MATURITY IN E-GOVERNMENT INTEROPERABILITY: AN EXPLORATORY STUDY OF E-SERVICES IN NORWAY

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ABSTRACT

This paper is concerned with maturity levels in e-government interoperability. Stages of growth are sequential in nature, they occur as a hierarchical progression, and involve a broad range of organizational activities and structures. Two case studies and lessons learned from experience of the government sector in Norway are useful for analysing the number of stages of growth, dominant problems at each stage, and evolutionary path. Based on the stages of growth model of Gottschalk and Solli-Sæther (2008), a framework to analyze and predict organizational, semantic and technical interoperability is described. Using the framework, workable benchmark variables applicable for each stage are applied to the cases. E-government interoperability has been recognized to have potentially great impact on productivity and user satisfaction. The utility of the analytical framework in identifying key issues needing to be addressed in e-government interoperability is presented.

KEYWORDS

Electronic government, stages of growth, interoperability, information technology, benchmark variables.

1. INTRODUCTION

Maturity levels in terms of stages of growth models have been widely used in both organizational research and information technology management research. According to King and Teo (1997), these models describe a wide variety of phenomena – the organizational life cycle, product life cycle, biological growth, and so forth. These models assume that predictable patterns (conceptualized in terms of stages) exist in the growth of organizations, the sales levels of products, the diffusion of information technology, and the growth of living organisms. These stages are (1) sequential in nature, (2) occur as a hierarchical progression that is not easily reversed, and (3) involve a broad range of organizational activities and structures.

This study is concerned with validating a stages of growth model of e-governance interoperability proposed by Gottschalk & Solli-Sæther (2008). Two exploratory case studies, conducted through February – June 2009, had the following guiding research question: *Does Gottschalk and Solli-Sæther's maturity model accurately describe how e-government interoperability matures and evolves?*

The selection of cases was from cooperating government organizations in Norway. The cases are of secondary interest; they play a supportive role, facilitating our understanding of something else (Stake, 1994, p. 237). The choice of cases was made because it was expected to advance our understanding of e-government interoperability. The "Birth case" was in an initial phase trying to establish a new governmental e-services and the "All In case" was a mature one renewing e-services in a governmental information portal. They provide a broad base of e-governance interoperability practices, suggesting that a case in each cooperating constellation would be of interest and value to this research study. Table 1 shows some characteristics of the cases studied.

Data collection was done through a total of 12 interviews, with questions addressing governmental e-services, dominant problems, benchmark variables, description of the evolution, and the economies of e-governance interoperability. For each case, six interviewees were selected among participating government organizations. Interviews were either personal meetings or by phone. The individual cases serve only as the evidentiary base for the study and are used as a basis for this cross-case analysis. The purpose is not to

portray any single one of the relationships. Rather, it is to synthesize the lessons learned from both, dispersed throughout separate cross-case issues.

Table 1. Two e-government research case studies

Government organization	Origin	Focus area	Services involved	Start of cooperation	Users
The Norwegian Tax Authority, Norwegian Directorate of Health Norwegian Centre of Informatics in Health and Social Care	Norway	Notification of births from hospitals to the National Registry	Birth message, choice of name, personal number	2008	Hospitals, the National Registry, parents
The Norwegian Tax Authority, The Brønnøysund Register Centr Statistics Norway	Norway	New information portal	Tax, VAT, salary and account, annual reports	2002	Unique citizens, companies and enterprises, public agencies

2. TWO GOVERNMENTAL E-SERVICES

In this section, a short introduction to the two cases is given. First, the governmental e-services are presented, and then its registers and transactions, and finally strategic drivers for change. This is done to set the scene for analyzing the stages of growth model.

2.1 Notification of Newborns

According to Smith-Meyer and Udjus (2008), the Birth case can be divided into two main parts. First, it is the notification of birth which is an electronic birth message from regional hospitals to the National Registry. Second, it is orchestration of all relevant governmental e-services into one main process of services relevant to people preparing for having a child and for the first living year of the newborn.

Today, notification of newborn is partly conducted manually with a several stakeholders involved, e.g., staff at hospitals, staff at the National Registry, and staff at the Norwegian Tax Directorate. The work process is supported by different information systems as each regional hospital trust operates its own healthcare information network. The National Registry operates the government database to file personal identifying information about a person. The steps in the notification process are briefly as follows:

- When children are born, hospitals in Norway send a message (usually done by midwife) on a standardized physical schema, in three copies, to the regional office of the National Registry, which is operated by the Norwegian Tax Directorate.
- At the National Registry's regional office, schemas are controlled manually. One schema is sent forward to the National Registry central office for further processing, one schema is sent to the Church, and one schema is archived.
- The National Registry central office controls, registers, and assigns a personal number (i.e., social security number) to the newborn. The physical schema is archived.
- The final step is completion of the birth certificate (with the personal number) which is sent as a physical message from the regional office to the newborn's parents. A naming schema is also sent, which initiates the naming dialogue.

The national population register, called the National Registry, is a government database of all people with affiliation to Norway. Since 1991, the register has been kept up-to-date by the Norwegian Tax Directorate. The register is used by the Norwegian government as a means of tracking its citizens, permanent residents, and temporary residents for the purposes of work, taxation, government benefits, health care, and other governmentally-related functions. In Norway, a citizen is issued a number at birth. Non-citizens are issued such numbers when they enter the country. Several government registers use the personal number, e.g., property, car, driving licence, company, family doctor. Change of name or address is done in the national population register and transferred to other registers. Bringing the register up to date is partly based on messages from other government authorities, e.g., birth messages, death certificates, marital status, and partly by individual messages. All citizens have a duty to report change of residence, both domestic and abroad.

The national population registry also deals with naming of children and changes of name. Access to the national population register is restricted. Only companies and organizations with reporting responsibility can apply for access.

In the Norwegian health and social sector there have been years of strategic IT planning. According to the Office of the Auditor General of Norway (OAG, 2008a), there is inadequate follow-up of ICT efforts in the health service: *"Despite the focus on information and communication technology (ICT) and health during the last ten years, a great deal of the information flow in the health service is still paper-based. So far, electronic medical records in hospitals have only made a limited contribution to improving cooperation and the utilization of resources. The Ministry of Health and Care Services has failed to fulfil its responsibility for following up the national ICT efforts."* As described the work process notification of newborns is to a large extent paper-based. The first initiatives in the electronic birth message started back in 2004 and involved two hospitals and the Norwegian Tax Directorate. The process stopped without being able to implement any electronic services or solutions. The project was reestablished in 2008. In addition to services connected to notification of birth – such as the electronic birth message, naming of newborn and assignment of personal number – a set of possible governmental e-services can be developed.

2.2 The Information Portal "All In"

Each year, Norwegian enterprises complete a series of public reporting forms in order to satisfy the public need for information. Surveys indicate that Norwegian enterprises spend over 4800 full time equivalent hours on statutory reporting, just to central government agencies. As a measure to ease the burden of public reporting, the transition to electronic reporting is of high importance in public trade and IT policies.

In 2002, the Norwegian Tax Administration, Statistics Norway, and the Brønnøysund Register Centre joined forces in order to create a common Internet portal for public reporting. The portal was launched in December 2003 under the name All In, and has been in full operation since. More than 120 different public forms are available and more than 23 million forms have been submitted through All In. The users of All In can either fill in the forms directly in the Internet portal or they can use their own IT systems to transfer data, for example salary and accounting systems or a year-end accounting package. The companies' own IT systems transfer pre-filled forms to the portal through a simple interface where the forms can be subsequently completed and signed in the portal. Efforts have been made to make the forms as easily accessible as possible. All In is a 24/7 solution, which gives high flexibility for the users. It allows users the opportunity to use the solution anywhere, any time.

The registers contain information and key data about such matters as liabilities and titles in mortgaged movable property, business enterprises, annual accounts and auditors' reports of limited companies, bankruptcies and compulsory liquidations, marriage settlements. Others include a shareholder register list, notification of change of address, monthly report biomass and salmon lice, turnover reports, tax returns for wage earners and pensioners, coordinated register notification, tax returns for businesses, operators and companies, term reports, annual accounts (Brønnøysund Register Centre, 2009). The responsibility to administer and develop All In is allocated to the Brønnøysund Register Centre. The Brønnøysund Register Centre is an administrative agency responsible for a number of national control and registration schemes for business and industry. The Brønnøysund Register Centre performs an important task by coordinating the reporting obligations of business and industry. The aim is to prevent superfluous collection and registration of information.

The work on establishing the next generation All In solution (All In II) is forging ahead. Before starting All In II, a new mission statement was developed: "All In is the key to world class e-government services." All In shall be developed into a cooperative platform for all public authorities, enterprises and local authorities in their dialogues with enterprises in the public and private sector. All electronic services for business enterprises shall be made available in the All In portal. All In can be used for the production of services for private individuals and shall also enable interaction across agency boundaries in the public sector. According to head of the All In control group and Director General of the Brønnøysund Register Centre, *"All In is a vital common effort to establish electronic administration in Norway. The focus on All In has been strengthened because it is anchored both with the public authorities and on the ministerial level."*

3. CHARACTERISTICS INFLUENCING STAGES OF GROWTH

Three core topics emerge when modeling stages of growth. The first challenge is to identify and explore the number of stages of growth. Second, is to develop workable benchmark variables identifying the stages. Third, is to find a proper description of the evolution in the model. In this section, the maturity model of e-governance interoperability is discussed with respect to number of stages, dominant problems and benchmark areas, potential benchmark variables, and finally the two cases studied are placed into the evolutionary stages of growth model.

3.1 Number of Stages in the Model

Based on the reviewed literature on systems interoperability and stages of growth models, Gottschalk and Solli-Sæther (2008) identify and discuss four stages of e-government interoperability as shown in Table 2. Semantic interoperability was defined as the extent to which information systems using different terminology are able to communicate, and organizational interoperability was defined as the extent to which organizations using different work practices are able to communicate. The stage model was experimental in nature by assigning phenomenon to four stages and by labelling each stage according to a meaningful characteristic.

Table 2. Stages of e-government interoperability

Stage	Extent of e-government interoperability
1. Aligning work processes	Employees inter-operate in work processes across organizations
2. Knowledge sharing	Employees share knowledge across organizations
3. Joining value creation	Organizations create value in inter-operating organizations
4. Strategic alignment	Managers share strategy in inter-operating organizations

Stage 1 – Aligning work process; Common work processes are clearly defined among cooperating agencies. Some activities are carried out in one agency, other activities in another agency. Efficient operation requires integrated activities, schemas and (physical or electronic) data exchange among different information systems. Data definitions must be specified in detail in certain cooperating areas. Interoperability at this level is partly manual work and partly supported by IT.

Stage 2 – Knowledge sharing; Agencies demonstrate their ability and determination to share knowledge. Knowledge sharing plays an important role for inter-organizational learning and innovation. Agencies put effort into defining best practices, specification of metadata, methods, and technical standards for information infrastructure, systems and data exchange. Bilateral exchange of knowledge requires places to meet and support from knowledge management systems.

Stage 3 – Joint value creation; Being able to see common value configuration is fundamental in creating added value from cross-agency services. Common information models and service catalogues are necessary for joint development of services for common end-users. Agencies are ready to bare costs although benefits may be created in another agency.

Stage 4 – Strategic alignment; Common strategic positioning requires (political) alignment of mission statements. Joint governmental financing of projects is necessary to achieve socio-economic benefits. Adaptation of laws and regulations is necessary to achieve strategic alignment.

As an overall impression, the interviewees found the suggested four stages relevant to their particular case. According to the respondents in Norwegian public sector organizations, too few stages will make the partition too large, and too many stages will make the partition too detailed. They argue it is more important to find a proper description of each stage of growth. Respondents' understanding of each stage is summarized below.

3.2 Dominant Problems and Benchmark Areas

Jayasuriya (1993) has discussed the growth of end-user computing, using a framework were structure, technology, and people, are interrelated and mutually adjusting benchmark areas. In a similar way, this research builds a composite analytical framework were each stage of e-government interoperability is

described in three different but related aspects: 1) organisational interoperability, 2) semantic interoperability, and 3) technical interoperability. These are similar to three aspects of interoperability identified by The European Interoperability Framework (IDABC, 2004). Table 3 was developed during the case studies asking respondents what were the dominant problems at each stage of e-governance interoperability. Respondents identified one or more important characteristics for each stage, which were later grouped into the three different but related benchmark areas.

Table 3. Framework for e-government interoperability

Stage / Benchmark area	Aligning Work Processes	Knowledge Sharing	Joining Value Creation	Aligning Strategies
Organizational Interoperability	**Efficient operation requires integration of activities and schemas (B) (A)**	**Best practices (A) Real-time knowledge transfer (A) Change of organizational culture**	**Cross-agency value configuration New services based on business cases Inter-organizational control mechanisms and trust**	Political decision-making Socio-economic benefits
Semantic Interoperability	**High degree of specificity and common data definitions in certain areas (B)**	**Meta data specification (A) Knowledge management system**	**Service catalogues Information models**	Adaptation of laws and regulations Business models
Technical Interoperability	Physical or electronic data exchange among separate applications (B) Closed systems (B)	Common architecture (A) Technical standards (A)	Joint application development Common databases Information security (A)	Joint financing

To illustrate application of the framework presented in Table 3, the Birth case (B) and the All In case (A) were selected to represent different levels of e-governance interoperability. Below, they are analysed based on the relevant parameters of the framework. The All In case has established a common service architecture indicating level 2 of technical interoperability. Today there are common tools and guidelines for service development, but little joint application development and no common databases. To a large extent, agencies have their own professional applications made available for end-users through a common information portal. Joint application development, planned in All In II, indicating they are striving for level 3. There is a high degree of specificity and there are common data definitions in schemas used by several agencies. Metadata is specified in semantic register for electronic interoperability. This indicates level 2 of semantic interoperability. Activities and schemas are to a certain degree aligned. Although some services are agency specific, there are examples of services developed for two or more agencies. The existence of All In user groups and service owner groups indicates organizational interoperability at level 2. The All In II project serves as an arena facilitating real time knowledge sharing used for joint service development. Overall, the All In case is at knowledge sharing stage trying to reach the next level of maturity by joining value creation.

In the Birth case work process “notification of birth” is aligned with some activities carried out at hospitals and some activities carried out within the Norwegian Tax Directorate, the National Registry. Today, work process is supported by separate information systems with physical data exchange (i.e., schema is printed and sent by mail in batch). Although physical data exchange between hospitals and the National Registry, requirement specifications are agreed upon to be able to collect, register, store and retrieve information about newborns. Overall, the Birth case is at an early stage regarding organizational interoperability with some work processes aligned. Although the Ministry of Health and Social Care has indicated a need for clear strategic control and management of ICT in health sector (press release 14/01/2009), there is still a long way to go. Today, responsibilities are fragmented and shared among several stakeholders, e.g., regional hospitals are allowed to decide upon their own information infrastructure and systems.

3.3 Possible Benchmark Variables

Organizational interoperability aims to link processes among different organizations. Thus, it is interesting to take a look at the inter-organizational architecture where these processes will take place. Conventionally organizational architecture consists of the formal organization, informal organization, business processes, strategy and human resources (e.g., Galbraith, 1995; Nadler & Tushman, 1997). These components can be

understood as the building blocks which are mandatory designing organizational interoperability. To obtain organizational interoperability in e-governance, agencies with different work practices must be able to design a common stage where this work takes place. Galbraith's (1995) star model is a framework for thinking holistically about major components of organization design. These major components are seen in an organizational interoperability perspective, were components must be aligned to make the public-sector agencies interoperable.

The parameter of strategy plays an important role in the development of organizational interoperability. As illustrated in the Birth case, the public agencies are focusing on their firm-specific skills and know-how, solving problems related to "life and death" and "collecting key numbers for tax purposes." The agencies have very different value creation logic, where hospitals are solving unique customer problems and where the National Registry is transforming inputs into outputs. The formal structure is based on a few guidelines and process descriptions to secure quality of the process. Participants facilitate the working relationship making it as efficient as possible. The business process has some integrative roles where stakeholders are doing separate parts of an overall work process. Workers are employed in very different organizations and motivated by work feedback related to their functional responsibility.

In the All In case, organizations are sharing knowledge, having strategic discussions on how to leverage distinctive internal or external resources. Being able to integrate and exploit strategic resources, they are trying to establish a strategic direction for the development of All In II. Information flows between participating agencies as they have established coordination committees, formal meeting for discussions, councils, etc. In the All In case there are clearly defined organizational roles for agencies participating in the information portal. The Brønnøysund Register Centre has the responsibility of coordinating profit-taking in industry and businesses, the Agency for Public Management and eGovernment has the responsibility of coordinating profit-taking of citizens and between public sector agencies. Agencies have the responsibility for their own services. The informal structure is based on trust and reciprocity. The formal and informal networks have created a culture for knowledge sharing. Individuals are learning from each other as well as from external sources.

Regarding *semantic interoperability*, the two cases studied showed different levels of maturity. The Birth case had developed a requirement specification, where common data is thoroughly specified, and this document is distributed to all stakeholders involved in the birth message. In the All In case metadata was stored in the semantic register for electronic interoperability.

Technical interoperability can be viewed as a starting point achieving e-governance interoperability. In the Birth case information infrastructure, participating agencies have their own systems and databases with physical schemas for data exchange. The All In case has established common infrastructure with common application architecture. Although agencies have their own applications there are protocols for sharing and data exchange. They have also developed general security services.

The two cases illustrate the use of benchmark variables that would enable the organization to develop plans and a strategy to utilize them. Organizational interoperability was influenced by the semantic and technical interoperability. In addition to these benchmark areas both legal interoperability and political context may influence e-governance interoperability.

3.4 Evolutionary Path

Agencies' maturity for e-government interoperability develops over time. The evolutionary path seems to be logic, although it cannot only be a linear progression. The average value may have a linear progression, but in certain areas the evolution may divert. Maturity and growth should be transparent for all cooperating parties. It is important that the agencies have a common goal (or expectations) for interoperability. Agencies experience development in cycles; some decades ago we were talking about maturity of end-user-computing, now it is interoperability in e-government. The next cycle can be something totally different because development will not stop. The maturation process varies among government agencies. The Birth case was initiated in 2004, but is still in a conceptual mode striving for level 1. The All In case has matured from its start-up in 2002, reaching level 2 with the All In II initiative.

4. CASE ANALYSIS AND DISCUSSION

The idea of making developing governmental e-services as described in the two cases has the following objectives. First, an electronic dialogue will make better services for end-users. Second, there is a great potential for more efficient services within the agencies. In addition, building cross-agency services for its citizens and public sector agencies will appear as a unity. According to the Office of the Auditor General of Norway (OAG, 2008b), there is poor utilization of the potential for the electronic exchange of information in the government administration: *"Many public sector agencies possess information that is useful to other public agencies,' says Auditor General […]. 'Better utilisation of this information could contribute to more secure, speedier and more efficient services for citizens and businesses."*

According to IDABC (2008), benefits can be classified by the interoperability level which provides them, the type of benefit obtained (cost, time, etc.) and by the beneficiary (agencies, businesses and citizens). At the technical level, interoperability amounts to dramatic savings in time and cost deriving from the avoidance of ad-hoc or point-to-point solutions. Furthermore, the resulting exchanges are likely to be more reliable and require less maintenance. Interoperability at the semantic level may benefit from labour-intensive and time-intensive actions needed to process data for reuse at the receiving end. Interoperability at the organizational level may benefit by enable certain processes and activities to take place, and certain objectives to be met, that often or normally would not be possible. Benefits to public agencies are such as: better and more efficient services facilitate reuse of data and functionality, improve management decision, speed up development, better coordination, and reduced ICT costs. Benefits for industry and businesses are such as: reduction of reporting burden, service aggregation and better coordination, increased and fairer competition. "The All In information portal has reduced the reporting burden of industry and business by a thousand man-years," said an information manager interviewed. Finally, benefits to citizens are such as: reduction of reporting burden, accurate and complete information in their dealing with governments, and citizen-centric services.

Contingency theory states that the relationship between some characteristic of an organization and its organizational effectiveness is determined by contingency factors (Legner & Wende, 2006). Applied to e-governance interoperability, we consider organizational interoperability as a characteristic of the organization. Effect on organizational performance depends on contingencies within the organization as well as outside of it. The underlying assumption is that the greater collaboration (in terms of higher interoperability), the better the results (in terms of organizational performance). According to Hansen (2009), working across organizational boundaries can create tremendous value or destroy it. The potential of collaboration can be such as: innovative cross-unit product development, increased sales through cross-selling, and transfer of best practices that reduce costs. But he also warns, the conventional wisdom rests on the false assumption that the more employees collaborate, the better off the company will be. A collaborative return is the difference between the projected financial return on a project and the two often overlooked factors – opportunity costs and collaboration costs (Hansen, 2009). A similar warning was also raised by a senior manager within the health sector, "higher organizational interoperability might also increase transaction costs." The manager was concerned with control and management cost related to definition of data, services, and business processes. As such, the challenge is to determine when it makes sense to collaborate and when it does not.

5. CONCLUSION

Companies can use models to identify which stage they are in, particularly when using the characteristics of each stage (Earl, 2000). Having positioned their firm, the stages of growth model potentially helps managers in identifying upcoming issues and thus provides a framework for planning and orchestrating the evolutionary journey. Using the benchmark variables suggested for e-government interoperability provides agencies with a set of considerations that may deserve special attention. And thus, the concept of stages of growth models should enable practitioners to better understand, manage and plan for the evolution in their firms (King & Teo, 1997). According to Burn (1993) an important feature of the stages of growth model is that it can identify for management where major transition points occur and also the change factors which need to be managed if staged growth is to be accomplished effectively.

Stages of growth models have the potential of creating new knowledge and insights into organizational phenomena. Such models represent theory building tools that conceptualize evolution over time in a variety of areas. For researchers, the conceptual stages of growth for e-government represent a theory to be explored and empirically validated. For practitioners, the stages of growth model represents a picture of evolution, where the current stage can be understood in terms of history and future.

In this research, the number of stages and the contents of stages were developed in an iterative cycle involving dominant problems that seem different at various stages. Two cases were applied to illustrate content characteristics of each stage as well as significant differences between stages, where preceding and following stages have different kinds of dominant problems. The suggested stages of the growth model for e-government by Gottschalk & Solli-Sæther (2008) was found relevant in two cases studied of government sector in Norway. Experience from the government sector in Norway was applied to explain stages, their contents as well as the evolution from one stage to the next stage. Potential benchmark variables was derived from discussions with practitioners.

Further research should carry out empirical testing of stage model benchmark variables. This can be done as a survey, where stages, evolution, as well as benchmark values are empirically tested. Based on the empirical test from survey research, the stages of growth model for e-government interoperability should be revised. It would also be interesting to investigate the effect of increased interoperability on benefits, in the direction of increased efficiency, effectiveness, and user satisfaction.

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