiral techniques can be used in this model (Figure 6). E-government begins with the infrastructure stage by developing some of its elements after which some elements of interaction are implemented. Some elements of enhancement are performed followed by some elements of transaction. Then some integration is implemented followed by some participation elements. The process continues with more infrastructure development followed by more interaction until all required e-government activities are completed. Furthermore, work on stages should continue while subsequent stages are being implemented. Work on infrastructure, for example should continue while work on subsequent stages is done. Overlapping can also occur whereby elements from two or more stages can be carried out



concurrently. Project management and system development techniques are required in all stages.

Figure 6: Proposed e-government stage model combined with adaptive approaches

The proposed model could be used to determine the degree of e-government development and growth. The extent of e-government in the country seems to fall between the infrastructure and interaction stages of the proposed model.

PNG does not seem to have a well-established national ICT infrastructure. Not all citizens have access to technological facilities and services. The ICT infrastructure needs to be improved and further established to reach all clients. Not all government departments, institutions and public organisations have Web sites. Those who have Web sites provide information with downloadable forms to be completed and submitted either through email or posts.

The proposed model could also be used to plan for the development of egovernment. PNG does not have adequate resources to carry out all egovernment activities immediately. The government could use this model to create a long-term plan for e-government over a number of years until it is successfully implemented throughout all aspects of government and adopted by clients. Lessons from other countries can be also investigated and incorporated for successful planning and development.

It is important that the government perform an assessment of the current state of national ICT infrastructure. This should be done before embarking on egovernment. It also needs to examine the extent to which different aspects of egovernment are developed in different regions. This assessment is essential as it will inform the government and its main stakeholders what is required for egovernment. This will also aid in the planning and development of the subsequent stages of e-government development. Training and awareness for employees of government organisations need to be carried out before the embracement of e-government so they provide positive contribution.

## Conclusion

With advances in ICT, it is now time to implement electronic access to government services to the variously located citizens of PNG. In order to do this, this paper has examined present models found in the literature. It has found that these models are less than satisfactory and are not entirely suitable for guiding e-government planning and implementation. It has proposed a hybrid model from various authors who have tried to model the implementation of e-government.

A major factor perceived to be missing for the application of these models in PNG is a consideration of a national ICT infrastructure and promotion, awareness and training relating to e-government. This paper has proposed two further stages to the models, examined the national infrastructure and indicated a possible network model.

Furthermore, it has discussed how adaptive approaches to systems development could be combined with this proposed model for effective planning and implementation of e-government. It has also highlighted that this model could also be used to determine the degree of e-government implementation and measure its progress.

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#### Glossary

Access centres	Public Internet access centres that provide computers with Internet access.
Access	ICT facilities that clients can use to interact with the government.
infrastructure	
Clients	Citizens, businesses, government organisations and employees that interact
	with the government for information and services
Electronic	Use of ICT and Internet technologies to provide unified, client-centric
government	information and deliver services online.
(e-government)	
E-government	Services provided delivered through e-government systems.
service	
Electronic service	Services provided electronically through online systems.
(e-service)	
ICT infrastructure	Includes networking and telecommunications, hardware and software,
	databases and applications, standardisation and interoperability, privacy and
	security, access networks, and policies and regulations on the use of
	technology.
Telecentre	Public Internet access centres that provide users with Internet access.

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