

An e-Government Stages of Growth Model Based on Research Within the Irish Revenue Offices

Finn de Brí

Office of the Revenue Commissioners, Dublin, Ireland

fdebri@revenue.ie

Abstract: This paper describes a stages of growth model for e-Government. The proposed model is comprised of seven stages, which are divided into three phases. The model is based on research into and analysis of Information Systems and Information Communications Technology (ICT) solutions in the Irish Revenue Offices for more than a 50-year period. It is argued that this model provides a useful template for understanding the growth of ICT in government organisations.

Keywords: stages of growth, e-government, learning organisation, ICT, IT evolutionary models, IT maturity

1. Introduction

The proposition underlying this paper is that government agencies evolve through distinct stages and that those stages may be outlined as an e-Government stages of growth model. e-Government here is defined broadly as the application of innovative forms of government and governance through the use of ICT (Castelnovo and Simonetta 2007; Nygren 2009). This paper is concerned with how information systems and ICT solutions evolve within a public sector organisation. An information system in this context is understood as a system, automated or manual, that comprises methods to organise and/or process data that represent user information.

The paper focuses on the Irish Office of the Revenue Commissioners (Revenue) outlining the stages of its e-Government initiatives. The observations are then abstracted and developed into a model which may have broad use within other public service organisations.

2. Theoretical framework

Although stages of growth modelling is not new (Anthony 1965; Churchill 1969) the approach was first popularised in the information systems field by Nolan in the 70's and 80's. Nolan's model evolved in each of these papers (1973; Gibson and Nolan 1974; 1979) and was strongly criticised by King and Kraemer who found it wanting on empirical, theoretical and practical grounds (1984). King and Kraemer questioned the empirical findings of the model saying that the model's predictions are not supported by their own research and that of others (King and Kraemer 1981; Goldstein and McCririk 1981). It is interesting to note that despite the fact that Nolan's model was the subject of heavy criticism by some academic researchers the concept of stage models was well received by practitioners and continues to be referred to in the IS literature (Friedman 1994). It provides a conceptual language which allows the ability to assess the current position and strategise future positions (King and Kraemer 1984; Benbasat and Zmund 1999).

More recently maturity models have proliferated to the extent that Mutafelija and Stromberg (2003) claim that there are now more than 150 maturity models in existence. These models address issues such as the maturity of IT Service Capability, Strategic Alignment, Innovation Management, Programme Management, Enterprise Architecture and Knowledge Management.

Most of these models simply pre-define maturity for the chosen topic and allocate progressive steps which enable the path toward that goal. According to de Bruin and Rosemann (2005) the most popular way of evaluating maturity is with a five-point scale where '5' represents the highest level of maturity. This type of model can be categorised as an evolutionist type model as opposed to an evolutionary model (van Parijs 1981; King and Kraemer 1984).

3. Evolutionist and evolutionary models

Models that describe change in terms of direction are described as "evolutionist" models and are distinct from "evolutionary" models, which describe change in terms of mechanisms (Toulmin 1972; van Parijs 1981; King and Kraemer 1984). An evolutionist model views the stages of development as stepping-stones toward a progressively more complex or perfect version of itself – whatever that

might be. This type of model defines the desired endpoint and the maturity scale and is therefore a model from design. Such theories embody a clear concept of the direction of change and the destination of change. Models such as this explain the course of change in terms of its direction toward the final end point or maturity. A significant number of maturity models as described by de Bruin and Rosemann (2005) including the Capability Maturity Model Integrated (CMMI) models can be categorized as evolutionist. However these models may have a reflexive element whereby the model and the adoption of the model is likely to have some predictive qualities in as much they influence the potential outcome of the entity being assessed or tracked.

Evolutionary models, by contrast, are agnostic about the direction of change or the final stage of development. Evolutionary models focus on the mechanisms, which drive change, and the features of the new stages of development (van Parijs 1981). According to King and Kraemer (1984) "Evolutionary mechanisms are mechanisms of local optimization in which features of an entity change and in which the new features are preferable to the old features in aiding survival of the entity or improving its chances of satisfaction."

The model presented here is an evolutionary one.

4. Stages of growth

The development of an organisation over time is known variously as organisational learning, stages of growth or organisational maturity. Two types of growth or learning are described in the literature: vertical growth also understood as conceptual learning; and horizontal growth also referred to as operational learning (Kim 1993; Chen et al. 2003). Vertical growth or conceptual learning occurs when members of the organisation challenge the organisation's underlying assumptions, values, and procedures, attempting to replace them with new ones. According to Chen et al (2003) vertical growth requires that the organisation change its pattern of thinking and that it question its operating principles. Horizontal growth uses existing conceptual models held within the organization to create efficiencies. This type of learning or growth is concerned with detecting performance deviations from standards and goals, and reducing the level of divergence through systematic problem solving. Organisations typically engage with both types of learning or growth. Vertical growth is mapped in this paper with distinct stages of development whereby the organisation understands its environment differently and develops an 'intelligence' to deal with it.

The term intelligence is used here with reference to the concept of multiple intelligences, which was first introduced by Howard Gardner (1993). Gardner asserted that humans display a wide number of aptitudes, competencies or talents, which he regards as separate intelligences. Some examples of the intelligences include: cognitive intelligence; kinesthetic intelligence; interpersonal or emotional intelligence. Humans use these intelligences as distinct tools to solve problems or avail of opportunities. This term has been applied here in this paper to the stages of growth found in Revenue. More specifically it is posited that each stage of development is likened to a distinct intelligence. As each intelligence is adopted by the organisation it may be used many times, as a solution in different contexts, even when the organisation has moved to the next stage. Just as a person develops interpersonal or emotional intelligence they do not relinquish cognitive intelligence as a method to deal with problems or opportunities.

5. Research methodology

A single case study was used in this research in which evidence was collected through 15 in-depth interviews each of which averaged approximately one and a half hours duration. Other sources of evidence include: annual reports; government reports on administrative efficiency; reports of government commissions on taxation; internal documents and other artefacts.

The research approach in this case was qualitative. The philosophy used is interpretative.

6. Background to tax administration

National tax administration is a complex affair and involves several stages some of which are: drafting clear legislation; interpreting and implementing this legislation; keeping taxpayers and administrators abreast of new legislation and interpretation; identifying taxpayers, their income and wealth and on that basis assessing their liabilities; providing machinery which allows collectors and taxpayers to agree on assessments; and operating appeal procedures.

Like taxation systems in most countries, the Irish taxation system grows in a piecemeal fashion with adjustments made with the annual budget. Tax concessions are designed to encourage particular forms of economic or social behaviour and to give special relief to particular sectors of the economy. These concessions dilute the effectiveness of each existing tax and erode its efficiency over time (Commission on Taxation 1985). Taxes have a propensity for increasing complexity, and when they reach a point where they are in danger of becoming unworkable due to administrative costs they are reviewed for efficiency. Overall reviews of a tax are infrequent occurrences, which require careful consideration planning and change management.

7. Propensity for increasing complexity and administrative costs

This propensity for taxation systems to increase in complexity over time has the effect of increasing the administrative cost of running the organisation – see figure 1. Revenue's administrative budget, the budget allocated by national parliament each to year to run the organisation, acts as a driver of efficiency. The fact that this budget is not amenable to adjustment means that there is significant pressure on the organisation to adapt to any demands with renewed efficiencies.

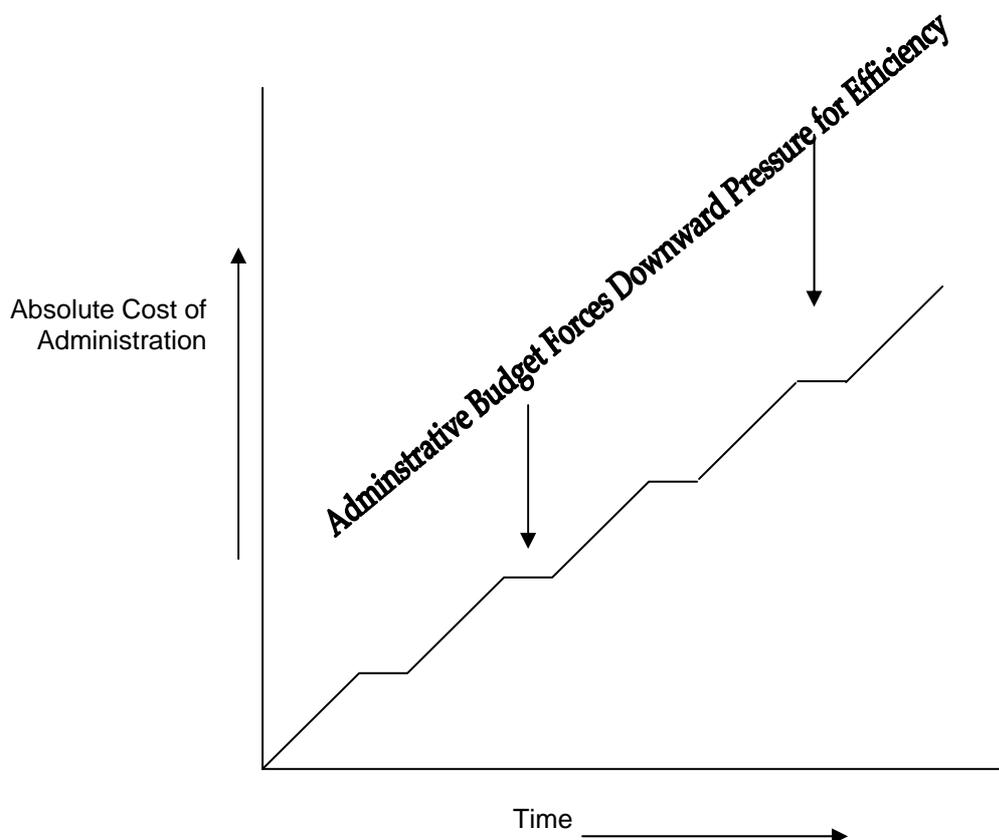


Figure 1: Revenue's forces for growth mechanism

This propensity for increasing complexity and the restraining force of the administrative budget has acted as a driver for change and has moved the organisation through a number of stages of growth and development.

8. General description of the stages of growth model within revenue

Stages of growth in Revenue occur in a logical sequence. This also manifests itself as an increasing repertoire of intelligences with which to deal with continuing demands for efficiency. Once a stage has been reached, or taken on, it remains as part of the organisation's response repertoire, even when later stages are adopted.

While the following model has a focus on e-Government, the use of ICT is not introduced until stage three. To understand the evolutionary processes of the e-Government era it is necessary to introduce the structural basis on which it rests. Stages one and two are therefore prerequisites and are foundational to any electronic government initiative. These stages will heavily influence the path that

subsequent stages follow and without having adopted these stages it is likely that an organisation may not commit to ICT to such an extent.

9. Stages of growth model

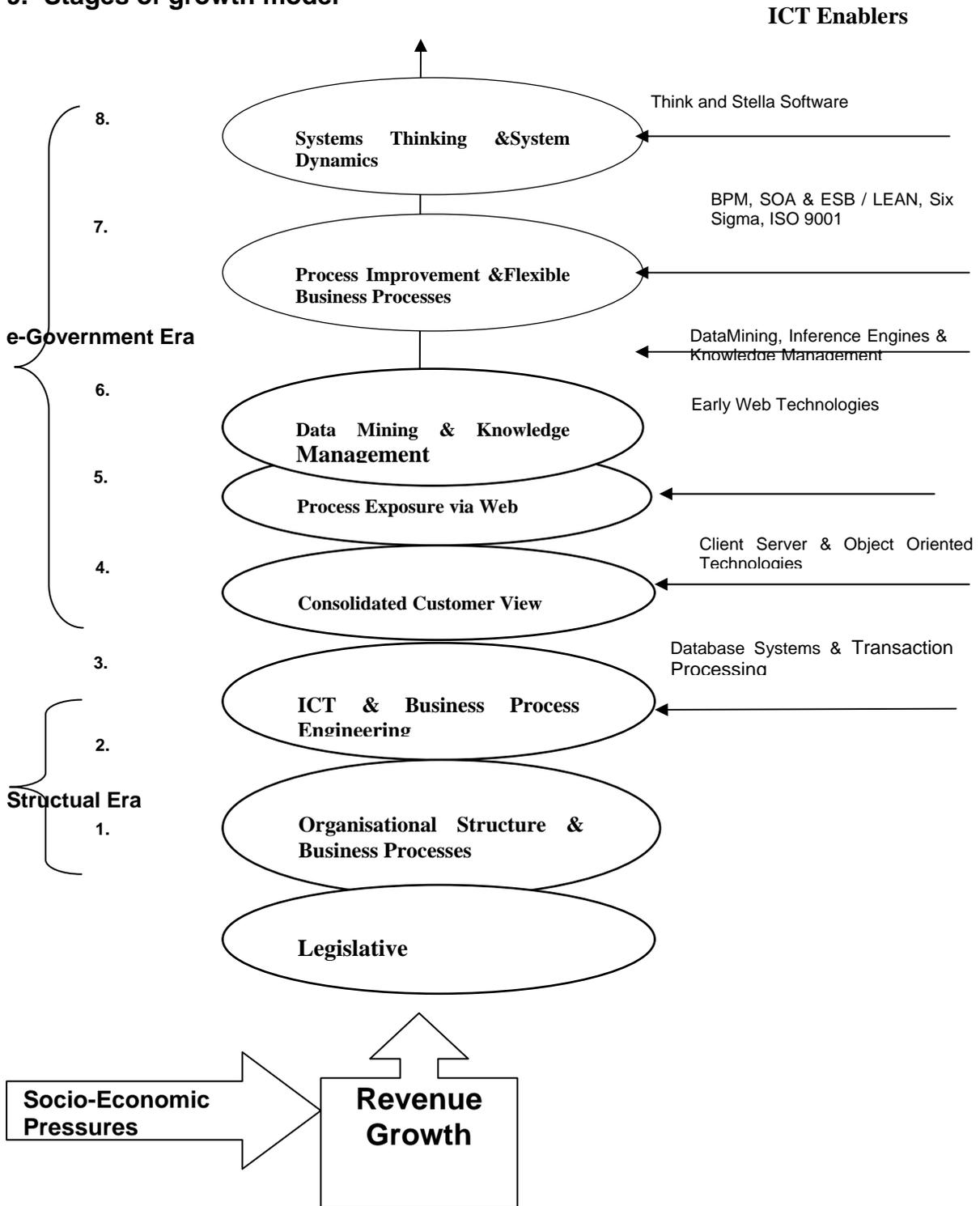


Figure 2: Revenue's stages of growth model

10. Stage 1 – structural era: legislative foundation

The legislative function is presented as the first stage and foundation level which the organisation had to adopt, in order to solve the many socio-economic demands on the taxation system. Putting a legislative process in place within the organisation is fundamental to all the subsequent stages of development and so is categorised as the structural phase or era of the organisation. The

organisation has continually relied on the ability and expertise of the legislative architects and technicians to give precise direction and advice with regard to the tax acts and the substantial case law. This legislative competency was and remains essential as a foundation and support for further stages of development. As the organisation's business processes are built on the foundations of the legislation and the tax code, it is necessary that this ability be established before the subsequent stages are approached.

This legislative foundation was categorised as a stage and not merely as a foundation as it did and continues to hold the potential for generating organisational efficiencies. Legislative policies in taxation such as 'Self Assessment' have created and continue to create efficiencies by outsourcing tasks to the taxpayer, thereby reducing administrative costs. The legislation function acts as a foundation and source for all business processes and has the potential to impact on efficiencies within the organisation.

11. Stage 2 – structural era: organisational structure and business process

By 1939 the organisation had emerged as a strong bureaucratic machine which was capable of manually administering the complete taxation process (including assessment and collection) for all taxpayers in the State (Réamonn 1981). It is difficult to observe when exactly this intelligence or stage was reached but from this point forward there was certainly the concept of using different organisation components for different functions. The organisation structures as described in the many artefacts available, show that the organisation had taken on the classic machine bureaucracy features as described by Mintzberg (1981). The organisation had at this point already put together many analysts to maintain and design legislative structures and to standardise complex taxation processes which were being administered by the many tax units around the country. The Secretariat as described by Réamonn (1981) is clearly in line with Mintzberg's view of this type of organisation structure – with a large hierarchy in the middle of the organisation to oversee the specialised work being performed in the operating core. Revenue took every opportunity to stabilise its environment with these technostuctures and support staff. This stage was categorised as foundational and important to an organisation which was constantly coming under pressure with demands from the socio-economic environment.

12. Stage 3 – e-government era: ICT and process engineering within silos

Procedures in the organisation had now stabilised into business processes. The organisation had developed the competency to maintain this stability over time. This setting was a foundation for the introduction of ICT. The fact that ICT was introduced at this early stage was a function of the mechanism of socio-economic pressure and the administrative budget constraints. In the economic boom of the late 50's and early 1960's the number of taxpayers trebled. The foundation of established, stabilised and well analysed business processes provided the necessary conditions for change.

Revenue's first e-Government initiative commenced in 1960 with the automation of existing taxation processes, each of which operated in silos within the organisation. These silos had little if any coordination between them. Each business process was separate as regards legislation, organisational structure, staffing and business processing. When the ICT function was introduced it was used to support the existing structure and not to re-engineer the process or structures. Consequently, the ICT applications were themselves very much silo based with no connections between them and with a substantial amount of duplicated functionality and code (Bannister 2001). In keeping with a machine bureaucracy the organisation developed its own in-house technical staff to support these processes and so the ICT development function began to emerge.

13. Stage 4 – e-government era: coordination with customer view

An increasing strain on Revenue resources occurred again during the 70's and 80's when eight new tax types were introduced – among which were: Value Added Tax; Corporation Tax and Capital Gains Tax. The silo type tax system began to turn up with an increasing number of anomalies - some of which were introduced with new taxes and others were merely becoming more observable. For instance it was possible in this era to have a substantial liability in Income tax and to simultaneously be the subject of a refund of VAT.

From a technical perspective, as the number of tax types increased and a corresponding number of ICT systems increased, more anomalies began to emerge. Not alone did business anomalies emerge, but ICT nuances were developed with each system - development work was duplicated and where any attempt was made to make these anomalies consistent across systems a substantial cost was incurred.

In 1989 an internal study took place to observe what the organisation felt was a real lack of coordination between the various taxheads. This study was based on the simple premise that each taxpayer was likely to be registered for many taxes and that each system was likely to be duplicating development and maintenance costs not to mention the larger business costs of differing business processes within the organisation.

The study led to a major reconstruction of the Revenue's computer systems, enabling a subsequent transformation of the Revenue business processes and organisation structure. The intention was to organise data and applications around the taxpayer rather than the tax. Revenue's own studies and global experience in other agencies had demonstrated that this led to a more efficient collection of tax, a more effective combating of tax evasion and an improved customer service for taxpayers.

This approach to the taxpayer brought about a review of existing structures, which recommended a major restructuring of the organisation, to one which deals with taxpayers in a more holistic way.

14. Stage 5 – e-government era: tax processes exposed via the web

The introduction of a fully interactive and transactional web presence was a milestone within the organisation and was significant in terms of the efficiencies it brought. Although this type of direct contact between the customer and Revenue's internal systems was not new, webservices provided the first opportunity where this type of direct contact could be applied to many of Revenue's business processes. While this was certainly a significant stage in Revenue's stage development it does not fit quite so neatly into a more general e-Government stages of growth model. This stage of Revenue's development was contingent on the introduction of web services by the ICT industry. The use of this technology by Revenue had no other contingencies apart from the structural prerequisites held by stages one and two. Therefore while this stage remains as stage five in Revenue's stage development, any current e-Government model should incorporate this type of processing within the early ICT stages – if not the earliest.

15. Stage 6 – e-government era: data mining and knowledge management

At this point the organisation adopted a voluntary compliance model with Self-Assessment, which meant that Revenue needed to detect where taxpayers were not compliant with the new regime. As a quality assurance measure Revenue now relied on interventions with taxpayers in the form of audits. Revenue auditors are an expensive resource to train and deploy. It is important therefore that this resource be used effectively and that auditors' interventions with taxpayers are valuable in terms of return on investment. An audit of a taxpayer who is fully compliant is a waste of resources for Revenue and the taxpayer. The ability to assess taxpayers and to target those delinquent cases, increasingly demanded more understanding of the taxpayer's propensities. To this end a data warehouse was created, data mining commenced and an inference engine was used to assess risks in areas such as debt collection, late payments and special investigations.

This type of analysis and data mining relies for its information on the ability to focus on the taxpayer from many different perspectives in order to get a more holistic view of their propensities.

This type of data mining and inference engine use is a distinct new stage of development, in terms of its operational approach. The data is compiled from a complete customer view of the taxpayer, which up to this point was not available. The inference rules are applied to each taxpayer and resources are allocated according to the level of risk identified by those rules. The rules are continuously challenged for validity and relevance.

16. Stage 7– e-government era: service oriented architecture and business process management

Service oriented architecture (SOA) and business process management (BPM) have been adopted as a stage of development as a result of the increasingly complex requirements of many diverse taxes being applied to the single monolithic system which is a dominant feature of ICT in the organisation. SOA is an opportunity where value can be gleaned from both technology and business in terms of flexibility and reuse (Papazoglou and Georgakopoulos 2003; Krafzig et al. 2005; Erl 2006). BPM is defined as a holistic organisational management practice (Rosemann and de Bruin 2005) with an emphasis which looks to processes and process improvement in a way that can take advantage and support the standard process improvement methodologies such as ISO 9001, Six Sigma and LEAN (Perse 2006). As the complexity level grows in any system beyond a certain point, function becomes impaired, operation becomes inefficient, and reliability declines. In software terms this means that to maintain reliability and efficiency in an increasingly complex environment more effort is required. Allen and Starr (1982) point out that as code is modified in an application or an algorithm, initially modifications are simple and the utility is clear. They describe how subsequent changes bring problems through secondary effects of the modifications and so improvement is made at a price. Over time significant effort must be applied to the algorithm to compensate for deleterious effects and so balance the benefits. Eventually a point is reached where the costs of further changes and the benefits accruing cannot be balanced. Once this point is reached only a macro level change can simplify systems so further adaptation can occur.

Revenue is increasingly coming under pressure externally from the European Union (EU) to adopt additional control and taxation measures, and internally to provide more business processes, which may be short-lived or have a flexible composition. To add this type of complexity to an already complex integrated system requires a new approach to the architecture and development of software within the organisation. To this end a long-term perspective has been taken with the adoption of SOA and BPM. This approach will allow flexible processes to be built while being able to reduce the risk of rising complexity as regards software architecture. Both these are in essence a single approach to business processes, which allow process modeling and process improvement. Enterprise architecture must allow continuous changes in order to adapt to evolving legislation and or business reorganisation. The move to SOA and BPM is a move away from the development of monolithic systems. This does not imply that monolithic systems should be completely deconstructed but rather this stage appreciates the value associated with monolithic systems, and is able to recognise when return is diminishing from the further aggregation of processes in a single system.

17. Stage 8– e-government era: systems thinking and systems dynamics

This incipient stage was identified by a small number of informants but held some significance, as the most senior of the informants outlined it. The organisation was identified as having many stages of development or independent intelligences each with separate inputs, structure, governance and dynamic. For instance, Revenue now has a complex information system surrounding the stage two, legislative stage or intelligence. An internal team manages external political demands for changes. In particular it manages proposed new legislation, operations procedure and not least the implementation of ICT solutions. Similarly the 'Structural and Process' stage (Stage2), which is governed by the Human Resource Division of the organisation, has its own structure, system and dynamic. Although these intelligences or stages of growth remain isolated, acting as separate rational competencies, they must also be viewed as interacting currents with structural consequences, which should be considered as a whole for their systemic or overall impact. This approach should take into account all intelligences or stages of growth with a view to aligning divergent currents associated with each of the competencies. Jackson (2003) and Senge (1990) describe this approach to the management of complex systems as the field of System Dynamics. According to Jackson (2003) the field attempts to map causal relationships between subsystems. Senge (1990) describes the field as a discipline for seeing wholes and a framework for seeing interrelationships and patterns of change rather than static instances. It became clear that this stage was being identified as one, which had the purpose of unifying the many threads in a faceted enterprise of systems.

18. e-government stages of growth model

The stages of development presented in this paper are a description of how one government agency has evolved over time. These stages are not a recommendation for how an e-Government initiative should be approached. This is a descriptive, not a normative model. Some of the stages are specific

to moments in time when the advent of new technology enabled change. For example Stage 5 describes the emergence of a web presence within an organisation and does not fit neatly into an e-Government model. For any newly emerging public sector organisation it is conceivable that a web presence (Stage 5) could be developed at any point from Stage 3.

Friedman (1994) argues that stages of growth models have a 'shelf life' and context within which they are considered to be valuable. In this instance the model applies to an organisation, which is growing in both size and service types. Simple organisations, which remain static, may not find a requirement or pressure to advance beyond the initial stages – but this is a feature of all evolutionary models. For this model to apply, the organisation should provide a service, which is analysable in a way that its processes have some application to ICT. For an organisation, which has only one service type and remains as such, Stage 4 (consolidated customer view) does not apply. However, that does not preclude the organisation from progressing to the next stage and using data mining and knowledge management techniques to gain efficiencies. If over time the organisation takes on an additional service, which applies, to its existing customers, Stage 4 may be revisited and progress may continue forward once more in the same direction, revisiting stages 5, 6 and 7 in order to readjust them.

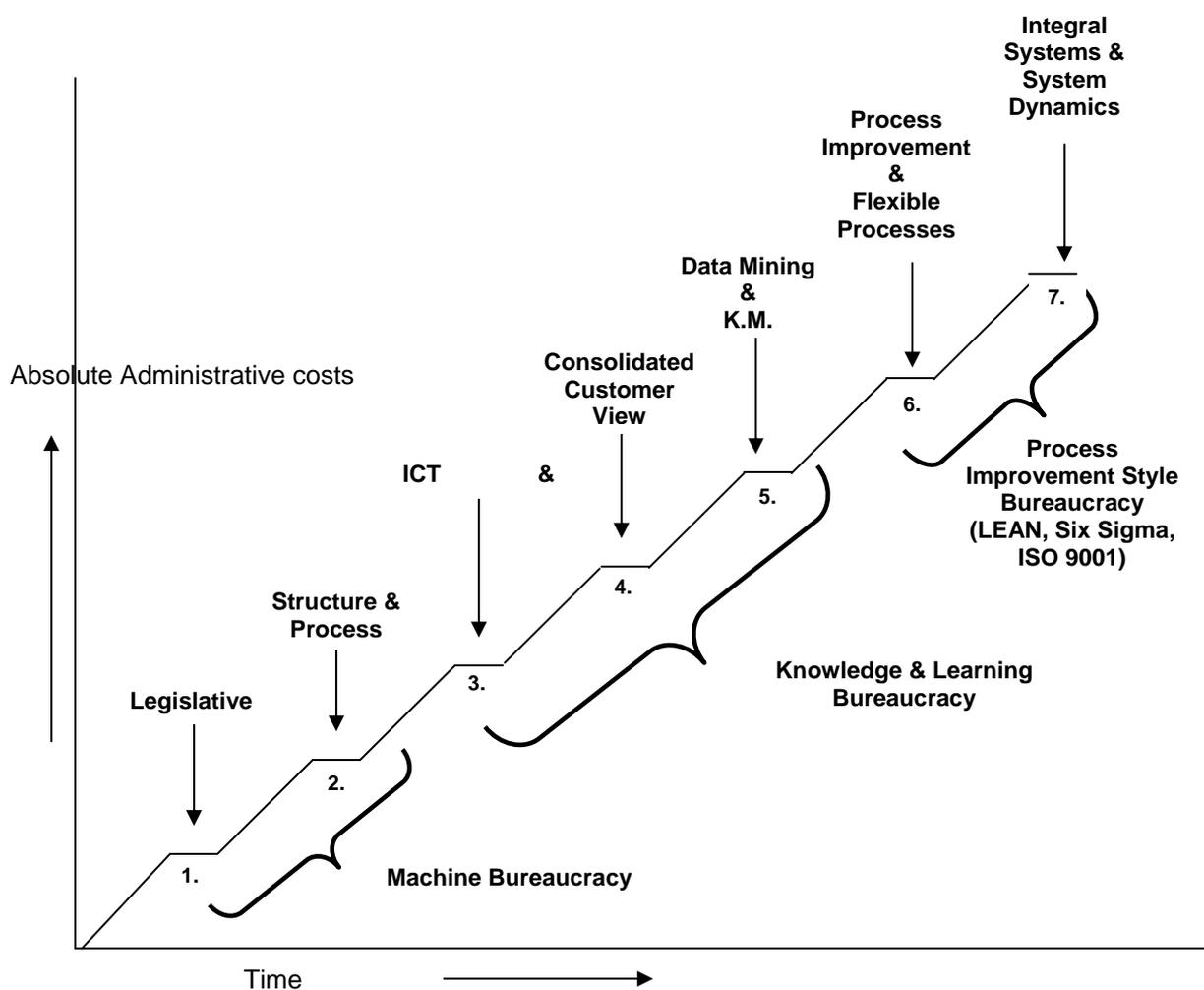


Figure 3: e-government stages of growth model

Given the above caveats, the model may have broad use within other public service organisations as a guideline for e-Government initiatives. Figure 3 outlines the stages of such an e-Government model. This model outlines seven stages of development which are divided into three phases. Phase 1 is the Machine Bureaucracy Phase, which includes stages 1 and 2. This phase generally sets out the basic requirements, which need to be in place before ICT is introduced to a medium or large public service organisation. The Knowledge and Learning Bureaucracy Phase incorporates stages 3, 4 and 5 where stage 4 is optional. This phase includes the initiation and knowledge specific utilisation of ICT in the organisation. Phase 3, the process improvement phase, includes two stages: Stage 6 which focuses on process improvement and flexible business process management (BPM and SOA);

Stage 7, the Integral Systems Stage, takes an overall perspective on the alignment of all the organisation's intelligences. Organisations that progress to Phase 3 without utilising the benefits of Phase 2's Stage 5 will miss the benefits to be gleaned from that stage. It is assumed here that if the organisation's services are complex enough to apply SOA and BPM then data mining and knowledge management most likely has a part to play in adding efficiency to the organisation.

19. Conclusion

The stages of growth model presented, is a descriptive one, which outlines how e-Government has evolved over the period of the organisation's history. Eight stages of growth were identified at distinct points in time when underlying assumptions, values, and procedures within the organisation were challenged and where the organisation's existing conceptual models were replaced with new ones.

The evolution of the organisation in question was abstracted and presented as a stages of growth model for e-Government. The model was presented with seven stages, which were divided into three phases. Some caveats to the model's applicability were presented. Firstly the model recommends the adoption of a stage provided there is consensus within the organisation that there is value in moving forward. Some stages of development may be skipped but phases may not be skipped over.

Benefits accruing from this model may include the ability to describe and gain consensus on the organisation's current level of maturity and sophistication as regards e-Government. The model may also assist senior management in formulating an appropriate strategy to pursue their organisation's e-Government objectives. In addition the ability to identify a repertoire of distinct intelligences, with which to approach demands on the organisation, may offer some clarity when choosing the most suitable solution.

Evidence for this research was gleaned from one public service organisation. Further research may continue to validate this model by reference to other public service organisations or indeed large bureaucratic organisations in other sectors of the economy.

The model outlined with this paper has reduced the reality of a diverse area to a perspective. This type of model is discriminatory in the sense that it includes certain features and leaves out others. A model is not the territory and if it were identical in all respects to that which is modelled it would be useless. This model is valuable if organisations are given conceptual traction on e-Government with a roadmap that charts the stages of growth, and describes the change mechanism around stages.

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