The modeling process for stage models

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ABSTRACT

Purpose – The purpose of this paper is to present and test a modeling procedure, as researchers have struggled for decades to develop stages of growth models that are both theoretically founded and empirically validated. This article presents the concept and hypothesis of stages, the history of stage models and a procedure that may serve as a useful tool in modeling stages of growth.

Design/methodology/approach – Based on previous research and lessons learned from case study experience of the government sector in Norway, a procedure for the stages of growth modeling process is suggested and demonstrated. The procedure was used developing a stage model for e-government interoperability.

Findings – This article provides new insight into issues and challenges faced when engaging in stages of growth research. The paper proposes a new approach to stages of growth modeling.

Originality/value – The utility of the suggested procedure is to improve theory building and empirical validation. The contribution to academia is the modeling process that can be applied in future developments of stages of growth. The contribution to practice lies in the stage hypothesis of organizational development over time.

Keywords: Stages of growth models, organizational evolution; generations of struggle; literature review; procedure for growth modeling.

The Modeling Process for Stage Models

INTRODUCTION

Stages of growth models have been used widely in both organizational research (e.g., Chandler, 1962; Greiner, 1972) and information technology management research (e.g., Gottschalk & Solli-Sæther, 2006; King & Teo, 1997; Nolan, 1979). 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 is the core idea of the concept of growth models.

Based on a comprehensive literature review, presented in Appendix A, we found that researchers have struggled to develop and test stages of growth models:

1. *The work related to stages of growth has to a large extent been conceptual.* Several authors have proposed theoretical stages of growth models for organizations (e.g., Burn, 1993; Earl, 2000; Jayasuriya, 1993; Jeffery & Leliveld, 2004), but they have not been able to empirically test the models.
2. *Empirical assessment of the stages of growth:* The debate over whether stages exist or not suffered from lack of empirical evidence. Researchers have tried to statistically test whether firms actually advance through stages over time, finding that empirical

validation of the stages of growth through benchmark variables has been problematic (e.g., Drury, 1983; Gottschalk & Khandelwal, 2004; Solli-Sæther & Gottschalk, 2008).

3. *There is no inevitable linear sequence of stages in organizational life*. According to Teo & King (1997), the contingency perspective emphasizes that there are no predictable patterns whereas the evolutionary perspective emphasizes the presence of predictable patterns. Some researchers support the argument that stages are not tight, discrete packages of internal characteristics that develop in response to dominant problems, but are instead somewhat fluid, with problems overlapping in adjacent stages (e.g., Kazanjian, 1988; Nolan, 1979). Other researchers find support for an evolutionary pattern of growth (e.g., Teo & King, 1997). Still, there are only a few longitudinal studies examining the progression patterns, and thus findings can only be considered preliminary with tentative conclusions, which serve as basis for longitudinal studies.

These and other challenges relate to the area of stages of growth modeling. Whereas most existing research and initiatives focus on development of growth models by suggesting a number of stages, benchmark variables, and the path of evolution between stages, a systematic analysis of the modeling process is currently lacking. Therefore, the objective of this paper is to illustrate the potential of stages of growth modeling if researchers are able to solve theoretical as well as empirical issues in such research.

The rest of the paper is organized as follows. First, we present the issues and challenges of stages of growth modeling. Second, we present a procedure for the stages of growth modeling process. Third, a case of empirical model testing is presented. Finally, we summarize the main results and provide some concluding comments.

LITERATURE REVIEW

The research addressed in this study is based on literature review on stages of growth models in the context of information technology and systems management. The review covered a number of information systems journals which either contained "stages of growth" or "maturity model" in their title or key words and it is summarized in a table in Appendix A. Three articles were published in the 70s, eight articles in the 80s, four articles in the 90s, and eleven articles in 20th century. A number of research methodologies have been used in these articles, e.g. conceptual and illustrative studies, case and field studies

Number of Stages of Growth

The findings from our literature review indicate that in the late 1970s and 1980s, stages of growth were considered to be a new field of research mainly within the field of information systems management. Nolan's (1979) stages of growth model of the evolution of data processing became a landmark reference. Nolan developed a model with six stages of growth and some workable benchmark variables identifying the stages. Several other researchers have been inspired by Nolan's model and they have studied growth in areas such as growth of end user computing (Huff, Munro, Martin, & Sibley, 1988), evolution of information centers (Magal, Carr, & Watson, 1988), and growth patterns of technology based new ventures (Kazanjian, 1988). King and Teo (1997) suggested a four-stage model for the evolution of information systems planning. The level of integration between business planning and information systems planning has the following four stages: separate planning with administrative integration, one-way linked planning with sequential integration, two-way linked planning with reciprocal planning, and integrated planning with full integration. Earl (2000) suggested a stages of growth model for evolving the e-business, consisting of the following six stages: external

communication, internal communication, e-commerce, e-business, e-enterprise, and transformation, while Layne and Lee (2001) developed a stages of growth model for fully functional e-government. In the area of knowledge management, Nikhil, Sharon and Anju (2007) developed a five level model. In the area of data warehousing, three stages of growth were identified (Watson, Ariyachandra, & Matyska, 2001). Teo and Pain (2004) introduce a model for web adoption and examine the characteristics of different level web sites in terms of their features. Each of these models identifies certain characteristics that typify firms in different stages of growth. Among these multistage models, models with four stages seem to have been proposed most frequently.

Explanation of the Concept and Hypothesis of Stages

Two decades ago, Kazanjian and Drazin (1989) found that a number of multistage models had been proposed, which assumed that predictable patterns exist in the growth of organizations, and that these patterns unfold as discrete time periods best thought of as stages. These models have different distinguishing characteristics. Stages can be driven by the search for new growth opportunities or as a response to internal crises. Some models suggest that organizations progress through stages while others argue that there may be multiple paths through the stages. Kazanjian (1988) applied dominant problems to stages of growth. Dominant problems imply that there is a pattern of primary concerns that firms face for each theorized stage. In criminal organizations, for example, dominant problems can shift from lack of skills to lack of resources to lack of strategy associated with different stages of growth. Kazanjian and Drazin (1989) argue that either implicitly or explicitly, stages of growth models share a common underlying logic: "Organizations undergo transformations in their design characteristics which enable them to face new tasks or problems that growth elicits. The problems, tasks or environments may differ from

model to model, but almost all suggest that stages emerge in a well defined sequence such that the solution of one set of problems or tasks leads to a new set of problems or emerging tasks which the organization must address."

Benchmark variables are often used to indicate characteristics in each stage of growth. A one-dimensional continuum is established for each benchmark variable. If benchmark variables are to be successful in classifying a maturity model, empirical evidence should conform closely to the proposed conceptual formulations. Since values of each benchmark variable are distinct at each maturity stage, the general proposition can be stated: *Values of benchmark variables for each stage of growth will statistically correspond with the conceptual formulations given for that stage.*

In order to validate a growth model, it is necessary to demonstrate that transitions occur through the stages. Thus, we need to empirically demonstrate that most organizations will evolve in the general direction from first stage to second stage and so on. The second proposition can be stated: *Organizations show predictable patterns of growth from first stage to second stage, and so on, until they reach the final stage.*

Workable Benchmark Variables

A typical approach of model testing includes the following steps. First, a verbal description of the stages of growth is provided and managers are asked to indicate which stage most closely describes the present situation or status in their company. Second, managers are asked to indicate the importance of certain benchmark variables or critical success factors (e.g., using Guttman scaling or 7-point Likert scaling). Finally, managers are asked to indicate paths of evolution. Results from model testing show that empirical validation is problematic (Drury, 1983;

Gottschalk & Khandelwal, 2004; Solli-Sæther & Gottschalk, 2008), but some researchers have succeeded in their validation (King & Teo, 1997; Teo & King, 1997).

The measurement of benchmark variables have been carried out using Guttman scales (e.g., King & Teo, 1997) or Likert scales (e.g., Luftman & Kempaiah, 2007; Teo & Pian, 2004). Guttman scaling is a cumulative scaling technique based on ordering theory that suggests a linear relationship between the elements of a domain and the items on the text, while the Likert scale is a psychometric scale commonly used in questionnaires, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement.

The idea of benchmark variables seems attractive at first sight, but appears to be difficult to implement. To start with, there must be a definition of the variable (e.g. a quantifiable concept). Second, there have to be arguments why the benchmark variables proposed have been selected. Third, benchmark variables should involve activities and structures that are characteristic for each stage of maturity. In some of the conceptual models, benchmark variables seem to come out of the blue.

Path of Evolution

The concept of stages of growth has created a number of skeptics. Some argue that the concept of an organization progressing unidirectionally through a series of predictable stages is overly simplistic. For example, organizations may evolve through periods of convergence and divergence related more to shifts in information technology than to issues of growth for specific IT. According to Kazanjian and Drazin (1989), it can be argued that organizations and organizational relationships do not necessarily demonstrate any inexorable momentum to progress through a linear sequence of stages, but rather that observed configurations of problems,

strategies, structures and processes will determine a firm's progress. Kazanjian and Drazin (1989) addressed the need for further data-based research to empirically examine whether organizations in a growth environment shift according to a hypothesized stage of growth model. Since Kazanjian and Drazin (1989) published their work, several research studies have attempted to empirically validate growth models with mixed results. In summary, there is only partial support for the contention that an organization develops through a predictable pattern that can be related to the problems a firm finds pressing at sequential times.

Key Findings from Literature Review

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 particular 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 a specific model may provide practitioners 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 that need to be managed if staged growth is to be accomplished effectively.

Four core topics emerge when theorizing on stages of growth. First topic is to decide upon the number of stages. Stage models found in our literature review have a limited number of stages with stages conceptualized and defined as significantly different form each other. Second topic is to identify dominant problems to each stage, indicating there is a pattern of primary concerns for each stage. Third topic is to identify workable benchmark variables. Benchmark variables

indicate the theoretical characteristics in each stage of growth. Forth topic is concerned with the paths of evolution. Our literature review indicates that growth elicits from the initial stage via intermediary stages to the final stage. In addition to these core topics, we also found that a systematic analysis of the modelling process is currently lacking.

MODELING PROCESS FOR STAGE MODELS

Based on our literature and generations of struggle, we suggest a procedure for the stages of growth modeling process (Gottschalk & Solli-Sæther, 2009) as illustrated in Figure 1. The modeling process represents a goal-oriented procedure where the stage model changes its status from a suggested stage model, via a conceptual and theoretical stage model, to an empirical stage model, and finally to a revised stage model:

- *Suggested Stage Model*. The initial stage model is based on ideas from both research and practice. Research literature has defined evolutionary aspects of the phenomenon, and practitioners perceive different maturity levels for the phenomenon.
- *Conceptual Stage Model*. The number of stages and the contents of stages are developed in an iterative cycle involving dominant problems that seem different at various stages. Case studies are 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.
- *Theoretical Stage Model*. Relevant theories are applied to explain stages, their contents as well as the evolution from one stage to the next stage. Benchmark variables are derived from these theories. At the same time, theories and benchmark variables are discussed in focus groups.

- *Empirical Stage Model*. Each benchmark variable is assigned a benchmark value for each stage of growth. A survey is carried out, where stages, evolution as well as benchmark values are empirically tested.
- *Revised Stage Model*. Based on the empirical test from survey research, the empirical stage model is revised.

The modeling procedure is in itself an evolution where new challenges emerge as soon as previous challenges have been solved. Researchers can use this framework to assess current status and to identify key issues that need to be addressed to guide development of stages of growth models. In previous articles, researchers have, based on interviews or their practical insight into the field of investigation, proposed conceptual stages of growth models. Only to some extent these models have been empirically tested and revised. Future research should be concerned with measurement issues, accuracy of the evolutionary path indicated, and explore economic effects of reaching higher levels of maturity. The suggested procedure for the stages of growth modeling process might help future research.

<Insert Figure 1 about here>

EMPIRICAL MODEL TESTING

To empirically test the suggested procedure for the stages of growth modeling process, we followed the proposed five steps developing a stage model for e-government interoperability, as discussed below.

In Step 1, we proposed a stage model for e-government interoperability. This was based on ideas from previous research, but also based on ideas from practitioners. The theoretical work was conducted as a thorough literature review of interoperability research. Results from the review

indicated interoperability research was at an early stage and that the definitions and concepts underlying e-government interoperability still was under discussion. Further, theoretical concepts and models that are empirically validated are still highly underrepresented. The empirical work was based on informal discussions with researchers and practitioners in the government sector of Norway. Putting together ideas from previous research and ideas from practitioners we suggested a growth model that has four sequential stages for e-government interoperability. The stages occur as hierarchical progression, and which involve both organizational, semantic and technical activities and structures. By systematically developing interoperability in terms of aligning work process (stage 1), knowledge sharing (stage 2), joint value creation (stage 3), and ultimately strategy alignment (stage 4), long-wanted benefits from e-government might be expected (Gottschalk & Solli-Sæther, 2008). The suggested stage model for e-government interoperability is shown in Figure 2.

<Insert Figure 2 about here>

In step 2, we developed a conceptual stage model. The empirical work was conducted as case studies in government organizations. The idea was to use two cases to test the suggested stage model for e-government interoperability. The cases were of secondary interest; they played a supportive role, facilitating our understanding of something else (Stake, 1994). The "Birth case" was in an initial phase of e-government interoperability trying to establish a new governmental e-service called notification of newborns, which is an electronic birth message from regional hospitals to the National Registry. The case involved different stakeholders, e.g., regional hospitals, the National Registry, the Norwegian Directorate of Health, and the Norwegian Centre of Informatics in Health and Social Care. The "All in" case was a mature one renewing a governmental information portal of public reporting involving services such as TAX, VAT,

salary and account, and annual report. In addition to heavy participation of the Brønnøysund Register Centre, representatives from central ministries were involved, e.g., the Norwegian Tax Directorate and Statistics Norway. The choice of cases was made because it was expected to advance our understanding of e-government interoperability. 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 empirical model testing.

Data collection was done through a total of 12 interviews, with questions addressing the specific governmental e-services, stages of growth, dominant problems and benchmark variables for e-government interoperability, 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. 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 important to find a proper description of each stage of growth. Interviewees suggested an additional stage 0, where no formal cooperation is initiated, could be added to the model as a conceptual planning stage.

Theoretically we followed Kazanjian (1988), trying to find a relation between dominant problems and stages of growth. We asked interviewees what were the dominant problems at each stage of e-government interoperability. Dominant problems were grouped into three different but related benchmark areas – organizational, semantic and technical interoperability. We identified a pattern of primary concerns that governmental agencies face for each stage of e-government

interoperability. Based on empirical work in case studies and the theoretical work, a conceptual description of stages was suggested.

In step 3, we developed a theoretical stage model for e-government interoperability using the dominant problems identified in the previous step and the different aspects of interoperability. 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, our research built a composite analytical framework where each stage of e-government interoperability was 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). The framework was developed during presentations and focus group discussions with public sector stakeholders, showing a relation between dominant problems and stages of growth.

Organisational interoperability was defined as the extent to which organisations using different work practices are able to communicate, and semantic interoperability was defined as the extent to which information systems using different terminology are able to communicate. Technical interoperability can be defined as the extent of systems to communicate, interpret and interchange data in a meaningful way (Archmann & Kudlacek, 2008).

Potential benchmark variables for each area were developed from theories. E.g., organisational interoperability aims to link processes among different organisations. Thus, it was interesting to take a look at the theory of inter-organisational architecture. Conventionally organisational architecture consists of the formal organisation, informal organisation, 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 organisational interoperability. To obtain organisational interoperability cooperating public sector agencies must agree upon at which stage this work takes place. Galbraith's (1995) star model is a framework for thinking holistically about major components of organisation design and served as a base for developing benchmark variables. Benchmark variables would enable organizations to develop plans and a strategy to utilize them.

The empirical work of **step 4** included an exploratory survey among 133 major government agencies, hospitals, and municipalities in Norway. Useable responses were returned by 50 organizations (37.5%). Most of the respondents were senior IT executives. In the data collection instrument, the four different stages of e-government interoperability (aligning work processes, knowledge sharing, joint value creation, aligning strategies), developed in step 2 as conceptual description of stages, were described. Respondents were asked to indicate the type that best described their organization's current level of maturity and their organization's path of evolution as well as. This type of self-typing paragraph approach has been used in organizational research before (e.g., King & Teo, 1997).

Results from the survey showed, aligning work processes occurs most often (38 %), followed by knowledge sharing (24 %), join value creation (16 %) and aligning strategies stage (12 %). In addition, some organizations (10 %) reported they were not involved in any e-government initiative (a possible initial stage of the model). This was not unexpected as the model assumes predictable patterns of growth, where organizations are likely to start solving problems in the first stage before moving on to the second stage and so on. Very few public sector organizations indicated that they had reached stage 4. Note that the sample size is relatively small.

In addition, for each benchmark variable, respondents were asked to select the characteristic that most closely described their organization's present situation. A similar methodology has been used by Teo and Pian (2004) in their empirical testing of benchmark variables for web adoption. When testing hypotheses, values of benchmark variables are expected to correspond statistically with conceptual stage formulations. Overall, statements supplied by responding organizations provided limited support for the e-government interoperability benchmark variables.

Based on the four first steps of the suggested procedure for stages of growth modeling, the researcher are able to revise the stage model **(step 5)** of e-government interoperability. That is to carefully evaluate the stage model, benchmark variables as well as measurement issues concerned with stages of growth.

<Insert Figure 3 about here>

Figure 3 presents a graphic of the modeling process applied in developing a stage model for e-government interoperability. Following the both empirical and theoretical work described in the suggested procedure, the researchers are able to revise the suggested stage model.

CONCLUSION

Researchers have struggled for decades to develop stages of growth models that are both theoretically founded and empirically validated. This article presented characteristics of stage models, criticism of stage models, history of stage models, and a literature review on stages of growth models, as well as a procedure for the stages of growth modeling process. This paper has suggested and demonstrated an iterative process for the stages of growth modeling process to improve theory building and empirical validation.

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 practitioners, a stage model represents a picture of evolution, where the current stage can be understood in terms of history and future. It is like a map where the practitioners can identify past, current, and future location. For researchers, a stage model represents a theory to be explored and empirically validated. It is like a foundation for stage modeling to generate insights into organizational phenomena.

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Figure 1: Suggested procedure for the stages of growth modeling process

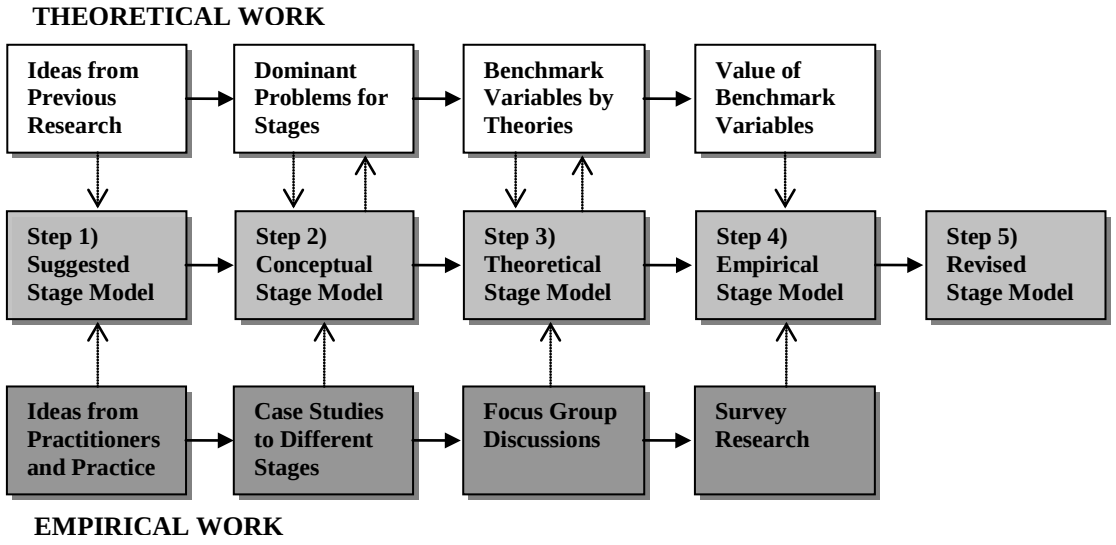


Figure 2: Stage model for e-government interoperability

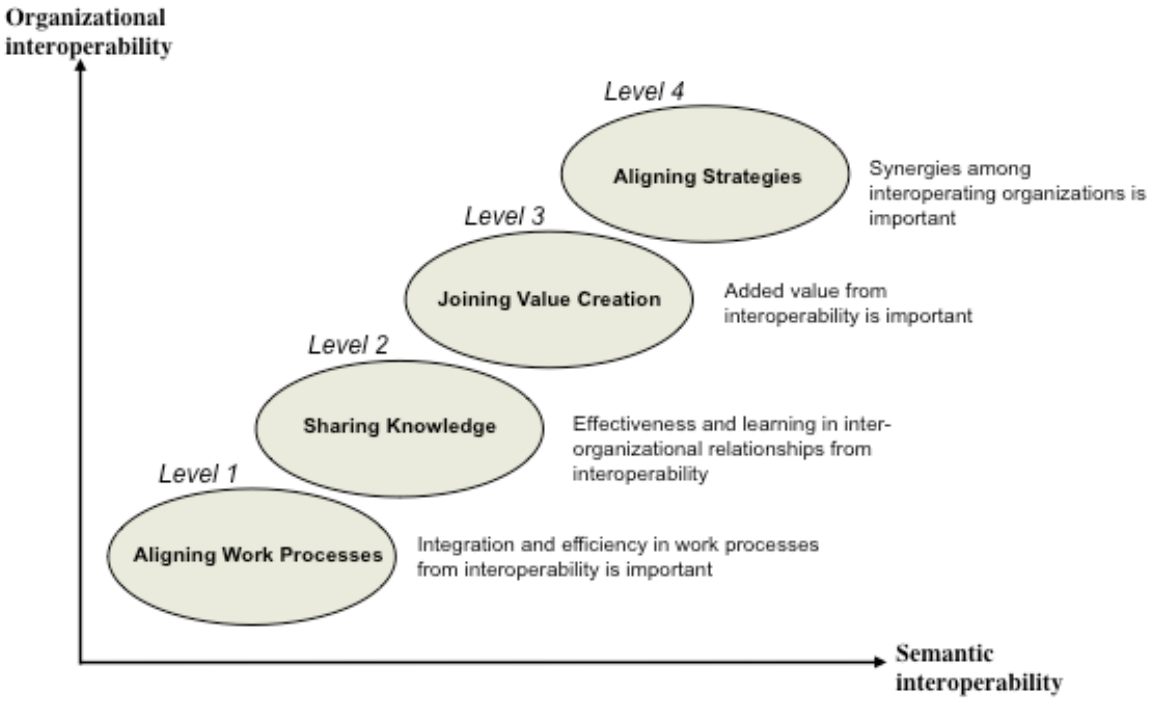
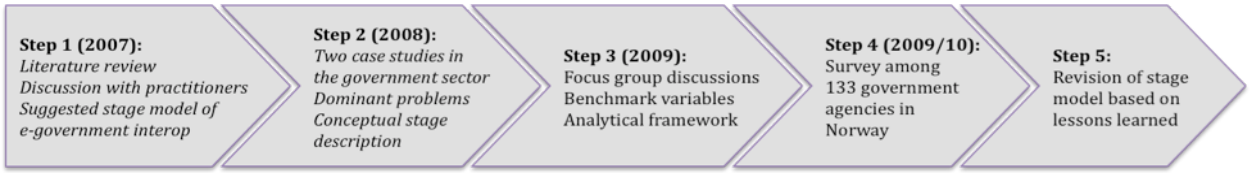


Figure 3: Example of modeling process for e-government interoperability



APPENDIX A: LITERATURE REVIEW ON STAGES OF GROWTH MODELS

Title/ authors	*Research design/ methodology*	*Scope of the research*	*Key conclusions/ findings*
Managing the computing resources: A stage hypothesis (Nolan, 1973)	Three companies	Expenditures for data processing	Suggests that the growth of computing follows an S-shaped curve that can be divided in into four stages: initiation, cognition, control, and integration.
Office automation: revolution or evolution? (Zisman, 1978)	Conceptual	Evolution of office automation technology	Outline of a conceptual framework of the evolutionary process of office automation, which will evolve and mature from a focus on task mechanization to one of process automation.
Managing the crisis in data processing (Nolan, 1979)	Studies of a series of large companies	Evolution of data processing; shift in management emphasis	Introduces a model with six stages for information technology maturity in organizations – initiation, contagion, control, integration, data administration, and maturity. Develops some workable benchmark variables identifying the stage.
An empirical assessment of the stages of DP growth (Drury, 1983)	Sample of 144 companies	Attempts to validate the stages of growth hypothesis by analyzing data concerning the benchmarks that were prescribed by Nolan	Although the hypothesis was not validated using the entire set of benchmarks for each stage, individual benchmarks were related to various DP management issues.
Corporate information systems management: the issues facing senior executives (McFarlan & McKenny, 1983)	Conceptual framework; based on field studies on 28 organizations over a seven-year period	Managing technology diffusion	Suggest a generic technology management stage model – technology identification and investment, technology learning and adaptation, rationalization/management control, maturity/widespread technology transfer. The process is considered as ongoing, with a new start for each new technology.
A critique of the stage hypothesis: theory and empirical evidence (Benbasat, Dexter, Drury, & Goldstein, 1984)	Review of (seven) empirical studies	Validity of the stage hypothesis as an explanatory structure for the growth of computing in organizations	Empirical support for the stage hypothesis is unconvincing. The various maturity criteria do not reliably move together, or even always in the same direction, thus refuting one of the requirements for claiming the existence of a stage theory.
Growth stages of end user computing (Huff, et al., 1988)	Field studies of information technology assessment and adoption	Nature and extent of interconnectedness	Describes the stages of growth and interconnectedness of the applications of end user computing in a model that is directed toward management and planning.
Critical success factors for information center managers (Magal, et al., 1988)	Field study of 311 information center (IC) managers	Identify and explore the stages of IC growth; investigate the CSFs for ICs; determine whether composite CSFs for ICs vary in importance among themselves and with the stages of growth	Four stages of IC growth are identified – initiation, expansion, formalization, and maturity. A principal component analysis is performed on the 26 CSFs which identify five composite CSFs: (1) commitment to the IC concept, (2) quality of IC support services, (3) facilitation of end-user computing, (4) role clarity, and (5) coordination of end-user computing. Statistical tests show that the

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			importance of these composite CSFs tend to vary among themselves but is relatively constant individually across the IC stages.
Relation of dominant problems to stages of growth in technology-based new ventures (Kazanjian, 1988)	Two case studies, and a survey of 105 firms	Growth patterns of technology-based new ventures	In the first study, a stage of growth model theorized to apply specifically to technology-based new ventures was developed. Stages are described as a configuration of organizational design variables representing a firm's response to the sets of dominant problems it faces at sequential times. The second study explored relationships between stages of growth and a theorized pattern of dominant problems. Partial support emerged for the link between dominant problems and stages of growth.
Managing strategies for information technology (Earl, 1989)	Conceptual	Experience in managing IT	The S-curves of learning visualized in stages of growth models seem to be repeated for the new technologies (e.g., data processing, micro computing, office automation, and telecommunication).
An empirical test of a stage of growth progression model (Kazanjian & Drazin, 1989)	Longitudinal sample of 71 ventures in computer and electronics industries	Development of a stage of growth model for technology based new ventures (TBNV)	Postulate four discrete stages of growth – conception and development, commercialization, growth, and stability. The hypothesis that TBNVs progress according to this model is tested using the Del procedure. Results suggest some variation in inter stage transition patterns.
Information systems strategies and the management of organizational change – strategic alignment model (Burns, 1993)	Framework evaluated by 56 organizations	Development of a theoretical framework to examine the relationships between organizational and IS strategy formulation	Different stages of growth in the use and development of IS requires different approaches to strategy, and different approaches to strategy are favored by different organizational configurations.
Stages of growth in end-user computing: applications in the health sector of developing countries in Asia-Pacific (Jayasuriya, 1993)	Three cases selected to represent different levels of growth	Describes a framework for analyzing and predicting growth of end-user computing in the health sector of developing countries	The basic stages of the model include – isolation, organizational integration, technological integration, and strategic integration. Structure, technology, and people parameters are used as benchmarks for each stage. The framework identifies key issues that need to be addressed in planning information systems.
Integration between business planning and information systems planning: validating a stage hypothesis (King & Teo, 1997)	Survey of 157 firms	Proposes and empirically validates a stages of growth model for the evolution of information systems planning	Results support the stages of growth model for integration of information systems planning (ISP) and business planning (BP), and the benchmark variables are generally found to be successful in predicting the stage of integration.
Integration between	Survey of 157 firms	Examining the evolution of ISP	The results confirmed the existence of an evolutionary pattern that

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business planning and information systems planning: an evolutionary-contingency perspective (Teo & King, 1997)		integration and the contingency variables that may influence BP-ISP integration	can be defined in terms of movement through four types of BP-ISP integration; administrative integration to sequential integration to reciprocal integration to full integration. Bypassed phases and reverse evolution, though observed, were uncommon.
Evolving the E-business (Earl, 2000)	Conceptual, based on observing, working with and researching companies	E-business as an evolutionary journey	Describes a six-stage evolutionary journey that corporations are likely to experience – external communication, internal communication, e-commerce, e-business, e-enterprise, transformation. Concludes with six lessons representing an essential agenda for evolving the business.
Assessing the impact of proactive versus reactive modes of strategic information systems planning (King & Teo, 2000)	Survey of 157 firms	The impact of information systems planning modes – defined as level of integration between BP and ISP	Firms operating in a proactive mode had significantly higher status for IS executive, significantly greater perceived IS contributions to organizational performance and significantly fewer ISP problems than did those operating in a reactive planning mode.
Developing fully functional E-government: A four stage model (Layne & Lee, 2001)	Grounded by various government websites and related e-government initiatives	Development of a stages of growth model for fully functional e-government	Posits four stages of a growth model for e-government – cataloguing, transaction, vertical integration, horizontal integration. Three fundamental technological and organizational challenges governments have to take into consideration are universal access, privacy and confidentiality, citizen focus in government management.
Data warehousing stages of growth (Watson, et al., 2001)	Eight expert interviews	Development of a data warehousing stages of growth model	Three stages of growth were identified – initiation, growth, and maturity. The nine variables that define each stage are data, architecture, stability of the production environment, warehouse staff, users, impact on users' skills and jobs, applications, costs and benefits, and organizational impacts.
Stages of growth for knowledge management technology in law firms (Gottschalk & Khandelwal, 2004)	Survey in law firms	How do firms move through various stages of growth in their application of knowledge management technology over time, and is each theoretical stage regarded as an actual stage in law firms?	A four-stage model for the evolution of information technology support for knowledge management is proposed and tested. Empirical validation of the stages of growth model through benchmark variables using Guttman scaling turned out to be problematic.
Best practices in IT portfolio management (Jeffery & Leliveld, 2004)	Survey of 130 companies	To find out if there were any broadly applicable stages of IT portfolio management effectiveness	Develop a model which segments a company's information technology portfolio management into four stages: ad hoc, defined, managed and synchronized. The stages are composed of major factors (developed through interviews), so that the synchronized stage include all the factors of the managed and the defined stages,

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			and the managed stage includes all the factors of the defined stage.
A model for web adoption (Teo & Pian, 2004)	Survey of 159 companies	Introduces a model for Web adoption and examines the characteristics of different level Web sites in terms of their features	The results indicate that the extent of the features tends to increase when the Web adoption progresses from lower to higher level. Two broad Web site categories can be identified: informational and transactional Web sites. Proactive business strategy, firm size, and competitive advantage was found to be positively related to Web adoption level.
Maturity model for IT outsourcing relationships (Gottschalk & Solli-Sæther, 2006)	Conceptual, based on organizational theories and outsourcing practices	Development of a theory-based stages of growth model for IT outsourcing relationships	First, relationships focus on economic benefits (cost stage), then there are concerns about access to competence (resource stage), and finally the development of norms and alliance management (partnership stage) are the main focus. Benchmark variables for each stage are suggested.
Infosys Technologies: improving organizational knowledge flows (Nikhil, et al., 2007)	Case study	Improvements in knowledge flow	A five-stage knowledge management maturity model was conceptualized to aid knowledge management implementation. The five different levels are labeled default, reactive, aware, convinced, and sharing.
An update on business-IT alignment: "a line" has been drawn (Luftman & Kempaiah, 2007)	IT Executives from 197 companies	Alignment between IT and business	Alignment involves interrelated capabilities that can be gauged by measuring six components: communications, value, governance, partnership, scope and architecture, and skills. Five maturity levels of IT-business alignment draw on the core concepts of SEIs CMM are: 1) initial or ad-hoc processes, 2) committed processes, 3) established, focused processes, 4) improved, managed processes, 5) optimized processes.
Stages of e-government interoperability (Gottschalk & Solli-Sæther, 2008)	Conceptual	Identify and discuss stages of e-government interoperability	Four stages are presented: work process stage, knowledge sharing stage, value creation stage, and strategy alignment stage.

Note: The review included the following major IS journals which either contained “stages of growth” or “maturity model” in their title or key words (most current volume available by February 2009); *European Journal of Information Systems, Information & Management, Information Systems Research, Journal of Information Technology, Journal of Management Information Systems, MIS Quarterly*, and *MIT Sloan Management Review*. Promising articles were followed back to their origin, whether based in articles, books, or dissertations.