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Preface

IFIP EGOV 2011 was the 10th annual international conference on electronic government research and practice organized by the International Federation for Information Processing Working Group 8.5 (Information Systems in Public Administration), or IFIP WG 8.5 for short. This conference has repeatedly been ranked as one of three core conferences worldwide in the research domains of eGovernment and eGovernance.

Traditionally, the series of IFIP EGOV conferences has attracted scholars from around the world. This was also the case in 2011, when the conference brought together scholars and practitioners from five continents and 39 countries.

As in previous years, IFIP EGOV was co-located with IFIP ePart, the IFIP Conference on eParticipation. IFIP ePart aims at presenting advances in both social and technological scientific domains, seeking to demonstrate new concepts, methods, and styles of eParticipation. IFIP ePart is closely aligned with the IFIP EGOV conference. The chairs of both conferences maintain close links and are committed to continue co-locating the two events in the years to come, which intentionally allows for exchange and cross-fertilization between the two communities.

The IFIP EGOV 2011 "Call for Papers" attracted 109 paper submissions, which included 84 full research papers and 25 work-in-progress papers on ongoing research as well as project and case descriptions, and 9 workshop and panel proposals. Among the 84 full research paper submissions, 38 papers (empirical and conceptual) were accepted for Springer's LNCS proceedings. These papers have been clustered under the following headings:

- Foundations
- Acceptance and Diffusion
- Governance, Openness and Institutions
- Architecture, Security and Interoperability
- Transformation, Values and Change

As in past years, Trauner Druck, Linz/Austria, published accepted work-in-progress papers and workshop and panel abstracts in a complementary proceedings volume. This year, that volume covers approx. 60 paper contributions, workshop abstracts, and panel summaries from both conferences, IFIP EGOV and IFIP ePart.

As in the previous years and per recommendation of the Paper Awards Committee, the IFIP EGOV 2011 Organizing Committee granted outstanding paper awards in three distinct categories:

- The most interdisciplinary and innovative research contribution
- The most compelling critical research reflection
- The most promising practical concept

The winners in each category were announced in the award ceremony at the conference dinner, which was a highlight of each IFIP EGOV conference.

Many people make large events like this conference happen. We thank the 95 members of the IFIP EGOV 2011 Program Committee and dozens of additional reviewers for their great efforts in reviewing the submitted papers. Marijn Janssen and his team at the Delft University of Technology were the major contributors who tirelessly organized and managed the zillions of details locally as well as the administrative management of the review process and the compilation of the proceedings.

The host of IFIP EGOV 2011 was the Faculty of Technology, Policy and Management (TPM) at Delft University of Technology, The Netherlands. Established in 1842 by King Willem II, Delft University of Technology (TU Delft) has a rich tradition reaching back more than 160 years. Initially, the university focused predominantly on civil engineering but today eight departments offer 15 Bachelor of Science and 29 Master of Science programs. With approximately 17,000 students and an academic staff of 3,000 (including 250 professors), TU Delft is the largest and most comprehensive university of engineering sciences in The Netherlands.

Delft is the epitome of a Dutch city with canals crisscrossing its historical center. Outdoor restaurants and pubs along with a myriad of retail shops make Delft a bustling place. The city is famous for its association with the Dutch Royalty (who are traditionally laid to their final rest in the city's cathedral), its blue pottery, and the renowned Dutch painter Vermeer. It was a great pleasure to hold IFIP EGOV 2011 at this special place.

August/September 2011

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Diversity and Diffusion of Theories, Models, and Theoretical Constructs in eGovernment Research

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Abstract. After more than a decade of research in the field of e-government, it is now timely and appropriate to reflect upon the overall developmental directions in the area. The purpose of this paper is to explore research progress to date by systematically analysing the existing body of knowledge on e-government related issues. Usable data relating to e-government research currently available were collected from 434 research articles. Based on the investigation of the various studies, our findings reveal that survey was the most utilised research method, and the Technology Acceptance Model was the most utilised theory to explain research models. Although a large number of theories and theoretical constructs were borrowed from the reference disciplines, their exploitation by e-government researchers appears largely random in approach. The paper also presents limitations and further research directions.

Keywords: E-government, Theories, Models, Theoretical Constructs, Methodologies.

1 Introduction

E-government is defined as the use of internet to deliver services and information to citizens and businesses [27, 28, 66]. It has been argued that the electronic government research now transitioning to maturity phase and emerging as a multi- and cross-disciplinary research area [72]. Although governments have adopted e-government rapidly, it remains comparatively a new experience. Over the past few years, a small but emerging body of scholarly literature about e-government has begun to come into view [57]. After a few years of rapid growth in the field it would be appropriate to pause and reflect on the state of e-government research [23] by means of examining the scholarly literature that has been published in it to date [57]. Despite the potential significant impacts of e-government systems on the public administrations, organizations, individuals, and society, so far, only a few systematic and thorough studies have been undertaken on the subject [23, 36, 44, 57, 72]. Andersen and Henriksen [2] conducted an analysis of 110 peer-reviewed journal papers and found that the IS research themes dominates the e-government research body and that

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interdisciplinary research involving core public administration research along with IS research is yet to emerge [2]. Gronlund [23] analysed a large number of papers from *DEXA*, *HICSS*, and *ECEG* conferences to conclude that the publications in the conferences need to address quality criteria such as rigor and relevance in order to develop eGov into a mature research field. Yildiz [91] randomly reviewed the limitations of the published eGov research. In line with previous studies, Scholl [72] analysed a sample of publications from e-government and public administration conferences and journals in order to describe the profile of the core researcher community. Although these studies provided the systematic reviews of research issues, topics and research community, none of them have explored a systematic use of theories, models and theoretical constructs.

A number of previous studies [2, 26, 91] have previously argued that the majority of published research in this area are weak in methodological and theoretical rigour and sometime less relevant to the practice. However, these arguments are yet to be supported by observation from the analysis of existing literature. Given the importance, complexity and existing gap in the topic area, and the lack of the published comprehensive review of the e-government adoption literature [81], the aim of this paper is to present a comprehensive retrospections of the previous e-government research studies that have taken place in terms of diversity and diffusion of theories, models, and methodologies utilised to examine issues related to e-government adoption and diffusion in both from individual and organizational perspectives.

2 Methodology

As a part of active research in the literature review, we began to search the articles related to e-government by developing some relevant set of keywords appropriately through our online journal database *ISI Web of Knowledge®*. We finally found 823 articles from journals (such as *Government Information Quarterly*, *Journal of Strategic Information Systems* as some of the leading journals) and conferences (such as *IFIP EGOV and Pacific Asia Conference of Information System* as some of the leading conferences) on electronic government by the applied search process. With an extensive search process, we were able to find out 433 suitable journal and conference articles. Moreover, the dedicated journals for electronic government research were also considered for getting some appropriate articles required for our research. Three dedicated journals such as *Transforming Government: People, Process, and Policy (TGPPP)*, *Electronic Government, an International Journal (EGIJ)*, and *International Journal of Electronic Government Research (IJEGR)* were explored for the same. We found a total of 85 articles in *TGPPP*, 171 in *EGIJ*, and 90 in *IJEGR*. Out of these dedicated journal articles, 26 articles from *TGPPP*, 91 from *EGIJ*, and 83 from *IJEGR* were found relevant for electronic government research.

Considering all generic and specific electronic government literatures, it was found that a total of 434 research studies consisting of the articles from *ISI Web of Knowledge®* and dedicated journals were suitable for our studies. These usable articles were again scanned for those which have utilised certain theories, variables

and constructs to analyse the various electronic government applications of different countries. The focus was also for those articles which have used the existing theories, models, and frameworks to discuss the e-government developments and issues. It was visualized that a total of 112 articles used the different theoretical constructs to discuss the overall e-government scenarios. It was also noticed that 70 studies used various theories, models, or frameworks either in their original structure or in the altered form to base their research models.

We collected overall 363 independent and 158 dependent variables from the studies which used variables and constructs to represent their research. After further scanning of these variables 177 independent and 110 dependent variables were subjected to further analysis. These independent and dependent variables were then categorized into four different groups such as environmental, individual, innovation, and organizational characteristics [39].

3 Findings

Table 1 shows the list of those theories or models which have been used either in its partial or complete form to represent the specific e-government research model along with the corresponding methodologies utilised for those studies. In course of screening all the research studies it was found that 70 of them used the existing models or theories to represent their cases. Analysing such models it was also noticed that TAM was the highly utilized model (25 studies) for examining the issues related with electronic government adoption. This is followed by Information System Success Model (11 studies) [14][15], diffusion of innovation (DOI) (11 studies), unified theory of acceptance and use of technology (UTAUT) [85] (9 studies), theory of planned behavior (TPB) (8 studies), extended technology acceptance model (TAM2) (4 studies), theory of reasoned action (TRA), structuration theory, and trust model (3 studies each) as some of the frequently utilised models and theories for representing the electronic government research models. While analysing the 70 research studies, it was also marked that 90% (N=63) of research studies based on any one of 29 existing research models or theories were published in or after the year 2006 whereas only 10% (N=7) got published on or before the year 2005. As far as the methodologies for these theories and models are concerned, most of them used survey (N=61) as their methodology whereas a very few theories (N=9) have used the other methodologies such as secondary data analysis, case studies, descriptive approach, and literature review and synthesis to represent their cases. Out of total 29 theories and models being employed to represent the models of 70 studies, two theories were used purely for case studies (Governance Theory, and Intermediation Theory), whereas three of them used only for descriptive approaches (Grounded Theory, Dynamic Info-Inclusion Theory, and Complexity Theory).

Moreover, out of 70 studies which used existing theories and models as the foundation for explaining their research models or frameworks, 20 used more than one theory or model. Five studies [20, 24, 29, 52, 58] used TAM and TPB together, four of them [6, 24, 48, 77] used even three theories or models, whereas three [32, 68, 74] used TAM and DeLone and McLean's [15] IS success model together to propose

Table 1. Model-wise utilised methodologies

Theory/Model/Framework	Methodology/Source
Technology Acceptance Mode (TAM)	Survey: [6], [8], [9], [12], [16], [20], [24], [29], [32], [48], [49], [52], [58], [63], [67], [68], [74], [77], [76], [79], [86]; Interview: [84], [86], [89]; Secondary Data Analysis: [31]; Case Study: [69]
Information System Success Model (DeLone and McLean, 1992, 2003)	Survey: [19], [22], [30], [32], [55], [59], [65], [68], [74], [80], [87]
Diffusion of Innovation/ Diffusion Theory/ Innovation Diffusion Theory	Survey: [6], [10], [16], [17], [24], [48], [58], [70], [77], [82]; Case Study: [69]
Unified Theory of Acceptance and Use of Technology (UTAUT)	Survey: [7], [35], [51], [67], [71], [83], [88], [90]; Theoretical Approach: [5]
Theory of Planned Behavior	Survey: [11], [20], [24], [29], [33], [34], [41], [52]
Extended TAM	Survey: [1], [69], [70]; Interview: [89]
Theory of Reasoned Action	Survey: [5], [58]; Interview: [79]
Trust Model	Survey: [4] [6], [50], [60]; Questionnaire: [48]
Active Agent Framework based on Structuration Theory	Interview: [61], [75]; Literature Review: [62]; Case Study: [75]
Other less frequently utilized theory: Decomposed Theory of Planned Behavior-Survey: [46], [47]; IS Success Model [60]- Survey [78]; Resident Decision Model- Questionnaire: [25]; IS Planning and Investment Model- Secondary Dataset, Survey, Interviews: [45]; Social Cognitive Theory: Questionnaire Survey: [51]; Leadership Theory- Case Study, Interviews; Stakeholder Theory- Case Study, Interviews: [53]; Actor Network Theory- Case Study, Survey: [3]; Schutzian Theory of Human Agency- Descriptive Approach: [21]; Dynamic Info-Inclusion Model- Secondary Data Analysis: [40]; Theory of Connection- Literature Study: [13]; Grounded Theory- Secondary Data Analysis: [31]; Governance Theory- Case Study: [43]; Structurational Model of Technology- Literature Review: [62]; Transaction Cost Analysis- Survey, Questionnaire: [77]; Coordination Theory- Case Study, Interviews: [38]; Institutional Theory- Web-Based Survey: [54]; Complexity Theory- Descriptive Approach: [18]; Intermediation Theory- Case Studies: [37]; IS Success Sub-Model- Survey: [19]	

and test their research models. One study [79] used TAM and TRA together however, other few studies have used two similar models to explain the resulting research, such as Sang et al. [69] used TAM and TAM2, Floropoulos et al. [19] used two success models: DeLone and McLean's [14] updated IS success model, and Seddon's [73] IS success sub-model, and Parvez [62] based his model on Gidden's structuration theory, and Orlikowski's structurational model of technology (SMT).

Table 2 demonstrates a few variables from a list of 177 unique independent variables selected from an overall count of 363 variables used across 112 studies. These unique independent variables are categorized into four different groups such as environmental (23 variables), organizational (91 variables), individual (35 variables), and innovation (28 variables) characteristics as per their traits. Environmental, organizational, individual, and innovation characteristics are the factors that describe the environment, organization, individual, and innovational traits [39] of the underlying variables in the suitable contexts respectively. It was found that organizational characteristics were the most utilised one among the others followed by individual, innovative, and environmental. Amongst four categories, largest (C=11) number of variables among organizational characteristics category were used as independent as well as dependent

variables. Similarly, six variables from innovation characteristics, five from individual characteristics, and one from environmental characteristics were used both as independent as well as dependent variables. Analysing all 112 studies that used the theoretical constructs, it was found that only 12 of them were related to pure organizational perspectives.

Table 2. Independent variables and their final four groupings (Adapted from Jeyaraj et al. [39])

Categories	Example Independent Variables**
Environmental Characteristics The factors that describe the environment	Adequacy, Competition, Dominance, E-Commerce, External Influence, Linguistic Diversity, Persuasion, Primary Influence, Social Norms, Web Adoption*
Organizational Characteristics The factors that describe an organization	Administrative Autonomy, Business Competitiveness*, Business, Internet Use, Centralization, Clarity, Collaboration, Cost, Experience, Employee, Enacted Technology*, Facilitating Conditions, IT Leadership*, Job Productivity
Individual Characteristics The factors that describe an individual	Age, Anxiety, Attitude*, Behavioral Intention*, Commitment*, Education, Effort Expectancy, Empathy, Gender, Image, Income, Individual Impact*, Perceived Behavioral Control*, Self-Efficacy, Usage
Innovation Characteristics The factors that describe the innovation	Accessibility, Accuracy, Compatibility, Complexity, Cumbersome, Perceived Ease of Use*, Perceived Knowledge, Perceived Quality, Perceived Usefulness*, Relative Advantage, Self-actualization, Service Quality*, System Quality*,

[**Legend** *: Variables also used as dependent variables; **: Only a few example independent variables shown due to space constraints]

Similar to the independent variables categorization, a list of 110 unique dependent variables gathered from a collection of overall 177 dependent variables from 112 research studies. These variables were also divided into four categories: environmental (11 variables), organizational (52 variables), individual (25), and innovation (22 variables). The most frequently used dependent variables include intention to use (23 studies), perceived usefulness (20 studies), behavioral intention (16 studies), adoption behavior (13 studies each), and trust (8 studies). This trend is similar to the one investigated in a study of IT innovation and adoption research carried out by Jeyaraj et al. [39]. The categorization also revealed *ethnic minority, business competitiveness, environmental activism, and e-elections* as the environmental characteristics; *competitive advantage, net benefits, customer, decision quality, revenue generation, results, and social trust* as the organizational characteristics; *age, attitude, behavioral intention, satisfaction, and usage* as individual characteristics; and *efficiency, information quality, service quality, system quality, enacted technology, and perceived usefulness* as innovation characteristics to count a few. Due to the space limitation all variables are not listed in Table 2, but interested readers may request them from the authors.

4 Discussion

Looking at the theories and models along with the methodologies applied for 70 studies which used the existing models and theories either in original or altered forms to represent the e-government research models, it was found that survey was the most frequently utilized method across various theories and models explored. The striking reason for this may be because of the ease of collecting data based on the existing models would have inspired the researcher to go for survey methodology. The compelling reason for using any other methodologies except survey such as case study, descriptive approach, and secondary data analysis, literature study etc. may be completely based on the qualitative nature of the theories such as governance theory, intermediation theory, grounded theory, dynamic info-inclusion model, theory of connection, and complexity theory applied to represent the suitable research cases.

Investigating the theories and models used by the studies to include different constructs, it was seen that few studies used even three theories or models to propose an integrated model. For example, a study by Carter and Belanger [6] integrated the combination of three models to propose and test their conceptual model. The theoretical models, in particular TAM and DOI, have overlapping constructs. The '*complexity*' construct from DOI is similar to the perceived ease of use (PEOU) construct from TAM. Similarly, some researchers have suggested that perceived usefulness and relative advantage are the similar constructs [6]. Carter and Belanger [6] argued that they included both DOI and TAM in the e-government adoption because DOI adds up significant contribution to the prophecy of adoption intent [64]. But, combining similar constructs together definitely raises the issue of repeating the similar variables and would make the resulting model less relevant and more repetitive in nature that may likely to add minimal contribution to the existing knowledge. Similarly, Floropoulos et al. [19] adapted both DeLone and McLean [15] updated IS success model, and Seddon's [73] IS success sub-model. This raises a serious question of repetition of constructs as the former model is constituted of the later model.

Examining the unique independent constructs from 112 studies indicated that more than 50% of variables fall under the organizational characteristics even though only 12 out of 112 studies have investigated organizational issues. The major reason for such diverse extent of use of organizational characteristics might be due to certain variables which were although used for employees (considered as individuals), can be more influential to describe the organizational traits than the individual or personal characteristics. The investigation of 10 or higher frequencies for some of the constructs such as perceived ease of use (29 studies), perceived usefulness (24 studies), education (17 studies), age (15 studies), trust (14 studies), gender (13 studies), compatibility (12 studies), subjective norm (12 studies), attitude (11 studies), and self-efficacy (10 studies each) clearly designated that the individual and technology/innovation traits are more frequently examined in the e-government adoption and diffusion research than the organizational characteristics. However, a majority of constructs with organizational characteristics have fewer occurrences across the varied research studies.

5 Conclusions

The following prominent points can be drawn from findings and discussions of the study:

(1) Technology Acceptance Model (TAM) was the highly recommended model (25 studies) for representing e-government research studies. This is followed by DeLone and McLean's IS Success Model (N=11), Diffusion of Innovation (N=11), Unified Theory of Access and Use of Technology (UTAUT) (N=9), and Theory of Planned Behavior (TPB) (N=8) as some of the most frequently utilised models.

(2) 90% (N=63) of overall research studies (N=70) which are based on any one of 29 existing research models or theories were published in the span of last five years only.

(3) TAM and TAM2 have been used together in some studies even though TAM2 model is the extension of TAM model.

(4) The survey method was used in 87% (N=61) of the total number of studies (N=70).

(5) Although only 12 studies were related to pure organizational perspective, 51% (N=91) of total independent constructs (N=177), and 47% (N=52) of total dependent constructs (N=110) fell under organizational characteristics category.

(6) From a list of variables, 23 (i.e. 11 from organizational, 6 from innovation, 5 from individual, 1 from environmental) constructs were used both as independent as well as dependent variable.

(7) Perceived usefulness, attitude, satisfaction, perceived ease of use, and perceived behavioral control were some of the most frequently utilised independent as well as dependent variables.

6 Limitations and Future Research Directions

The first limitation of this research is the inaccessibility of a number of relevant studies through researchers' library. The accessibility of such papers would have helped in performing more accurate and in depth analysis. Secondly, this study does not take into consideration the moderating variables. Thirdly, this study concentrates only on the specific aspects of adoption and diffusion for e-government research. Finally, the papers from conferences such as *DEXA*, *HICSS*, and *ECEG* and journal such as *Information Polity* have not been explored to identify relevant research studies on e-government adoption and diffusion.

These limitations of the existing study can be proved to be a step forward toward the future research directions. More papers which could not be accessed should be taken into consideration in the future review of e-government research. The consideration of moderating variables and their explanation may bring in some more interesting facts to correlate and explore along with independent and dependent

variables. Also, this study only explored and analysed theories and models related to adoption and diffusion of e-government. However, there might be a number other theories and models (for example, Klievink and Janssen [42] examined e-government transformation and evolution using Nolan's stage model) that have used to study other aspects of e-government. Therefore, a further effort is required to explore and identify such theories and relevance in e-government context.

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Building Theoretical Foundations for Electronic Governance Benchmarking

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Abstract. The success of the electronic governance (EGOV) benchmarking has been limited so far. Lacking a theory to integrate existing conceptualizations has made the acquisition and sharing of knowledge produced by different benchmarking exercises difficult. In order to address this problem, this paper: 1) explains the nature of the EGOV benchmarking activity though a well-established theoretical framework - Activity Theory, 2) applies the framework to carry out a mapping between a number of existing EGOV benchmarking conceptualizations, 3) develops an unified conceptualization based on these mappings and 4) validates the resulting model though a real-life national EGOV strategy development project. The use of the Activity Theory in the paper has enabled defining and relating initial dimensions of the EGOV benchmarking activity, and mapping the dimensions present in existing conceptualizations. This not only created a unifying theoretical basis for conceptualizing the EGOV benchmarking activity but allowed learning from and integrating existing conceptualizations. The work impacts on the EGOV benchmarking practice by enabling a logical design of the activity, and contextually correct understanding of existing EGOV benchmarking results with respect to their intended usage.

Keywords: Electronic Governance, Benchmarking, Activity Theory.

1 Introduction

Since it was introduced by Xerox Corporation over two decades ago [2][10], benchmarking has become a well established tool for improving organizational performance and competitiveness particularly in the private sector. With increasing focus on performance management and continuous improvement in government, benchmarking has been also accepted as a useful management instrument in the public sector [16]. In particular, the international benchmarking series like the United Nations e-Government Survey, Accenture e-Government survey or the European Union e-Government Study are well known in the EGOV domain [7][8][22].

The concept of benchmarking has received various definitions. For instance, [17] refers to the process of evaluating and applying best practices in order to improve performance while [15], in the EGOV context, defines benchmarking as a systematic comparison of the performance of (parts of) organizations and their similar services,

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processes and routines, based on predetermined indicators, with the goal of improving performance by learning from one another. As a concept, benchmarking has evolved significantly over the years. Today, competitive, process, strategic and network benchmarking are all carried out in private and public sectors, and at the international, regional and national levels [17][18][24], with contemporary practice shifting from model learning (i.e. learning what) towards process learning (i.e. learning how) and adaptive learning (i.e. learning to change) [17]. For any organization involved in the benchmarking exercise, the final pragmatic goal is identifying learning points and understanding how what has been learnt could make the organization better [2].

As a research domain, benchmarking research is fairly mature. For instance in 2002 there were over 350 publications on benchmarking, shared between foundations (46%) and applications (43%) [9]. In February 2011, the authors' search in the Scopus database (www.scopus.com) of the articles with "benchmarking" in the title resulted in over 4000 publications and a dedicated journal: Benchmarking - An International Journal. Despite this, [3] notes the scarcity of literature devoted to the conceptual and practical problems of EGOV benchmarking. Indeed, the Scopus database search produced only 40 publications in this area, congruent with the finding by Yasin [29] that only 1.8% of the benchmarking literature is associated with the public sector.

The need for a better theoretical and conceptual foundation for benchmarking in general and for EGOV benchmarking in particular were pointed out in [10][17][20]. Specifically, [29] asserted in 2002 that the academic community was lagging in developing models and frameworks that integrate many aspects of organizational benchmarking. Since then, efforts aimed at providing the required conceptual foundations have been documented in [3][8][12][15], albeit using different terminologies and levels of abstraction. The resulting conceptual multiplicity makes the integration of research findings associated with different conceptualizations difficult, and leaves the need for more theory development unresolved [19].

Many of the reported issues relating to the EGOV benchmarking practice are arguably caused by a mismatch between the original purpose and subsequent use of the benchmarking results [25]. For instance, it is common for EGOV benchmarking series to rank countries in very different ways. In order for governments to learn from and exploit these differences, they must understand how the goals, scope, measures, etc. used by different series are related, how to correctly and meaningfully interpret and reason about different benchmark data with respect to specific exploitation goals, e.g. to inform EGOV strategy formation for better EGOV global positioning.

To address the problem above, this paper applied Activity Theory [1] as a unifying framework. A tool for better understanding human activities taking place within social and organizational contexts, Activity Theory has been widely used in learning, organizational analysis, design of interactive systems, enterprise engineering and others [1][23][27]. As EGOV benchmarking is an activity situated within the government context, carried out by policy makers, strategists and researchers to achieve certain learning-oriented outcomes, it is intuitively amenable to Activity Theory-based analysis. Indeed, [23] shows how Activity Theory can be applied as a mapping and integrative framework for enterprise ontologies. Here, Activity Theory is used to align existing conceptualizations of EGOV benchmarking, and to integrate them into a unified conceptualization which, well-grounded in theory, enables specification and analysis of EGOV benchmarking. The paper also shows how this

unifying conceptualization was build and applied in analyzing a concrete benchmarking activity within a real-life national EGOV strategy project.

Our contributions to EGOV benchmarking research and practice are as follows: 1) providing a theory-based unifying model which identifies and relates the core dimensions of the "EGOV benchmarking" concept, and 2) enabling detailed design of the EGOV benchmarking activity as well as detailed profiling of existing EGOV benchmarking initiatives to guide the use of their associated results.

The rest of the paper is organized as follows. Section 2 provides an overview and analysis of existing EGOV benchmarking conceptualizations. Section 3 presents the methodology adopted to guide this research, followed by the presentation of Action Theory as adopted theoretical framework in Section 4. The Activity Theory-based benchmarking model and the process of mapping and integrating existing conceptualizations using this model, resulting in the unified EGOV benchmarking conceptualization, is described in Section 5. Section 6 validates this conceptualization though a real-life national EGOV strategy project, Section 7 discusses the findings of the paper, and Section 8 provides some conclusions.

2 Related Work

This section provides an overview and discussion of eight EGOV benchmarking conceptualizations. Section 2.1 presents five research-oriented conceptualizations, followed by three practice-oriented conceptualizations in Section 2.2, and some observations about these conceptualizations in Section 2.3.

2.1 Research-Oriented Conceptualizations

Among the research-oriented conceptualization presented below, [17][25] were published in measurement-related journals, [3] in a public administration journal and [8][15] in EGOV journals. Among them [3][8][15][25] address EGOV benchmarking, while [17] addresses general benchmarking.

Kyro et al. [17] argue for the need to update the traditional concept and forms of benchmarking to address contemporary issues. To this end, the activity is described using three dimensions: benchmarker - who is benchmarking; target - what is to be benchmarked; and partner - with whom the subject will be benchmarked.

Banister [3], to answer the questions of usefulness and beneficiaries of EGOV benchmarking, discusses conceptual issues in EGOV benchmarking and proposes three questions for any benchmarking exercise: what is the purpose, what is to be measured, and what type of benchmarking should be carried out.

Saleem [25] provides a conceptual framework to guide governments in assessing the applicability of EGOV benchmarking as a driver for EGOV initiatives. The framework employs four dimensions to analyze international benchmarking reports: context, methodology, benchmarking type, and sociological paradigm.

Codagnone et al. [8], drawing from concrete practice, describe a conceptual framework for EGOV benchmarking based on the European Commission's benchmarking projects. The framework provides three dimensions in the form of questions: what to measure, how to measure, and for whom to measure.

Lastly, Jansen et al. [15] describes a model-based method aimed at improving the practice of EGOV service benchmarking, with fives benchmarking dimensions: goal, respondents, indicators, methods and infrastructure; and three levels of analysis: benchmark partner level, organizational level, and specific service level.

2.2 Practice-Oriented Conceptualizations

Among the practice-oriented conceptualizations [12][14][26] presented in this section, [14][26] focus respectively on benchmarking Information Society and EGOV within the European Union, while [12] provides concrete EGOV benchmarking guidelines. The three conceptualizations are described as follows.

IANIS [14] identifies a number of dimensions for carrying out benchmarking in support of EU regional strategies for developing the information society: what to collect data about, when to collect data, about whom to collect data, from whom to collect, how to collect secondary data, how to collect fresh data, at what level of aggregation to compare regions, and how to process benchmark data.

EUeGovBe [26] is a related but specialized framework for EU e-Government Benchmarking. The framework presents three detailed dimensions: guiding principles and policy, benchmarking method and reporting and learning.

Heeks [12] provides detailed guidelines on how to answer the questions of purpose, subject, method and presentation of EGOV benchmarking, together with conceptual models to support the operationalization of the benchmarking exercise.

2.3 Observations

As we can see in Sections 2.1 and 2.2, the purpose of conceptualizations varies, from analysis of benchmarking initiatives, through effective use of benchmarking results, to standardization of the benchmarking practice and tracking of policy implementations.

Unlike traditional benchmarking which is carried out by an organization to learn from others, and thus improve its own operations, EGOV-related benchmarking is carried out mostly by third-party organizations [3]. Among the reviewed conceptualizations, only [15][17] position government in the role of a benchmarking entity. This may affect the expectations of the learning outcomes in the EGOV benchmarking. For instance, only [12][26] explicitly address the learning objectives.

Considering our goal, none of the research-oriented EGOV conceptualizations, except [17], has been formally derived or associated with specific theory or existing conceptualization. The conceptualizations are also relatively incomplete, compared to generic ones [17], lack validity information, and mappings between them do not exist.

3 Methodology

By conceptualization we mean the process of transforming a theoretical construct, for instance “EGOV benchmarking”, into observable or measured concepts, for instance the “benchmark method” with “scope”, “data gathering method”,” type of analysis” and “research paradigm” elements [19]. By theoretical construct we mean a set of conceptual terms used to define a phenomenon of theoretical interest [11], used as fundamental elements to drive research and practice in a given field [15].

Conceptualization is essentially carried out in two ways: theoretical – starting from a theoretical construct and then operationalizing and measuring it, or observational - starting with observations and relating them through models. Adopting the former approach, this work starts with the EGOV benchmarking construct but, to minimize possible inconsistencies caused by different operationalizations, constrains the resulting conceptual model in a way similar to the hybrid approach described in [19].

The methodology prescribes two basic steps grounded in Activity Theory [19] and depicted in Table 1: inductive - determine the dimensions of the construct, and deductive - relate the dimensions into a conceptual model. The former starts by considering benchmarking simply as an activity undertaken by human agents for a certain purpose. This enables the grounding of benchmarking in Activity Theory [23][27] and identification of initial dimensions of the benchmarking construct, used to discover domain-specific dimensions from the conceptualizations in Section 2. The task is analogous to ontology mapping [5] or integration of constructs [17]. The deductive step systematizes the dimensions, creating a conceptual model for EGOV benchmarking, where the meaning of dimensions and the relationships between them are consistent with those of the underlying Activity Theory-based benchmarking model. The approach is similar to [17] – mapping and analyzing benchmarking conceptualizations to build a more detailed conceptualization, and [23] – using Activity Theory to synthesize dimensions of an enterprise ontology.

Table 1. EGOV Conceptualization Methodology

	Inductive Step	Deductive Step
Activity Theory	Generic dimensions for the benchmarking construct based on Activity Theory	Activity Theory-based model for benchmarking
EGOV-related Conceptualizations	Domain-specific EGOV benchmarking dimensions with existing conceptualizations	EGOV with domain-specific dimensions

4 Theoretical Framework – Activity Theory

The Activity Theory is a tool for better understanding human activities within social and organizational contexts, attempting to link human actions with the relevant contextual elements [28]. The theory enables assessing the factors that influence the performance of an Activity by a Subject, using Artifacts, subject to certain Rules, and divided among members of a Community to act in specific Roles, to accomplish an Object and ultimately an Outcome that influences an organization [23]. Figure 1 depicts the model of an activity derived from Engestrom [30] and the original in [28].

As a unit of analysis, activities are [28]: 1) mediated using artifacts and tools; 2) pragmatic as they are driven by objects and motives; 3) situated in specific time, space and community; 4) provisional as they evolve continuously; and 5) contested since they involve varied interests, viewpoints and perspectives and often give rise to contradictions both within and between activities (dialectical perspective).

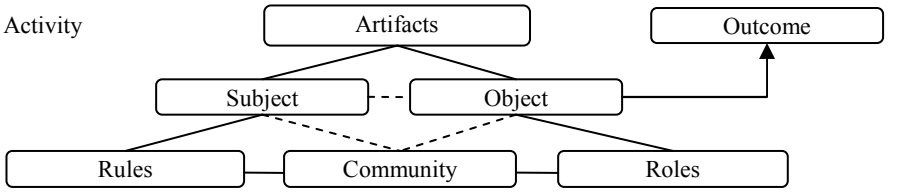

Fig. 1. Activity Representation in Activity Theory

The theory has been used in various domains including learning, organizational analysis, design of interactive systems and enterprise engineering [1][23][28].

5 Activity Theory-Based EGOV Benchmarking

This section presents the details of the EGOV benchmarking conceptualization based on the Activity Theory. Section 5.1 shows how the theory helps synthesize the generic dimensions of the benchmarking construct. Section 5.2 interprets the eight EGOV benchmarking conceptualizations in Section 2 against the generic dimensions and helps discover new dimensions. Section 5.3 organizes all dimensions into an Activity Theory-based EGOV benchmarking model, followed by the operationalization of the model through a case study in Section 5.4 and its validation in Section 5.5.

5.1 Activity Theory-Based Generic Benchmarking Model

The relevance of the Activity Theory to EGOV benchmarking rests upon two arguments. First, benchmarking is an activity that should be carried out in a context [2][4][6][16][15]. Second, as the context is often inscribed into EGOV system design, such inscriptions can mismatch the actual deployment context creating a contextual collision that could lead to EGOV failure [13]. To operationalize this connection, consider that the benchmarking activity (Activity) is carried out: by a benchmarker (Subject); using a certain benchmarking approach (Artifacts); subject to certain

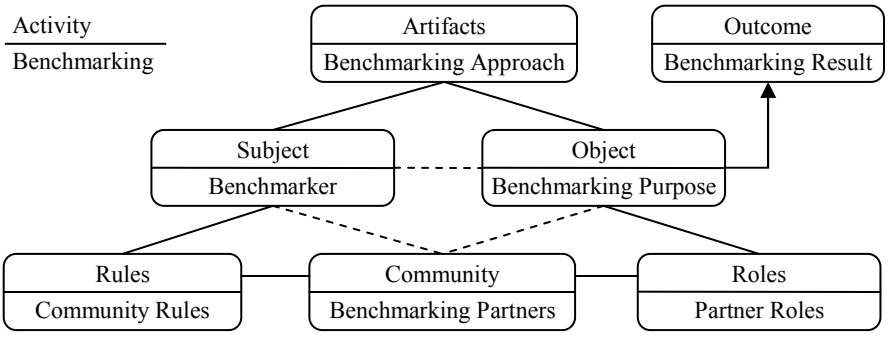

Fig. 2. Activity Theory–Based Benchmarking Model

benchmarking rules (Rules); and involving benchmarking partners (Community) with their commitments and roles (Roles); to achieve a certain benchmarking purpose (Object) and eventually the expected benchmarking results (Outcome). The resulting Activity Theory-based model for benchmarking is shown in Figure 2.

The model maps the eight generic concepts of the Activity Theory - Activity, Subject, Artifact, Object, Outcome, Community, Roles and Rules into the corresponding concepts in the benchmarking domain, as follows [1][21][23]:

1. Activity – A form of "doing", it is the main object of concern in Activity Theory and usually comprises several actions. In the benchmarking domain, Activity is mapped into Benchmarking. It is specified as a collection of the specifications of the other seven elements defined below. Example is EGOV Benchmarking.
2. Subject – An individual or organization that undertakes an Activity. In the benchmarking domain, Subject is mapped into Benchmarker e.g. government organization, international EGOV ranking organization, EGOV researcher, etc.
3. Object – It is explored or transformed by Subject to motivate and achieve the goals of Activity. In the benchmarking domain, Object is mapped into Benchmarking Purpose, e.g. "to determine the source of good practice for citizen-focused mobile services" and determines the Benchmarks or measures.
4. Artifact – The material or conceptual tools that mediate actions of the Subject on the Object, produced by other activities. In the benchmarking domain, Artifact is mapped into Benchmarking Approach - processes, techniques and tools to support the benchmarking activity, e.g. online survey instruments.
5. Outcome – The final result of Activity obtained when pursuing Object, possibly serving as Artifact for another Activity. In the benchmarking domain, Outcome is mapped into Benchmarking Result, e.g. EGOV ranking or benchmarking report prepared by a government agency for a supervisory office.
6. Community – All partners (people or organizations) directly involved in Activity, sharing the Object with the Subject, and establishing a link between the Subject and Activity context. In the benchmarking domain, Community is mapped into Benchmarking Partners for data gathering, resourcing and joint implementation.
7. Rules – The norms - guidelines, code of conduct, heuristics and conventions that mediate cooperation within and participation of the Subject in the Community. In the benchmarking domain, Rules are mapped into Community Rules, e.g. open publication of data on public service delivery by Community partners.
8. Roles – Refer to how cooperation and specialization occurs in an Activity to achieve the Object. In the benchmarking domain, Roles are mapped into Partner Roles, e.g. commitment by Community partners to implement good practices.

This mapping identifies eight generic dimensions for the benchmarking construct: 1) Benchmarking, 2) Benchmarker, 3) Benchmarking Purpose, 4) Benchmarking Approach, 5) Benchmarking Result, 6) Benchmarking Partners, 7) Community Rules and 8) Partner Roles, which concludes the first task in our methodology.

5.2 Activity Theory-Based Interpretation of EGOV Benchmarking

This section interprets the eight EGOV benchmarking conceptualizations in Section 2 against the generic dimensions of the EGOV benchmarking construct in Section 5.1.

This has two goals: 1) provide EGOV-specific semantics to the generic benchmarking dimensions and 2) discover new dimensions for the EGOV benchmarking construct to explain existing conceptualizations, beyond the explanatory power of the Activity Theory. The interpretation is carried out by explaining each dimension using defining terms of existing EGOV conceptualizations as well as seeking the terms that cannot be explained by the generic dimensions. The exception to this is the Benchmarking dimension, explained in terms of the remaining, but having no source in existing conceptualizations (except the current paper). The result is shown in Table 3.

The definitions of the various terms in Table 3 are as defined in their source conceptualizations. However, the informal nature of the conceptualizations was the cause of frequent ambiguity of terms, making the task of mapping terms across conceptualizations challenging. For instance, the term Scope is used in [12] to represent a range of benchmark measures, part of the Benchmark dimension, but also in [17] to represent Geographical Scope. Term disambiguation and re-naming was carried out by examining example uses of each term in the conceptualizations.

Interestingly, the Activity Theory-based generic benchmarking dimensions suffice for explaining all eight EGOV benchmarking conceptualizations. On the one hand, all dimensions can be explained using defining terms of existing EGOV benchmarking

Table 2. Interpreting EGOV Benchmarking Conceptualizations against Generic Dimensions

No	Dimensions	Defining Terms	Conceptualizations
1	Benchmarking	Benchmarker; Benchmarking: Purpose, Approach, Result, Partners; Community Rules; Partner Roles	
2	Benchmarker	Nature of Organization, Organizational Structure Type, Geographical Scope	Kyro et al., Banister, Saleem
3	Benchmarking Purpose	Purpose, Policy, Priorities	Heeks, Banister, Saleem, Jansen et al., EUeGOVBe
4	Benchmarking Approach	Scope, Data Source/Method, Analysis Type/Unit, Research Paradigm, Limitation, Timing, Resources, Indicators, Underlying Framework, Indicators, Execution	Heeks, Banister, Saleem, Codagnone et al., Jansen et al., IANIS, EUeGOVBe
5	Benchmarking Result	Audience, Reporting, Access, Dissemination	Heeks, Codagnone et al., EUeGOVBe
6	Benchmarking Partners	Nature of Organization, Organizational Structure Type, Geographical Scope	Kyro et al., Jansen et al., IANIS
7	Community Rules	Data Format Standards, Quality Control, Data Privacy	IANIS
8	Partner Roles	Governance, Data Provider, Execution Party	IANIS, EUeGOVBe
9	Benchmark	Benchmark Type, Stakeholder Scope, Level of Government, Measure	Kyro et al., Heeks, Saleem, Codagnone et al., Jansen et al., IANIS, Banister

conceptualizations, albeit to different extent. For example, the explanation of the Purpose, Community, Rules and Roles dimensions by existing research-oriented conceptualizations is weak. In fact, only [14] explicitly addresses the Rules dimension in its conceptualization. On the other, all defining terms of existing EGOV benchmarking conceptualizations could fit within one of eight generic dimensions except one – Benchmark. Benchmark is thus added as a new discovered dimension.

5.3 Activity Theory-Based EGOV Benchmarking Model

Figure 3, elaborating on the model in Figure 2, provides a more precise meaning for different dimensions of the EGOV benchmarking construct. The model adds centrally the Benchmark dimension, and dependencies between dimensions. The grounding in Activity Theory enables the exploitation of the theory in the EGOV benchmarking context. For instance, the Subject element in Activity Theory brings into focus the Benchmarker concept missing in many EGOV benchmarking conceptualizations.

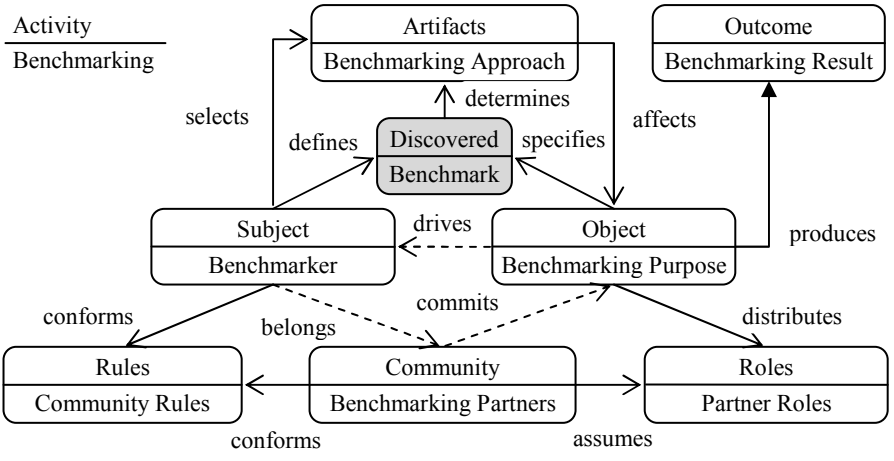

Fig. 3. Activity Theory-Based EGOV Benchmarking Model

5.4 Operationalizing Activity Theory-Based EGOV Benchmarking Model

This section describes how the EGOV benchmarking model defined in Section 5.3 was applied to guide a strategic benchmarking exercise within a national EGOV strategy development project implemented by the authors and a government partner. The aim of the exercise was to provide strategies and transferrable good practices in the area of EGOV (and e-participation) infrastructure. We highlight below the analyses made possible by the Activity Theory-based EGOV benchmarking dimensions, not provided or sufficiently explicated in existing conceptualizations.

Outcome – The project focused on two possible outcomes of the benchmarking exercise: producing strategies to lead to fundamental improvements in the country's EGOV program, and raising the country's international EGOV ranking to stimulate more funding. This prompted to carefully specify what information is sought.

Object – Considering the expected outcomes, the project elaborated and prioritized concrete objectives of the benchmarking exercise. In reaching the final decision of focusing on fundamental EGOV improvements and with increased country ranking as a secondary outcome, the implicit dialectical nature of Activity Theory was exploited.

Community – The notion of dynamically-changing Community with current state of Activity was applied in determining benchmarking partners through stakeholder analysis. The project developed community profiles to identify, adopt and utilize good practices e.g. a country with similar socio-economic and development condition serving as key sources of good practices in EGOV infrastructure development.

Roles – Based on the results of stakeholder analysis, each member of the identified Community was assigned a concrete Role for instance: data provider, benchmarking partner, best practice transfer facilitator, external user, etc.

Activity – Activity was treated as a context for developing various profiles for the benchmarking exercise, consisting of short statements and placeholders (meta-data) on different dimensions identified in the EGOV benchmarking model.

In a summary, the operationalization experience produced two main insights. First, the Activity, Object and Outcome dimensions enabled detailed profiling of the benchmarking exercise, addressing traditional concerns related to poor specification of benchmarking results [3] and insufficient information to assist users in making effective use of them [14]. Second, the model provided a theoretical framework to enable reasoning about the design of the benchmarking exercise, e.g. the composition of Community vis-à-vis the expected Outcome and cost, or policy and political interests vis-à-vis the impact on long-term organization and institutional goals.

5.5 Validating Activity Theory-Based EGOV Benchmarking Model

Two basic validation obligations identified for this work are: 1) the soundness of use of Activity Theory as a basis for conceptualizing the benchmarking activities, and 2) the validity of our conceptualization in terms of the process and resulting dimensions. Concerning the first obligation, we argue in Section 5.1 that benchmarking is fundamentally a context-based activity and shares inherent features of the activities defined in the Activity Theory. Concerning the process part of the second obligation, we explained in Section 3 how this work follows a well-established approach to conceptualization [21][19]. We could also adopt the formal conceptualization practice through ontologies. In fact, our mapping and integration process is analogous to a typical ontology mapping and integration exercises, and similar to [25] which also relies on Activity Theory as its base theory. Concerning the dimension part of the second obligation, the mapping of Activity Theory-based dimensions to equivalent dimensions across existing conceptualizations provides a form of validation or cross validation in terms of the relevance of the dimensions. Empirical validation e.g. vertical validity [11][29] of the dimensions and the established relations are planned as part of our future work. However, the use of our conceptualization in a concrete project in Section 5.4 is a first step in establishing its validity empirically.

6 Discussion

So far, the proposals for improving the EGOV benchmarking practice focused mainly on finding better measures and associated indicators. Lately, the emphasis has been on situating the EGOV benchmarking in well-defined policy [6][28] or organizational [16] contexts, and benchmarking the EGOV backend [17][27]. Our first proposition (P1) is therefore that a conscious contextual embedding is critical to EGOV benchmarking in view of its purpose and to enable its exploitation.

The next challenge is how to bridge different contexts to enable accumulation of knowledge from cases, facing lack of a unifying theory to guide progress in the field [31] and methodological pluralism characteristic of e-Government measurement [8]. Thus our second proposition (P2) is that the availability of a unifying framework for EGOV benchmarking is essential to advancing its theory and practice.

In line with the second proposition, the paper shows that Activity Theory can play the role of a top-level integrative conceptualization for EGOV benchmarking, similar to the development of Activity Theory-based Enterprise Ontology in [25]. This leads to our third proposition (P3) that Activity Theory provides a useful framework for understanding and improving the EGOV benchmarking practice particularly through its focus on the context and purpose of the benchmarking activity. This is particularly important in view of the challenges facing public sector and EGOV benchmarking: determining time and cost [10][16][31], assessing the impact of benchmarking on an organizations [10] and ensuring that the benchmarking results are used correctly [27].

Further evidence in support of P3 is the possibility to address the correct use of benchmarking results through so-called using Activity Theory-based inter-activity systems [12] or boundary objects connecting multi-activity subjects [30]. The former also appears applicable to the regional benchmarking frameworks where either the outcomes or artifacts are shared among ongoing benchmarking activities.

Given its inherent limitations [30] and as Activity Theory evolves to address emerging organizational challenges, the range of its application in the benchmarking domain will have to be discovered over time.

7 Conclusion

The current EGOV benchmarking practice suffers from the lack of a theoretical framework to facilitate the accumulation of knowledge in the domain when carrying out different benchmarking exercises. This paper makes a step towards building a theoretical framework for EGOV benchmarking which relies on Activity Theory and which unifies existing conceptualizations. This effort opens up the possibility of exploring relationships between the dimensions towards domain theory building. For benchmarking practice, the model provides a comprehensive high-level framework for designing and analyzing EGOV benchmarking activities. Practical application of the model has also shown that it offers analysis and insight which are not possible with existing conceptualizations, e.g. the notion of communities and conflicts between the different interests of their members. Our future work includes applying the developed conceptual model to analyze and profile more EGOV benchmarking cases, towards empirical validation, as well as exploiting recent developments and extensions in the Activity Theory to address specific benchmarking challenges.

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Connecting eGovernment to Real Government – The Failure of the UN eParticipation Index

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Abstract. eGovernment rankings are increasingly important as they guide countries' focus of their efforts. Hence indexes must not just measure features of web sites but also accurately indicate underlying government processes. eGovernment rankings are in a process of maturation in that direction, moving from purely measuring web sites to assessing use and government qualities. One such measurement is the UN eParticipation index, intended to measure how well governments connect to their citizens. This paper analyzes the quality of the index by validating it against other indexes of government-citizen relations qualities, democracy, internet filtering, and transparency. Results: The relation between the index and democracy and participation is non-existent. Countries which are authoritarian or obstruct citizen internet use by filtering can score high on eParticipation by window-dressing their webs. We suggest that the eParticipation index includes an element of reality check and propose ways to do that.

Keywords: UN, UNDESA, eGovernment, electronic government, index, eParticipation, Democracy.

1 Introduction

eGovernment rankings are increasingly important as they guide countries' focus of their eGov efforts. Therefor it is important that indexes not just measure features of web sites but also accurately indicate the underlying processes. eGovernment rankings are in a process of maturation in that direction. From purely measuring web sites they are moving on to assess use and users, hence aiming to measure government qualities.

There are a number of eGovernment indexes. Some of them have become frequently cited and used as benchmarks, guiding the debate as well as governments' investments in eGovernment. In the EU, regular benchmarking has over the past decade been used to guide the development and gague Europe development [1]. In a global perspective, frequently cited indexes include the recurrent UN e-Government rankings[1], the Economist's e-Government readiness index[2], and Brown university's

[1] The entire set can be retrieved at http://www2.unpan.org/egovkb/global_reports/index.htm
[2] The 2009 measurement can be retrieved at https://www-935.ibm.com/services/us/gbs/bus/pdf/e-readiness_rankings_june_2009_final_web.pdf

M. Janssen et al. (Eds.): EGOV 2011, LNCS 6846, pp. 26–37, 2011.

regular global e-Government studies[3]. The indexes are different in many ways, and they have changed over time. The UN index was originally quite similar to the EU one, measuring technical sophistication of government online services by means of ladder models starting from information on the web, over interactivity using e.g. online forms to full case handling, including decisions and payments as necessary. While different terms have been, and still are, used for these steps the general idea remains the same. More technical sophistication yields a better score. The Economist's index is much broader and measures "readiness" including not only technical features but also government quality aspects such as government policy, business climate in the country, and social and cultural environmnet factors. Finally, the Brown index still focuses on features of web systems but includes factors that specifically have to do with government qualities pertaining to interaction with citizens, such as the existence of a privacy policy, security policy, advertisements, the opportunity to comment, etc. [2].

As the result of the maturation of eGovernment services and the use of them, indexes mature. More use yields more data which can be analyzed, so indexes can increasingly include not just the potential of specific online tools but also the effects of them. Also ambitions increase. While automating government processes earlier was at the focus of eGovernment development, the explosive increase in use of social media has increased the requirements on eGovernment services to become "citizen-centric", including taking part in decision making, i.e. democratic participation [3]. According to the UN, "e-government should play an ever-greater role in development. Many countries have made tremendous strides in the last two years, due in part to recent, exciting advances in the diffusion of technology. With its responsive, citizen-centric qualities, I firmly believe that e-government can make a decisive contribution to the achievement of the MDGs, particularly in developing regions" [3, p iii]. With this ambition, there is clearly a need to make indexes of eGovernment actually reflect not just the "e" but actual government processes, methods, and policies.

To measure citizen-centricness the UN 2010 eGovernment index has been amended by a new set of measurements collectively labeled "eParticipation". This measure follows current research in the field and measures the availability of "polls, surveys, blogs, social networks, newsgroups and other interactive services that facilitate engagement" [3, p 96]. eParticipation is generally taken to be more or less directly related to democracy. This link is explicitly stated in the UN report; the e-participation index is to "bring some order to measurement of e-governance by positing the relevance of three factors in citizen engagement: electronic information dissemination, electronic consultation and electronic participation in decision-making [3, p.96]. The link is also established empirically by research. For instance, Sanford and Rose [4] found that research on eParticipation has largely concentrated on issues of deliberation and inclusion and is almost exclusively related to participation in the political process.

There are reasons for worry here. The eParticipation field is theoretically and empirically immature. First, the field of eGovernment itself does not have firm

3 http://brown.edu/Administration/News_Bureau/2006-07/06-007.html

theoretical foundations [5], [6], [7]. The area of eParticipation is arguably even less theoretically founded. Although the state of eGovernment research has been in focus in a number of literature reviews [8], contemporary research in the sub-area of eParticipation has only been partially reflected upon. Sæbø et al. [9] find it "eclectic" with many theories imported from other disciplines and not thoroughly tested as concerns their appropriateness in an eParticipation context.

The field is an integral part of eGovernment research, and it is theoretically focused on democracy models originating from the domain of political science and philosophy [4]. eParticipation has sprung from a field earlier called eDemocracy, but the relation between e-participation and democracy or e-democracy is confused [10]. The role of participation in democracy (both with no e:s) has been discussed for over two hundred years, and it is still contested. There are different democracy models, each attributing participation different roles. Adding the "e" to either or both terms has not made this relation clearer but rather confused it by adding the technology dimension without much discussion of the fact that technology is a mallable medium able to serve many types of participation, including bogus types designed to in fact prohibit real participation [11]. So far, eParticipation has taken off on a technology track. It has not connected to government in any clear way. This means measurement on eParticipation criteria is potentially dangerous as the models are not validated.

Against this backdrop, the purpose of this paper is to investigate the credibility of the UN eParticipation index as an indicator of the qualities of government it is intended to measure. These qualities are named "citizen-centricness" in the UN reports. Other terms used include "connecting to the citizens" or e-democracy [12], but they all explicitly relate to democracy and citizen participation in decision making. We do that by validating it using other, more established measurements of the processes, methods, and policies that eGovernment support, i.e. (real) government operations. We use indexes of democracy, internet filtering, transparency, and social climate; all important qualities of the relation between government and citizens.

2 Method

The underlying research model used in this paper is that participation requires political ambition (e.g. policy, legislation, methods etc.), technical facilities (here "eParticipation" tools), and a social climate conducive for participation. We showed above that the concept of eParticipation is clearly argued to be based on ideas of democracy. Therefore, this paper tests how well the eParticipation index matches indexes of democracy. The latter are more specifically defined as government policies and practices and a conducive social climate. Specifically, our proposal is that, to be usable as an index of participation in "real government", the eParticipation measure, as a part of the eGovernment definition, must yield results that are in line with indexes of democracy. If not, it measures something else and should not be used for the purpose of measuring the participation aspect of eGovernment.

To investigate this proposal we test the UN eParticipation against three indexes that measure aspects of democracy.

1. The Economist Intelligence Unit's (EIU) democracy index [13].
2. The Economist eGovernment index, specifically the "social and cultural environment" factor.
3. The OpenNet measure of internet filtering [14]

These indexes were chosen because they reflect important aspects of democracy. The first represents a holistic, theory-based view of democracy and measures government practices and policies, the second measures the social climate, which is a necessary but not sufficient precondition for democracy, and the third measures government policy and practice specifically for the electronic medium. Together they give a rich picture of participation in practice in each country. We test the relation between each of them and the UN eParticipation index as well as their interrelatedness, e.g. the correlation between index 1 and 2.

3 Theory: Indexes Measuring Democracy and Participation

The brief literature review above showed that researchers and practitioners agree that eParticipation should reflect democracy and democratic values in the field of electronic services from government. This means the index must not deviate too much from indexes measuring democracy in terms of outcomes. Clearly eParticipation measures items on web sites rather than the direct nature of governments, but it indirectly measures also government processes and the policy guiding these processes. Hence, a good eParticipation measure should not yield outputs which are incompatible with outputs from indexes measuring democracy and government nature.

There are numerous indexes concerning democracy and the nature of government. In this paper we limit our studies to a few which are commonly cited and measure crucial aspects of eGoverment.

1. The Economist Intelligence Unit's (EIU) democracy index [13]
2. The Economist eGovernment index
3. The OpenNet measure of internet filtering [14]

A brief look into these indexes show that they together cover important aspects of democracy and participation, and hence also eParticipation.

1. The Economist Intelligence Unit's Index of Democracy is based on 60 measures grouped into five categories: (1) electoral process and pluralism; (2) civil liberties; (3) the functioning of government; (4) political participation; and (5) political culture. The measures draw on both available statistics and politics analysis. Examples of statistical measures for the category "Participation" include voter participation/turn-out for national elections, women in parliament, the extent of political participation, membership of political parties and political nongovernmental organisations, adult literacy, and percentage of population that follows politics in the news media (print, TV or radio) every day.

Examples of measures drawing on polls, analyses etc. include the preparedness of the population to take part in lawful demonstrations, the extent to which the adult population shows an interest in and follows politics in the news, to what extent the

authorities make a serious effort to promote political participation, whether ethnic, religious and other minorities have a reasonable degree of autonomy and voice in the political process, and citizens' engagement with politics.

The category indexes are based on the sum of the indicator scores in the category, converted to a 0 to 10 scale. Countries are placed within one of four types of regimes:

- Full democracies (score 8-10)
- Flawed democracies (score 6 -7.9)
- Hybrid regimes (score 4 to 5.9)
- Authoritarian regimes (score below 4)

In all, the index can be described as theory-based and inclusive, drawing on many of the commonly held values and measures of participation. It covers the majority of countries in the world, 167 ones in the 2010 measurement, and is frequently referred to [13]. So far there have been three measurements, in 2006, 2008, and 2010.

2. *The Economist's e eGovernment readiness index* includes six categories which are weighted into the total index as follows; Connectivity and technology infrastructure (20%), business environment (15%), social and cultural environment (15%), legal environment (10%), government policy and vision (15%), consumer and business adoption (25%).

This paper focuses on the overall index and the Social and cultural environment category, for two reasons. First, the overall index is designed to measure "readiness" very broadly, using social, technical, policy, and business indicators. It should hence be a good guide to "participation" in a general sense. The underlying philosophy is that government, business and individuals need to be free to cooperate best possible for both business and government to blossom. Second, the Social and cultural environment is particularly interesting here because it includes several preconditions for participation on part of the individual. The category measures basic education, web-literacy, entrepreneurship, technical skills of workforce, and degree of innovation. These measures together cover many aspects of participation ranging from basic preconditions such as literacy to general ambition to innovate and take action. While not focusing specifically on political participation the category attempts to measure the "innovative climate" in a country.

3. *The OpenNet initiative (ONI)* for measuring Internet filtering involves researchers from the universities of Oxford, Harvard, and Toronto. Internet filtering, censorship of Web content, and online surveillance are reportedly increasing in scale, scope, and sophistication around the world. ONI maintains an index of Internet filtering where countries are profiled based on empirical tests for filtering as well as analysis of policies relating to media, speech, and expression. Legal and regulatory frameworks, including Internet law, the state of Internet access and infrastructure, the level of economic development, and the quality of governance institutions are analyzed as they are central to how countries implement Internet content controls. Together, these analyses are intended to offer "a concise, accurate, and unbiased overview of Internet filtering and content regulation." [14]

Each country is given a score on a five-point scale. The scores measure four themes reflecting the focus of the filtering:

1. *Political*: Web sites that express views in opposition to those of the current government, as well as content broadly related to human rights, freedom of expression, minority rights, and religious movements.
2. *Social*: Material related to sexuality, gambling, and illegal drugs and alcohol, as well as other topics that may be socially sensitive or perceived as offensive.
3. *Conflict/security*: Content related to armed conflicts, border disputes, separatist movements, and militant groups.
4. *Internet tools*: Web sites that provide e-mail, Internet hosting, search, translation, Voice-over Internet Protocol (VoIP) telephone service, and circumvention methods.

The scores reflecting the magnitude of the filtering for each of the themes are defined as:

1. *Pervasive filtering* has both depth —blocks a large portion of the targeted content— and breadth —filters several categories of a given theme.
2. *Substantial filtering* has either depth or breadth: either a number of categories are subject to a medium level of filtering or a low level of filtering is carried out across many categories.
3. *Selective filtering*: Narrowly targeted filtering that blocks a small number of specific sites across a few categories or filtering that targets a single category or issue.
4. *Suspected filtering*: Connectivity abnormalities are present that suggest the presence of filtering, although empirical test cannot confirm conclusively that inaccessible Web sites are the result of deliberate tampering.
5. *No evidence of filtering*. [14]

There is also a measure of the transparency and the consistency of the filtering. *Transparency* is a qualitative measure based on how openly a country conducts its filtering. *Consistency* measures the variation in filtering within a country across different Internet Service Providers.

Beyond these technical measures, the ONI country profiles draw on other indexes, which are not directly relevant for the purposes of this study, such as the World Bank governance index and International Telecommunication Union (ITU) statistics on Internet usage.

4 Results: The UN eParticipation Index Vs. Other Indices of Government Qualities

Testing the UN eParticipation index against the EIU democracy index, Figure 1 shows that there is no relation between them. A high ranking on democracy does not yield a good eParticipation rank.

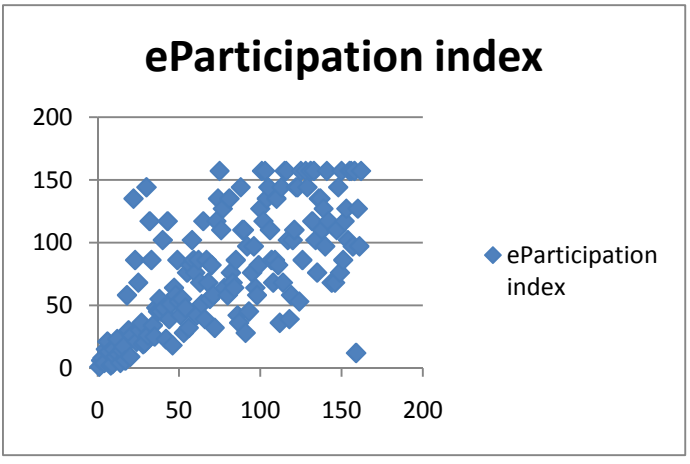

Fig. 1. Ranks on the UN 2010 eParticipation vs the EIU 2010 democracy index (x-axis). Lower rank is better (1st place is the best).

The fact that highly democratic countries do not score well on eParticipation is not necessarily a problem. It could just be that countries have not yet invested in eParticipation. What is worrying is that any country, no matter how undemocratic, can score high on eParticipation. Considering the EIU finding that 32.9 % of the world countries are authoritarian [13], it is worrying to see so many countries within this range score just as good as the top ones in the EIU ranking. In fact, the "full democracies", which are the top 15 % of the world countries, do not score significantly better than the authoritarian ones. Table 1 shows that the best 15 countries of the "authoritarian" group at the bottom of the EUI ranking score better than 50 % of the top 15 % EIU ranked "full democracies" in eParticipation.

Table 1. Averages for selected groups of countries

EUI index	UN eParticipation score average (0-1, 1 is best)
Top 15 % (30 countries), full democracies	0.42
10 best countries of bottom 30 % countries (authoritarian)	0.32
15 best countries of bottom 30 % (authoritarian)	0.29
Lower 50% of top 15 % (15 countries), full democracies	0.21

Because the eParticipation index measures items on web sites, the fact that even authoritarian regimes score well can be the result of trivial things. Having an online poll on the web does not mean people actually use it or that it is used to improve services. Moving on to more advanced eParticipation features, such as the use of social software to "engage" people in discussions, to voice opinions, participate in consultations etc., increases this web-reality gap. For people to dare to use such tools, there is a need for a social climate conducive to participation. Oppressional regimes

do not encourage individuals to voice opinions. This is a reason to look to indexes that also measure social factors. The Economist's eGovernment index is one such. Figure 2 shows that this index is fairly well related to the EIU democracy one as concerns the more democratic countries, but unrelated as concerns the least democratic ones. This means that the Economist's eGovernment index is a better indicator of democracy than the UN eParticipation indes is, even though this was not even the intention of the Economists' index, and even though the correlation is only valid for the top 2/3 of the countries. Put another way, the UN eParticipation index performs worse than even a general eGovernment index not specifically targeting eParticipation.

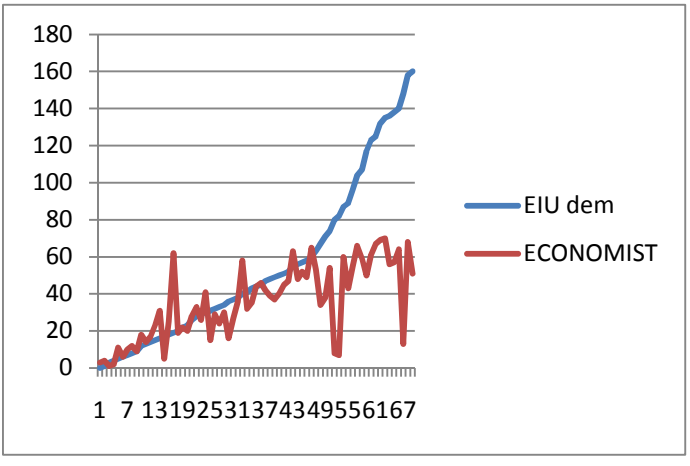

Fig. 2. Ranks on the EIU democracy index vs the Economist's eGovernment index (both 2010). Lower rank is better.

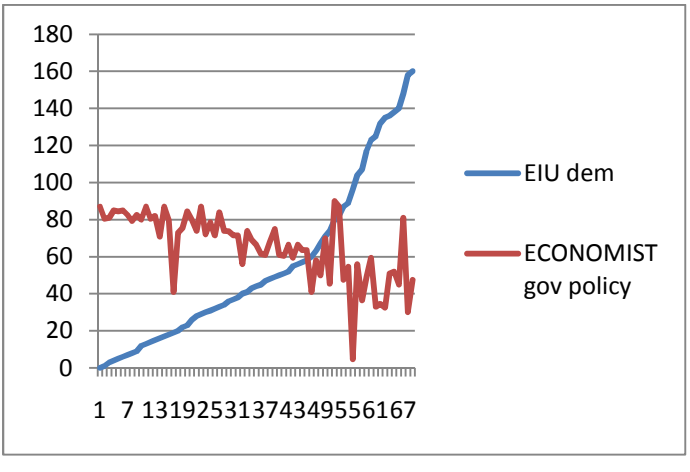

Fig. 3. EIU democracy index vs Economist's "Policy and vision" category of the eGovernment index, 2010

This is despite the fact that the UN eParticipation index is in fact included as one item in the Economist's "Policy and Vision" category. To see whether this incorporation has influenced the Economist index to become more correlated with the democracy index we specifically compared those two. Figure 3 shows that there is no such correlation.

To test for the conducive social environment we included the "Social and cultural environment" category of the Economist eGovernment index to see if that might be an indicator also of democracy. Figure 4 shows that the correlation is considerably better than for the UN eParticipation index. In fact, it is significant at the .01 level with a Pearson Correlation of .677.

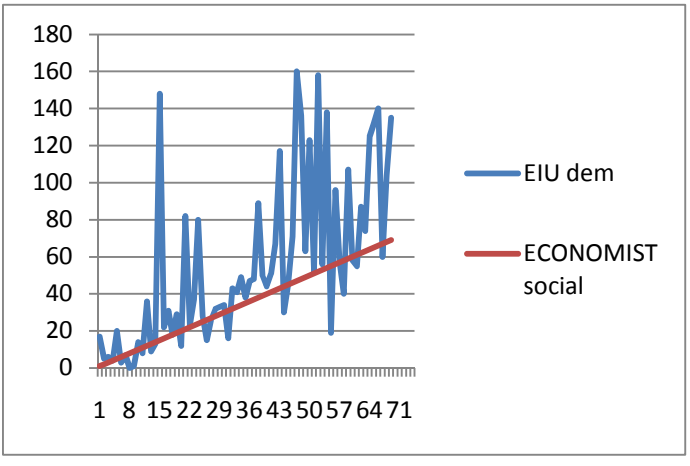

Fig. 4. EIU vs Economist social and cultural index

Turning now to government practice in the technology field concerning eParticipation we consider the ONI index for web censorship and filtering. Table 2 displays selected countries and shows that the addition of the eParticipation index into the UN eGovernment ranking has meant that many un-democratic countries have improved their position. Table 2 also shows that many countries who have gained substantially in scoring due to the introduction of the eParticipation index (1st vs 2nd columns) at the same time score very bad on oppressing Internet use by filtering (5th column. Note that the higher the score the more severe the filtering), and on the general level of transparency (6th column).

These countries are also all authoritarian or "hybrid" regimes in the EIU index (4th column). It appears strange for an index that purports to value participation – expressly defined as a democratic value – to reward countries for a small number of web site features when the same governments blatantly work against participatory values in the regulation of the very same medium. They do not become more democratic, and should hence not become more "eParticipatory", due to exhibiting web features that cannot be used in practice anyway due to regulation, policy and culture.

Table 2. eParticipation ranking compared to Internet filtering, transparency and democracy

Country	Rank in UN eGov index	Rank in UN eParticip. index	Rank/score/ category in EIU democracy index	ONI score on Filtering (0-16; 16 means most severe filtering)	ONI score on Transpar. (1-3; 3 is the most transpar.)
Pakistan	146	68	104/4.55/Hybrid	9	2
Kyrgyzstan	91	28	106/4.31/Hybrid	4	1
Sudan	154	102	151/2.42 /Authoritarian	8	3
China	72	32	136 3.14 /Authoritarian	16	1
Morocco	126	86	116/3.79 /Authoritarian	6	1
Ethiopia	172	135	118 /3.68 /Authoritarian	8	1
Belarus	64	51	130/3.34 /Authoritarian	8	1

5 Conclusions

Rankings are increasingly important as they guide countries' focus of their eGovernment efforts. Therefor it is important that indexes not just measure features of web sites but also accurately indicate the underlying processes. eGovernment rankings are in a process of maturation in that direction. Moving from purely measuring web sites they are moving on to assess use and users, hence aiming to measure government qualities. One such measurement is the newborn UN eParticipation index. This is intended to measure how well governments connect to their citizens, an important quality aspect of government. This paper analyzes the quality of the index by measuring it against other indexes of government-citizen relations qualities, democracy, social and cultural environment, internet filtering, and transparency. We find that

1. The relation between the UN index and indexes of democracy and participation is non-existent;
2. Even very undemocratic countries can score high on UN eParticipation;
3. Countries who severely obstruct citizen internet use by filtering can score high on eParticipation by introducing technical tools on their web;

4. Authoritarian countries who blatantly and persistently obstruct Internet use can improve their eGovernment score considerably by adding some eParticipation features on their webs;
5. Democratic participation is much better measured by the Economist's general eGovernment index, in particular the "Social and cultural environment" section of that index which is significantly related to the EIU democracy index.

All in all, measuring eParticipation by the UN index is wrong. It does not measure the values which are proposed as its underpinnings, namely the democratic values which are the foundation of eParticipation research. It is also potentially dangerous as its name gives a kind of democratic gloss to the eGovernment index which is in fact contradicted in its practice.

To arrive at a credible eParticipation index there is a need to introduce an element of reality check. This requires two types of modifications. One is to include some measure of actual use, for example the ONI web filtering index. This is the same method as is already used for other categories of the UN index, where measurements of web sites are complemented by national and international statistics, e.g. from the ITU. Applying the same method to the eParticipation category we suggest defining a composite index including the two ones we have used here – democracy and internet filtering – as a complement to the online tools currently measured by the UN. This way no country could boost their score by window-dressing, by putting some new politically correct electronic tools on their web site. Another measure would be to remodel the inspection of the eParticipation tool list so as to also include use items, e.g. number of postings and number of participants in a discussion forum.

eGovernment must relate to real Government. Only by enforcing rating methods that combine both that we can get real effects. The UN eParticipation index as of today is a dangerous tool because it is not related to the real world of government.

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Explaining History of eGovernment Implementation in Developing Countries: An Analytical Framework

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Abstract. The paper proposes an analytical framework to explain history of e-Government implementation over a certain period of time in the context of developing countries. The framework is built upon General Systems Theory (GST) and Institutional Theory enriched with literature from organizational changes, and information systems/e-Government implementation. Three scenarios of implementation are proposed, each with its own departing worldview (i.e., mechanistic, organic, and colonial systems), isomorphic mechanism, implementation model, and possible impact.

Keywords: General Systems Theory, Institutional Theory, mechanistic systems, organic systems, colonial systems, e-Government, developing countries.

1 Introduction

Countries in the world have been investing a lot of resources in implementing e-Government in various levels and aspects. While some governments have been successful in implementing e-Government initiatives, many initiatives fail to live up to expectations [16]. In general, development of e-Government in developing countries is lagging behind developed countries [54]. As noted by Sein [44], "implementing e-Government initiatives in developing countries is a complex and challenging process that face many hurdles."

Having this in mind, backdrop of this paper is twofold. Firstly, hitherto, most of the existing models of e-Government evolution suggest a natural linear progression [29]. This linear progression is indicated in various stage models that could be found in the literature [27, 30, 39, 46]. As noted by Lyytinen and Newman [28], "a majority of change studies treat the change as a simple, linier progression where a new (technical) system is designed, adopted, and modified in step-wise manner." Due to the absent of considering contextual specificity, this linear progression model has been criticized and extended [1, 29, 30].

In order to make e-Government implementation relevant for a specific context, serious consideration must be given to the social, cultural, and economic differences in e-Government development [5, 29]. Moon [30] points out that the stage model is a conceptual tool to examine the evolution of e-Government, and in practice, it may not follow a true linear progression. Coping with the limitations of the linear progression model, for instance, Lyytinen and Newman [28] develop a punctuated socio-technical

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change model which is based upon socio-technical theory viewing organizational systems as multivariate systems of four interacting and aligned components, i.e., task, structure, actor, and technology.

Secondly, in connection to this issue, in a literature review, Walsham and Sahay [58] identify several limitations in IS research in developing countries. The limitations include lack of in-depth study on IS implementation in developing countries. They also call for more action research and longitudinal study. Similarly, Yildiz [59], Heeks and Bailur [17], and Stanforth [50] suggest e-Government researchers to pay more attention on process-oriented or longitudinal studies, beyond output-based or factorial or cross-sectional studies that have been being focus of the e-Government studies in the last decade. To our knowledge, only a few studies in e-Government employ a longitudinal analysis. Among the exceptions include the studies by Pan et al. [36], Stanforth [49], and Heeks and Stanforth [18].

Against these backdrops, the current paper can be considered as a first attempt to address the call and fulfil the mentioned void by proposing an analytical framework built upon General Systems Theory (GST) along with Institutional Theory to explain development of e-Government over certain period of time. GST enables holistic study of history and allows multiple, simultaneous paradigms, each with its own system metaphors [38]. Three system metaphors, e.g., mechanistic, organic, and colonial systems will act as historical-construct inventories [38]. In addition, Institutional Theory, which might be used as a lens to study history of IS implementation within an organization [3], is brought in to explain how collective awareness or isomorphic change occurs. Institutional Theory offers three mechanisms of institutional isomorphic change: coercive, mimetic, and normative [9, 42]. Explanation using these two theories is hoped to provide a fresh interpretation how e-Government initiatives evolve over a certain period of time, which in many cases cannot be explained by the extant e-Government linear progression models.

Following this introduction, the rest of the paper is organized as follows. Section 2 and 3 respectively explains the main conceptions of GST and Institutional Theory. Next, Section 4 explicates and integrates these two theories along with literature from organizational change and e-Government implementation as an analytical framework to explain e-Government implementation. Lastly, Section 5 draws concluding remarks that bring this paper to end.

2 General Systems Theory

Ludwig von Bertalanffy and Kenneth Boulding are among the most prominent founders of GST [47]. The GST thinking is based on the fact that after examining laws in various fields of science (e.g. biology, physics, medicine, psychology, social sciences), von Bertalanffy [56] found what he calls formally identical or isomorphic laws. Isomorphism exists "when common characteristics, structures, formulas, and forms of organization are in accordance in different systems" [47:39]. Various forms of GST can be found in literature [47]; for example, Miller's Living Systems Theory [11, 47], Checkland's System Typology [8, 47] and Porra et al.'s [38] three metaphors, i.e. mechanistic, organic, and colonial systems. As aforementioned, this paper will adopt the three metaphors proposed by Porra et al. [38]. Each of the metaphors is explained in some detail as follows.

Mechanistic systems are isolated from their environment and only outside forces can change their structure [38]. This mechanistic worldview which is derived from classical physics of the nineteenth century leaves no room for any directiveness, order, or telos [57], and hence mechanistic systems have static teleology and assume one-way causality [57]. The principle of causality states that every effect is preceded, not followed, by a cause [47].

According to Porra [37], a mechanistic system does not have temporality; in other words, as soon as the purpose or goal of the system is determined by the initiator of the machine, the system stops changing, and "grows" by adding or changing parts to make its life longer. The system cannot evolve as a living system does [37]. Such systems are based on formal rules and can only operate with their hierarchy of rules no matter what the conditions and will ultimately fail when new environmental conditions emerge [31, 37, 38].

The organic worldview is introduced in response to insufficiencies in the mechanistic view [57] by adding the notion of feedback and control to the formal rule-based structures of mechanistic systems. Organic systems include an implicit assumption of progressive evolution [37]. The evolution of organic systems "is gradual, discontinuous unfolding of events by incremental adaptation to its immediate environment" [37:44]. According to Porra [37], an organic system may survive longer than a mechanistic system by making local corrections to its behaviours during dynamic times. But this paradigm cannot capture the nature of turbulent change or punctuation that happens in the context of organization.

To cope with this limitation, Porra [37] introduces so-called colonial systems. These are based on mobile animal colonies. Borrowing terms from the biological evolution field, a colony can be defined as [37:39] "a voluntary collection of individuals with the shared characteristics of a common evolutionary social history (phylogeny), common methods for realizing stability and radical change (species-level evolution), and a common local context". Porra [37] builds colonial systems as an alternative to the mechanistic and organic system perspective. Colonial systems see an organization as a complex adaptive system, not only a collection of individuals working alone but also interacting – collaborating and competing – at different levels [7]. In responding to the changes in the environment, members of the colonial systems co-evolve. Co-evolution is a process where changes in an element depend (to varying degrees) on changes in other linked elements and will cause change in yet other ones [7]. Hence, as a result, the members of the system will have a shared evolutionary history [38].

GST in its various forms has been used in different areas of IS research [21]. Kendall and Kendall [23] point out that IS development methods, such as lifecycle concept or work breakdown structure, can be traced back to GST as underlying principles. Structured IS development methodologies are built upon the principles of mechanistic systems. Machines are used as the metaphor of this methodology [23]. Multiview methodology defines an IS as a social process using the principles of colonial systems to some extent. Kendall and Kendall [23] use society as a metaphor for this methodology. Soft-system methodology introduced by Checkland [8] also uses GST as underlying principles. In addition, Porra et al. [38] used GST with three metaphors, i.e. mechanistic, organic, and colonial systems, to construct the history of Texaco's corporate information technology function.

3 Institutional Theory

The development of Institutional Theory can be traced back to its early development in economics, political science, and sociology [43]. This theory sees institutions as multifaceted, durable social structures made up of symbolic elements, social activities, and material resources. Institutions, however, are not just constraint structures but also simultaneously empower and control [20]. According to Scott [43:48], "institutions are comprised of regulative, normative and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life". Scott [43] refers to regulative, normative and cultural-cognitive elements as the three elements or pillars of institutions.

The regulative conception assumes that institutions constrain and regularize behaviours by setting up rules and systems of rules [43]. Rules or systems of rules are symbolic systems and one of the carriers in the institutionalization process. According to Gil-Garcia and Martinez-Moyano [13], in an institution, systems of rules can be designed primarily as behaviour-constraining mechanisms and can be primarily thought of as a solution-guiding mechanism.

The emphasis of the normative view is that normative systems (i.e. values and norms) provide a prescriptive, evaluative, and obligatory dimension of social life [43]. Normative systems are seen as carriers in the institutionalization process. Here, values are defined as "the conceptions of the preferred or the desirable, together with the construction of standards to which existing structures or behaviour can be compared and assessed" [43:54], whereas norms "specify how things should be done" [43:54-55].

The third conception of institutions stresses the centrality of cultural-cognitive elements of institutions. This conception assumes that "internal" cognitive processes are shaped by an "external" cultural framework [43]. According to Douglas [10] – as cited in [43] – cultural categories should be treated as "the cognitive containers in which social interests are defined and classified, argued, negotiated, and fought out".

Although institutions function to provide stability and order, they undergo change that is both incremental and revolutionary [43]. In this sense, institutions are seen not only as a "property" or state of an existing social order, but also as a "process", including the processes of institutionalization and deinstitutionalization. Generally, institutionalization may be defined as "the process through which a social order or pattern becomes accepted as a social 'fact'" [3:236], whereas deinstitutionalization is "the process by which the legitimacy of an established or institutionalized organizational practice erodes or discontinues" [33:564]. For example, when information technology is adopted by an organization, the information technology development and organizational change involve the continuing institutionalization of information technology intertwined with the deinstitutionalization of the dominant organizational form [3].

According to Scott [42], institutionalization can be considered as a process of creating reality [6] or as a process of instilling value [45]. As a process of creating reality, Berger and Luckmann [6:54] – as cited in [42] – argue that, "Institutionalization occurs whenever there is a reciprocal typification of habitual actions by types of

actors". Both actions and actors are typified: certain forms of actions come to be associated with certain classes of actors. As a process of instilling value, institutionalization is the process “to infuse with value beyond technical requirement of the task at hand" [45:17] – cited in [42]. Before value is instilled in an organization, it merely has instrumental utility as a mechanical and disposable tool [42].

External environment is seen as influential for organizations. Institutional Theory views organizations not as passive entities that are controlled by the demand of their environments but as active players capable of responding strategically and innovatively to environmental pressure [35]. According to Selznick [45] – cited in [3] – we cannot explain what is happening in organizations by considering only the "rational" actions of their members; indeed we should take into account "irrationalities" stemming from the context of the organization as well as from cultural systems embedded in organizations. Thus, organizations are subject to pressure to be isomorphic with the external environment through various mechanisms. There are three mechanisms of institutional isomorphic changes: coercive, mimetic, and normative [9, 42].

Coercive isomorphism stems from political influence and the problem of legitimacy and is a result of pressure exerted on organizations by other organizations upon which they are dependent, such as resource-dominant organizations, regulatory bodies, and parent corporations [9, 51]. Normative isomorphism is associated with professionalization. In relational channels among members of a network, norms that are widely adopted by other organizations will influence organizational behaviour [9]. When organizations have direct and frequent communication with each other, they are more likely to think alike or behave similarly [51]. Mimetic isomorphism is a response to uncertainty. Uncertainty may emerge when organizational technologies are poorly understood, when goals are ambiguous, or when environments change [9]. In this case, over time, an organization may change to become more like other organizations in terms of its environment.

Scott [43] points out that institutional carriers are important in terms of the ways in which institutions change. He classifies carriers into four types: symbolic systems, relational systems, routines, and artefacts. Each institutional element has its own dominant carriers. For example, the carriers of the regulative element of institutions are rules, power systems, and standard operating procedures; values, authority systems, and roles are the carriers of the normative element; the carriers of the cultural-cognitive element include typifications and identities.

Institutional Theory has been used as a lens in different areas of IS research. Most of the researchers using this theory believe that IT itself is an insufficient predictor of IT impact on organization performance improvement [e.g., 3, 4, 34, 35, 48, 51]. Avgerou (2004:234) suggests that, "IT innovation itself is a process of combining technical-rational and social forces, neither driving, nor subsumed in the forces of organizational change, but interacting with them". Orlikowski and Barley [35] suggest that IS scholars should take into account the institutional context where IS is developed and implemented. In addition, Institutional Theory is also used to portray the relationship between actors and to explain isomorphic mechanisms between the actors occurs during the IT implementation [e.g., 13, 19, 24, 51, 52].

4 Explaining e-Government Implementation Using GST and Institutional Theory: An Analytical Framework

Implementation of IS, in which e-Government is a specific instance of its application, could be approached from various ways. Myers [32] argues that generally, there are two mainstreams in IS literature when researching IS implementation: factor research and process research. Factor research or variance research [25, 40] tries to identify possible determinants of IS implementation success. This research speculates about the processes connecting antecedents with outcomes [40]. Unlike variance research, process research focuses on the development of IS projects. The focus of the research includes the relationship between the designers and the users of an IS, and the impact of the systems on the organization [32]. Process research seeks to explain how change emerges, develops, and diminishes over time [40].

Yet, from another stance, Keil [22] – as cited in [32] – suggests three models of IS implementation based on the nature of causality as a basis. The three models are: (a) implementation as technology acceptance; (b) implementation as organizational change; and (c) implementation as organizational problem solving involving mutual adaptation. The first two models assume that the design activities will produce the change smoothly, and the design system remains stable. Here, IS change can be considered as linear and cumulative in nature and involve either technical or social dimension [28]. The third model include the intertwined relationship between technical and social aspects of IS implementation. As Lyytinen and Newman [28] argue, the IS change should be seen as complex, multi-level, and punctuated change that involve both technical and social changes.

Inspired by the idea from GST by identifying isomorphic conceptions both in GST and Institutional Theory, the paper proposes an analytical framework that consists of three scenarios as follow.

4.1 Scenario 1: Mechanistic Systems, Coercive, Techno-Centric, Accepters

When an organization is considered as mechanistic systems, for example by assuming that the organization has static teleology, formal and unchanging rules, and is singularly purposeful (see Table 1), e-Government implementation may follow teleology model as pointed out by Van de Ven and Poole [55][1]. Goal enactment is the generating force of the teleology model [55] which is also found in the conception of the mechanistic systems [37]. The teleology model consists of a cycle of goal formulation, implementation, evaluation, and modification of goals based on what was learned by the organization. Further, Van de Ven and Poole [55] argue that this sequence emerges through the purposeful social construction among individuals within the organization. Such conceptions can be found in the mechanistic paradigm [37, 38].

[1] Based on an extensive literature review across disciplines (200,000 titles, 2,000 abstracts, 200 articles), Van de Ven and Poole [54] identify four main organizational change models, i.e. teleology, life-cycle, evolution, and dialectic models. Each model has its own motors and assumptions.

Table 1. Theoretical framework of analysis

	Scenario 1	*Scenario 2*	*Scenario 3*	*Reference*
Departing worldview	Mechanistic systems	Organic systems	Colonial systems	[31, 37, 38, 57]
Control	Unchanging Built-in	Adapting through feedback from the environment	Feedback and feed-forward	[31, 38]
Change	Constancy of essence	Linear adaptive change	Punctuated equilibrium	[28, 37]
Institutional conceptions	Regulative	Normative	Cultural-cognitive	[43]
Basis of legitimacy	Legally enforced	Morally governed	Culturally supported	[43]
Isomorphic mechanism	Coercive	Normative	Mimetic	[9, 43]
Institutional carriers	Rules Power systems Standard operating procedures	Values Authority systems Roles	Typifications Identities	[43]
Implementation model	Teleology	Life-cycle Evolution	Dialectic	[55]
Implementation focus	Techno-centric	Government-centric/ Organization-centric	Community-centric/ People-centric	[22, 41]
Implementation perspective	Technology acceptance	Organizational change	Organizational problem solving involving mutual adaptation	[22]
Institutional adoption pattern	Accepters	Improvers	Transformers	[19]
Institutional impact	Automated	Improved	Transformed	[15, 19, 41]

In the context of e-Government implementation, the teleology model is probably adopted in the beginning stage of e-Government implementation where technological determinism dominates the assumptions. In other words, the implementation is techno-centric [41], which mostly are the cases in developing countries that generally are lagging in e-Government implementation when compared to their counterparts in developed countries [54]. In the beginning stage, as well, most local governments implement e-Government initiatives to response to national government regulation or programs. Technical assistance and funding may be provided by the national government to foster the e-Government implementation in lower levels. Here, technology acceptance may be used as an indicator of successful implementation [22].

The mechanistic systems are formal rule-based [37] which are similar with the conception of regulative element of institutions, which is legally enforced [43]. The centralized power and control in the mechanistic systems [37] also found in the regulative element of institution that position power systems as one of the institutional carriers [43]. In this situation, from the perspective of Institutional Theory, coercive pressure from higher authority (i.e., the national government) may be influential. When the incentive is put as the main motor behind the process of institutionalization, e-Government implementation may only be manifested as automation of the government

business process [41]. Using Hjort-Madsen's [19] terminology, this local government could be considered as accepters in which the e-Government implementation is mainly to comply with the regulation from an upper authority. As an example, implementing teleconference technology to facilitate meeting between various levels of government agencies without any organizational changes may follow this scenario.

4.2 Scenario 2: Organic Systems, Normative, Organization-Centric, Improvers

Further, when e-Government as a system is perceived as an organic system in which the government seeks balance with the environment by adaptation, implementation model adopted may be life-cycle or evolution model [55]. In Porra's terminology [38], this is an adaptive process with fixed arrangement. Van de Ven and Poole [55] consider life-cycle implementation model as organic growth. This model assumes that the change process progresses through a necessary sequence of stage linearly. Meanwhile, the evolution model assumes that implementation consists of a repetitive sequence of variation, selection, and retention events among members of an organization [55]. The impact caused by the implementation process using these assumptions is incrementally progressive.

Using interpretation from Institutional Theory, when adaptation is carried out through feedback from the environment [43], normative pressures from other organizations, or in the context of e-Government implementation, from other local government may be very determining. This adaptation mechanism is similar with the organic paradigm that adds feedback and control, in addition to formal rule-based structures of the mechanistic systems [37]. In this stage, communication and contact among local governments intensifies. This process most probably adopted not in the beginning stage of e-Government implementation, but in a later stage when some e-Government systems have been put in place as foundations. In this stage of implementation, local governments may be considered as improvers [19]. They do not merely automate the business processes, but they also improve them to some extent. In this sense, implementation may be considered as organizational change [22]. We may coin this implementation as organization-centric or government-centric approach. Implementation of ERP-like package to improve the decision making and controlling process in a local government is an example of e-Government that probably follows this scenario.

4.3 Scenario 3: Colonial Systems, Mimetic, Community-Centric, Transformers

Lastly, when assumptions in colonial systems are used as points of departure, e-Government implementation process may follow a different path. Colonial systems assume the existence of feedback and feedforward control between an organization and its environment. Over time, changes consist not only of stasis but also punctuations [38]. In this context, dialectic model described by Van de Ven and Poole [55] may accommodate the process. Dialectic models assume that the emergence of thesis and antithesis will create a conflict as a pre-process to produce a synthesis. In the dictionary of Institutional Theory, this conflict may produce confusion. This confused situation should be resolved by developing common beliefs that produce a shared understanding. This shared understanding is similar with the conception of shared evolutionary history and shared local context in colonial systems paradigm [38].

By integrating the two theories, we may postulate that colonial systems are built on cultural-cognitive conception of organizations; an organization is seen not only from technical aspect (as in mechanistic systems) or merely as social construction (as in organic systems), but from the understanding that social and technical aspects are intertwined, and the resulted changes are not only linear progression but also punctuations. In this context, mimetic pressures may dominate over coercive and normative pressures, since the role of culture building is very important [43]. Using Keil's [22] conceptions, this implementation may be considered as organizational problem solving involving mutual adaptation. Here, external environment gains a more substantial influence through a more intensive interaction and communication.

e-Government implementation that adopts the colonial systems and cultural-cognitive conceptions may generate more radical changes. e-Government will not only automate or improve the business process, but goes beyond by transforming the local government. The governments are transformed, and hence they become not only accepters or improvers, but transformers [19]. In this stage, the government implementation is community-centric [41] or people-centric [53], beyond techno-centric and government-centric. In the context of e-Government, the government treats "citizen as a partner" ([14] – cited in [41]) or e-Government is considered as "transferring power to the people" ([26] – cited in [41]).

e-Government initiative that follows this implementation scenario may include establishment of one-stop services in various levels of government involving a variety of government agencies to improve the public service quality and transparency. In many cases, the implementation process is not straightforward, but is going through a rather long process involving a dialogue, and in some extent a political conflict, between various government agencies that worry about losing their power [12]. At the end, the process will transform government business processes that very much put the public service quality and transparency improvement at the highest priority.

5 Concluding Remarks

GST and Institutional Theory have been briefly presented in this paper. An analytical framework to explain e-Government implementation that is built upon the two theories has also been proposed. The main contribution of this paper is the introduction of three scenarios of e-Government implementation. Each of these scenarios in the analytical framework is with different departing worldview, isomorphic mechanism, implementation model, and possible impacts.

One possible approach would be to view these scenarios as adjustable analytical tools. In practice, these three scenarios most likely are not mutually exclusive, but they are interdependent and intersect in some extent, though a scenario may be predominant over the other two. This integration that preserves the distinction of each theory yields a richer theoretical framework that can be used as lenses to explain e-Government implementation. However, to get a better understanding of the process of e-Government implementation over time, the framework should not be used mechanistically as a simple checklist.

Although the scenarios are theoretically supported, they need to be empirically examined. Possible expected result from the empirical studies is new understanding to evolution of the e-Government initiatives over a certain period of time. For instance,

some e-Government implementations may have evolved organically or colonially and others, especially in the context of developing countries, may simply have been mechanistic. If these scenarios gain empirical support, then we can conclude that the departing worldview used in the process of e-Government implementation will partake in giving explanation to the e-Government success or failure. But, we should note here that definition of failure or success is dependent on the intended strategic purpose in the outset for a certain initiative [2]. A clear statement of the intended strategic purpose in the outset of each e-Government implementation then is very crucial in determining a scenario that may fit best. For example, in some cases [31], mechanistic systems are more preferable than organic and colonial systems. This new understanding, then, can be utilized as a basis to increase the success rate and to maximize the benefits of the e-Government implementation, especially in the developing countries which experience most e-Government implementation failures as reported by Heeks [16] and others, without closing the possibilities of applying the analytical framework in the context of developed countries.

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Paving the Way for Future Research in ICT for Governance and Policy Modelling

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Abstract. In light of the contemporary societal challenges and the current technological trends that have revolutionized collaboration and creativity, ICT for Governance and Policy Modelling has recently emerged to achieve a better, participative, evidence-based and timely governance. Bringing together two separate worlds, i.e. the mathematical and complex systems background of Policy Modelling with the service provision, participation and open data aspects in Governance, it has recently gathered significant attention by researchers and practitioners. This paper presents the grand challenges that will inspire research in the domain in the next years, as well as the track from the state of play study, the visionary scenarios building and the gap analysis that has eventually led to their recognition. The specific research challenges target at achieving a collaborative, model-based governance with a strong scientific basis, empowered with data in order to reach collective intelligence, and providing public services as a utility.

Keywords: ICT for Governance and Policy Modelling, Grand Challenges, Taxonomy, Research Areas, Model-based Governance, Government Service Utility, Data-powered collective intelligence and action.

1 Introduction

Today the world has become increasingly interconnected, complex, and fast-evolving, with the effects of individual behaviour and of policy choices becoming much less predictable. In fact, unpredictability and complexity are two distinguishing characteristics of our society, as widely recognised in the literature about complexity science, chaos theories and non-linear systems. Highly improbable events [26] and "wicked problems" [25], which are outside the range of predictability based on past behaviour, dominate our lives as the recent financial crisis has proven.

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The paradox is that at the same time, the amount of data available for making sense of the socio-economic environment is increasing exponentially, provided through sensors (such as Radio-frequency identification-RFID) and mobile devices, with the help of open government initiatives that have already started to emerge and release public data, or even in bottom-up ways through "crowdsourced" citizens' reports in Social Media. However, governments clearly still struggle to make sense of such large amounts of data and take appropriate action.

With government facing such new and complex problems that cannot be dealt with easily by direct public service provision, more ambitious policies will require more complex interventions and collaboration with non-governmental parties [22]. In this context, 'empowerment' seems to be the next great societal value in response to the massive increases in information, communication and wealth permeating society [4], [23]. According to the new eGovernment Action Plan, by 2015 European public administrations should be "recognised for being open, flexible and collaborative in their relations with citizens and businesses" [19], [27].

Along these ways of evolution, future scenarios in ICT for Governance and Policy Modelling are promising to reach the target of a better, participative, evidence-based and timely governance, while taming greater complexity and attracting citizens' involvement [3]. ICT for Governance and Policy Modelling has emerged as an umbrella term for a number of technologies that can be applied in order to achieve the common goal of improving public decision-making in the age of complexity [8]. They aim at making the policy-making cycle more effective and more intelligent, and at accelerating the learning path embedded in the policy cycle. In recent years we have assisted to a flourishing of ICT tools to support governments in designing policies [5]. However, such tools are not often adopted successfully, also due to fragmentation between academic fields, application areas and approaches to innovation.

In this context, this paper presents the research roadmap related to the domain of ICT for Governance and Policy Modelling, which was created within the CROSSROAD project [9]. CROSSROAD was a FP7 Support Action funded by the European Commission in order to identify and characterize the key research challenges in the domain and ultimately outline a concrete, participative roadmap for future research. Working with expert researchers and practitioners from across Europe, CROSSROAD has consolidated and advanced research in a new, yet highly fragmented, domain by adopting a consensus-driven approach based on collaboration.

The structure of this paper is as follows: Section 2 outlines the methodology followed during the implementation of the roadmap. Section 3 gives an overview of the evolutionary path and the main results that have led to the recognition of the set of the grand challenges. Section 4 finally presents the Grand Challenges, leading to conclusions with the trends and an insight to the benefits of the domain.

2 Methodology

In the direction of science and technology roadmapping [11], the approach adopted and described in this paper from a high-level perspective adhered to the principles of openness, iteration, open ended, technology-focused but not technology driven, and beared the following steps:

- State of Play providing an overview of the state of the art in ICT for Governance and Policy Modelling in terms of research, practice / application, market and policy. A Research Areas Taxonomy has been formulated with the material collected and elaborated in the state of the art analysis in an effort to map for the first time and reach consensus on the diverse domain of ICT for Governance and Policy Modelling.
- Visionary Scenarios "Digital Europe 2030" outlining a set of extreme visionary scenarios on how governance and policy modelling could develop at the horizon 2030. The scenario design was built on two axes (Openness and Transparency, and Integration in Policy Intelligence) that represent the way in which different future societal and policy directions may develop.
- Gap Analysis assessing current developments in ICT for Governance and Policy Modelling and identifying the need for research and technology development (RTD) which is not yet in place through an analysis of the future scenarios.
- Research Roadmap defining a set of Grand Challenges which are understandable, bold and disruptive but strongly rooted in the state of the art and addressable by 2020, while containing significant critical mass of research and inspiring specific Research Challenges. It has raised awareness and created a shared vision that inspires collaborative and interdisciplinary research between academia, business, civil society and government on new research directions in the domain of governance and policy modelling. It has been accompanied by concrete Policy Recommendations and mechanisms on how to define and implement research policy in a complex world.

The proposed roadmap builds on relevant work undertaken in other roadmapping activities produced by other communities on specific application domains related to the ICT for Governance and Policy Modelling domain. Indicative studies that have been studied originate from eGovernment [7], Visual Analytics [15], Personal Health Systems [6], Complex Systems [18], the World Society Modeller [1], the Internet of Things [28] and Cloud Computing [14].

3 Background

3.1 State of Play

The purpose of the State of the Art Analysis was to provide an overview of the state of the art in ICT for Governance and Policy Modelling in terms of research, practice / application, market and policy [17]. It covered research approaches, practical guidelines and strategic visions that have emerged upon studying the underlying research initiatives, projects, positions, strategies and implementations in a number of technologies which can be applied in order to achieve the target of the better, participative, evidence-based and timely governance.

With the help of a quantitative and qualitative methodology, a Research Areas Taxonomy has been formulated with the material collected and elaborated in the state of the art analysis in an effort to map and reach consensus on the diverse domain of ICT for Governance and Policy Modelling [16]. The taxonomy, which now consists

of 5 Research Themes (RTs) as broad thematic categories that contain and classify a number of research areas at lower levels, has been discussed and validated by a large set of experts, as well as by relevant EU-funded projects in this domain.

The *Research Theme RT.1: Open Government Information & Intelligence for Transparency* appears as the data- and knowledge- oriented research theme. It tries to incorporate next generation light-weight semantic technologies into the Governance and Policy Modelling context by promoting the principles of open data and PSI reuse, as well as the philosophy of linked data and visual analytics.

The *Research Theme RT.2: Social Networks, Citizen Engagement and Inclusion* infuses the social dimension of the web into Governance and Policy Modelling by investigating the Social Computing phenomenon that has already revolutionized the way people communicate, exchange content and knowledge, raise their opinions and influence each other, by exploiting engagement and eParticipation tools and techniques, and by extracting people's opinion from the web in order to reach collective wisdom.

The *Research Theme RT.3: Policy Making*, clearly positioned towards ICT-enabled policy making, initially analyzes the economical, social and environmental context as a preparatory stage for policy modelling which then actually represents the problem and its proposed solution. Policy Simulation testing out the various models in an effort to pre-evaluate the application of a specific policy, in a controlled, artificial environment is also studied, while at the last stage in the policy-making process, Policy Evaluation provides the necessary qualitative and quantitative assessment mechanisms to monitor the actual policy application.

The *Research Theme RT.4: Identity Management and Trust in Governance* is driven by the need to safeguard citizens' and public authorities' digital presence from misuse. In this context, identity management with federated identities, access control and authentication mechanisms in ubiquitous environments, as well as privacy and data protection have proved to contribute in building trust among citizens and public authorities.

The *Research Theme RT.5: Future Internet for Collaborative Governance* embraces the internet evolution and entails transparent and multichannel service provision via the Internet of Services, low cost cloud infrastructures emerging from Cloud Computing advancements, better human-computer interfaces and seamless interaction with non-conventional web devices that communicate in the Internet of Things.

3.2 Visionary Scenarios

The open-ended visionary scenarios developed for Digital Europe 2030 aimed at defining a set of scenarios on how governance and policy modelling, supported and enhanced by the use of Information and Communication Technologies (ICTs), could develop by 2030 in order to identify the research needs and policy challenges to be addressed [21]. The scenarios are internally consistent views of what the European governance and policy making system could become by 2030 and of what the resulting implications for citizens, business and public services would be. The uncertainties underlying the scenario design are: 1) the societal value system we will be living in (more inclusive, open and transparent or exclusive, fractured and restrictive), and 2) the response (partial or complete, proactive or reactive) to the acquisition and integration of policy intelligence techniques in support of data processing, modelling, visualization and simulation for evidence-based policy making.

A framework for the analysis of current and future challenges in ICT for governance and policy Modelling has been drawn. Accordingly, the key impact dimensions were classified on two axes: Openness and Transparency and Integrated Policy Intelligence [20]. The following four scenarios were defined according to their positions on the two axes of the scenario design framework:

- *Open governance*: characterized by high openness and transparency and high integration in policy intelligence;
- *Leviathan governance*: characterized by low openness and transparency and high integration in policy intelligence;
- *Privatised governance*: characterized by low openness and transparency and low integration in policy intelligence;
- *Self-service governance*: characterized by high openness and transparency and low integration in policy intelligence.

3.3 Gap Analysis

Gap analysis aimed at comparing the present status of ICT for Governance and Policy Modelling presented in the state-of-the-art analysis and the future needs of ICT for Governance and Policy-Modelling depicted through the visionary scenarios. Taking into account that a gap expresses both mismatches between the state of play and the future scenarios, as well as lacks of current research identified in the scenarios [2], the gap analysis aimed at identifying specific gaps in the domain of Governance and Policy Modelling, i.e. the missing elements to realize the most desirable scenarios; and the elements of the current situation that could lead to the realization of the less desirable scenarios.

The gap analysis collaborative process resulted in 42 gaps: 6 gaps within RT1, 9 gaps within RT2, 11 gaps - RT3, 7 gaps - RT4, 5 gaps - RT5 and 4 gaps stemming from visionary scenarios. All gaps were assessed regarding their relevance and impact on the main principles of Good Governance (openness, participation, accountability, effectiveness and coherence) [13], while a cross analysis of relations between and classifications of gaps was introduced in order to depict their interrelations.

4 Crossroad Grand Challenges

In order to provide strategic directions for the future of research in the domain of ICT for Governance and Policy Modelling, consensus was reached through online and offline brainstorming and validation workshops on a limited number of Grand Challenges [10]. Such challenges present the following features: are understandable, visual and inspire research ideas; are bold and disruptive but strongly rooted in the State of the Art and addressable by 2020; contain significant critical mass of research; and address gaps across multiple Research Themes.

In particular, in order to grasp the opportunities that emerge from the current trends and to lead to a paradigm shift in policy-making, the following Grand Challenges have to be met:

- **GC1 - Model-based collaborative governance:** How to assist policy makers in taking evidence-based decisions in our complex, unpredictable world? Existing econometric models are unable to account for human behaviour and unexpected events. New policy modelling and simulation are fragmented, single-purposed and work at micro-level. There is a need for robust, intuitive, reusable collaborative modelling tools that can be integrated into daily decision-making processes.
- **GC2 - Data-powered collective intelligence and action:** How can we make sure that increased transparency translates into actual more open and more effective policy-making? Current tools require high involvement and attention, therefore engaging only the very committed people. They are designed to facilitate conversations, rather than action. There is a clear need for more intuitive collaborative tools that are able to engage also less interested people, maximizing the impact of short attention span and low-engagement, as well as for ICT based feedback mechanism that are able to encourage real action and behavioural change.
- **GC3 - Government Service Utility:** How to provide high-impact services to citizens, businesses and administrations in a way that allows for co-design, public-private collaboration, citizen interaction and service co-generation that allows for 1-stop, 1-second service delivery at very low cost and administrative burden and for completely new services, through mash-ups and interoperability-by-design?
- **GC4 - Scientific base of ICT for Governance and Policy Modelling:** How to make ICT-enabled governance a rigorous scientific domain, by providing formal methods and tools? The systematic classification of problems and solutions and description through formal languages, in an effort to make diagnosis and prescription of solutions a scientific process that will allow building on top of existing knowledge.

These challenges can be depicted as three key pillars crowned by the fourth overarching challenge in the adapted 'stagist' model of the policy process [12] and the management cycle, as illustrated in the figure below.

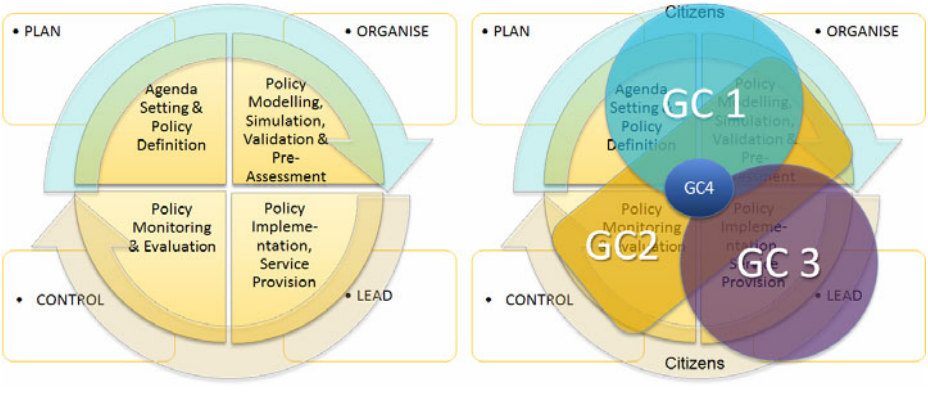

Fig. 1. CROSSROAD Grand Challenges in the Policy Making Cycle

4.1 Model-Based Governance

Our rapidly changing and complex society requires an efficient and effective decision-making process, able to anticipate future events, promptly detecting emergencies and evaluating the impact of different policy choices, reflecting the real-life complexity while making it simpler and addressable. The GC1 Model-based Collaborative Governance focuses on the development of advanced tools and methodologies in order to pursue the above-mentioned goals. It follows a vision of a radically different context for policy modelling and simulation, where standardisation and reusability of models and tools, system thinking and modelling applied to policy impact assessment has become pervasive throughout government activities. GC1 aims at enabling the engagement of all stakeholders (even without expert skills) in collaborative policy model building, simulation and evaluation process. This implies a great effort to improve state-of-the-art ICT tools and methodologies in order to guarantee the efficiency of policy modelling process. The improvements, in terms of usability and consequently time and cost consumption, the effectiveness of the process as well as in terms of reliability and knowledge of both models and policies should be introduced.

In this context, the research challenges that should be addressed with a long-term perspective include:

- *RC1.1: Integrated, composable and re-usable models* to create more comprehensive and complex models by using smaller building blocks or existing objects/models. This implies both model interoperability and the definition/identification of proper modelling standards, procedures and methodologies.
- *RC1.2: Collaborative modelling* encompassing participation of all stakeholders in the policy-making process through the implementation of Internet-based easy-to-use tools for all the levels of skills.
- *RC1.3: Easy access to information and knowledge creation* with a particular focus on elicitation of information which, in turn, during the overall model building and use processes will help decision makers to learn how a certain system works and ultimately to gain insights and understanding in order to successfully implement a desired policy.
- *RC1.4: Model validation* in order to guarantee the reliability of models and, consequently, of policies that are crucial for policy makers who need and use information that results from the simulations to develop more effective policies.
- *RC1.5: Interactive simulation* concentrating on the fact that the larger is the model in terms of size and complexity, the larger is the resulting amount of data to analyse and visualize. In particular, this challenge refers to the issue of integration of visualisation techniques within an integrated simulation environment, in order to dramatically increase the efficiency and effectiveness of the modelling and simulation process, allowing the inclusion and automation of some phases (e.g. the output and feedback analysis) that were not managed in a structured way up to this point.

- *RC1.6: Output analysis and knowledge synthesis* refers to output analysis of a policy model and, at the same time, to feedback analysis in order to incrementally increase and synthesise the knowledge of the model (and consequently of the policy).

4.2 Data-Powered Collective Intelligence and Action

The current citizen participation scene is characterised by an engagement of highly interested people only, and by an engagement that rarely stimulates genuine action. There are several complementary research areas in ICT for governance and policy modelling which have the opportunity to address the need for collaboration and behavioural change throughout different technological layers: enhanced data availability through public linked data and participatory sensing, analytical capability through opinion mining and visual analytics, and action-oriented tools such as simulation and serious gaming. These trends mutually reinforce each other to offer a new opportunity for future ICT for governance and policy modelling.

The collaborative governance vision, proposed as an alternative, includes citizens in all the phases of the governance: in collecting relevant data through participatory sensing tools; in analysing the data through simulation and visualisation software; in acting upon these data through bottom-up self-organized action which accompanies, anticipates and stimulates government policies.

For this vision to become a reality, substantial research effort is needed in following research challenges:

- *RC2.1: Privacy-compliant participatory sensing* for real-time policy-making refers to the use of sensors, usually embedded in personal devices such as smartphones allowing citizens to appropriately feed data of public interest.
- *RC2.2: Real-time, high-quality, reusable open government data* calls for simplification and lower costs of open data publication.
- *RC2.3: Federated dynamic identity management* addresses the eIdentity-related issues for secure public service provision, citizen record management and law enforcement.
- *RC2.4 Peer-to-peer public opinion mining* points out to the explosion of user-generated content, which widens the application scope of public opinion mining tools and to the fact that these tools need to become more pervasive and available to the majority of citizens.
- *RC2.5: Intuitive, collaborative visual analytics* of data for policy-making refers to the research focused on making sense of large datasets, such as those provided as open government data.
- *RC2.6 User-generated simulation and gaming tools* for public action underlines that serious gaming is still requiring high level of engagement and, therefore, progress in usability and attractiveness in order to widen the group of participants is needed.
- *RC2.7: New institutional design of collaborative governance* recalls that collaborative governance is developing without an appropriate reference framework.

4.3 Government Service Utility

The dawn of a new era which highlights service creation and delivery as its principal ingredient has started to influence the public sector that now needs to drive public services towards Future Internet advancements. The Grand Challenge GC3-Government Service Utility has adopted the key concepts of a utility [24], such as Ubiquitous nature, Usability, Federation, Co-generation, and De-regulation, and is aligned to the philosophy of collaboration, openness and innovation. According to the our vision, it aims to cultivate "... a vision of the Internet of the Future, where public organisations, citizens, enterprises and non-profit organisations can collaboratively shape public services at design-time and runtime, in order to be delivered as a utility-like offering at their own ends, to the channels they prefer and in the context and situation they are".

In this context, the research challenges that should be addressed in the long-term perspective include:

- *RC3.1: User-driven innovation shaping Public Services* during their whole lifecycle in order to be delivered to their beneficiaries at their own ends, in ways and means they prefer.
- *RC3.2: Change the DNA of Public Services* in the direction of the 1-1-1 concept that supposes that «Every public service can be provided in one-stop, within one second, with one euro (or minimum) cost, to any device and by anything».
- *RC3.3: Digital Public Services Value Proposition for All* which defines and assesses the impact for all stakeholders within a complex public services ecosystem.
- *RC3.4: Massive Public Information as a Service* promoting a service-oriented attitude to the public sector information (PSI).

4.4 Science Base of ICT for Governance and Policy Modelling

The general aim of GC4 is to establish the initial foundation of ICT for Governance and Policy Modelling as a new science, complementing those of Informatics and Political Science, which is envisaged to benefit from all developments of the neighbouring field. It encompasses the following Research Challenges:

- *RC4.1: Multidisciplinary issues and relations with neighbouring domains*, that investigates possible links with other scientific areas and attempts to structure the domain according to other successful domains.
- *RC4.2: Metrics and Assessment Models, Decision Support, Modelling & Simulation Tools*, that aim to bring together the technological and the societal aspects of the domain of ICT for governance and policy modelling towards more concrete, holistic and accurate decision support models.
- *RC4.3: Formal methods and tools*, which aim at the setting the foundations for the new proposed scientific domain.

5 Conclusions

A paradigm shift in the nature and quality of policy-making is emerging based on three complementary disruptive techno-economic trends: the explosion in the quantity of data available; the proactive role assumed by citizens in contributing to the policy-making process, by authoring and elaborating the data increasingly made available; and the advanced capabilities, affordability and accuracy of simulation and modelling techniques. ICT tools have the potential to effectively support policy modelling and governance and their use is growing continuously even if they still remain a "novelty" for the majority of governments. The already acknowledged benefits for their use by governments lie on the quality and speed of policy making, as well as on the evidence-based policy decision making [10].

In order to outline future research directions in the domain of ICT for Governance and Policy Modelling, the present paper has described a methodology that creates a shared vision, able to inspire collaborative and interdisciplinary research, and between academia, business, civil society and government. Upon studying the state of the art advancements in the domain, envisioning future, disruptive scenarios on how society will evolve in 2030 and analyzing the gaps, a set of concrete grand challenges that bundle together specific research challenges has been identified. The proposed grand challenges that have been validated by a large number of experts (in online workshops and face-to-face events) include the Model-based Governance (GC1), Data-powered collective intelligence and action (GC2), Government Service Utility (GC3) and Science Base of ICT for Governance and Policy Modelling (GC4).

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The Relative Importance of Intermediaries in eGovernment Adoption: A Study of Saudi Arabia

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Abstract. Although Gulf countries have invested large sums of money in implementing e-government services, adoption rates have been low due to various social, political and demographic reasons. This study aims to provide a better understanding to citizens' adoption of e-government services through conceptualizing the role of intermediary organisations within e-government. In particular, this paper examines the importance of intermediaries in the adoption of e-government from a citizens' perspective and the potential influence they have on bridging digital divide in societies. Following previous studies on e-government adoption, the study employs the unified theory of acceptance and use of technology (UTAUT) to examine the influence of intermediaries on citizens' adoption of e-government services in the context of Madinah city in Saudi Arabia. The results in this study indicates that the citizens' efforts towards using e-government services, their trust of the Internet and their trust of intermediary organisations contribute significantly towards their e-government adoption behaviour. Further, the facilitating conditions the intermediary organisations offer have a significant impact on the usage of e-government services.

Keywords: E-government, Intermediaries, Adoption, UTAUT.

1 Introduction

The adoption rate among citizens for e-government services determines its success or failure [16] [27][23]. Studies in this area has indicated that there are an increased emphasis on e-government adoption, exploring a number of significant factors affecting individual (citizens) adoption of e-government [9][2][10][5]. In particular interests have grown further in developing e-government systems and at the same time achieving its full potential. Governments worldwide have introduced various initiatives towards enhancing the effectiveness and efficiency of government services. Among these was the introduction of intermediary organizations under their e-government strategies [4][19]. Nevertheless, although concept of intermediary organizations adoption was introduced in other different contexts such as e-commerce, to date there has been little argument on the adoption of intermediary organization in the e-government realm

M. Janssen et al. (Eds.): EGOV 2011, LNCS 6846, pp. 62–74, 2011.

[4][19]. While e-government services offered a number of benefits that fulfils its potential through engaging all relevant stakeholders, others who lack technology skills and have low level of education were often left out and have been excluded from these benefits. Consequently, this has created a significant gap and inequality in accessing e-government services [20]. In this regard, many countries worldwide have established strategies to minimize digital divide and increase citizens' engagement new e-government services that are implemented in their countries [5][8].

Over the last few years, in the developing world, Gulf countries in particular have invested large sums of money in e-government initiatives. Among these countries is Saudi Arabia. Saudi Arabia is a rich developing country in the Middle Eastern region that has started implementing national e-government projects since 1998 [24][1]. According to UN report, in the context of e-government readiness, Saudi Arabia significantly transformed its electronic service delivery from 2005 to 2008 [29] According to a recent report by Internet World Usage and Population Statistics, the total population in Saudi Arabia is around 28,146,657 and about 6,380,000 Saudi citizens have Internet access. Despite a dramatic increase in the number of Internet users from about 200,000 in 2000 up to 6,380,000 in recent years, a growth of about 3,090% (ibid), there are still delays in utilizing and adopting e-government services. In order to increase access to public services and effectively facilitate the usage of information technologies, Saudi Arabia's government attempted to deliver its public services through many channels. Among these channels are private-public-service offices (intermediaries). These offices are independent private organisations that offer a number of services to the public. They are used mainly to support access to public services and to collect required services fees from citizens. Although the use of intermediary organisations in the context of e-government diffusion is not entirely new, few studies have been conducted to examine their impact on e-government adoption. The rationale for undertaking this study is to *further explore the impact of intermediary organizations in relation to improving the adoption of e-government services in Saudi Arabia.* In order to realise this aim a research study is undertaken in Madinah city in Saudi Arabia. Madinah city launched its e-government services in 2003, and at present it is considered to be the second largest cultural city in Saudi Arabia. Madinah city is the only city that has implemented the e-government intermediary (referred to by Saudi's as e-office) concept under their local e-government initiatives. This research will examine the role of intermediaries in e-government adoption, using the case of the traffic department as an example of an e-government service in Saudi Arabia. Therefore, this study will be mainly focused on Saudi males as females are not allowed to drive in Saudi Arabia.

In order to achieve the above aim, section two begins by reviewing the theoretical background of intermediaries and factors influencing the adoption of e-government. This is followed by research methodology used for this study, offered in section three. Section four presents the research findings. Finally in section five, this paper will conclude by discussing the role of intermediaries in influencing the adoption of e-government services in Saudi Arabia and outlining some recommendations for future research.

2 Theoretical Background

As prior literature in the information systems (IS) and e-government realms show, few researchers have carried out studies that investigate the impact intermediaries on citizens' adoption and usage of e-government [4][19]. Most studies associated with e-government adoption have been mainly focused on the individual level factors that impact citizens' attitudes toward e-government [9][5]. Further, studies have also highlighted the need to examine the adoption of e-services from the users' perspective, which are prompted by the roles of intermediaries [18][6]. However, studies that have focused on understanding citizens' behaviour when using intermediaries to access e-services have not utilized conceptual models to examine the influencing factors [4][19].

Since many researchers in the information systems field build their argument on a theoretical background [9][2][10][5], it is essential to present a theoretical model or framework that helps to understand the factors that affect the individual level (citizens) adoption of e-government services prompted by intermediaries. Users' acceptance and adoption of technologies is considered as a primary condition for a successful implementation of any IT project. This is due to the fact that users' attitudes to use and adopt new technologies plays an important role in the success or failure of these projects [23][27]. According to Venkatesh et al. [28 p. 446], users' acceptance of technology refers to the "initial decision made by the individual to interact with the technology". It has been found that numerous theories and models could be used to examine users' adoption of information technology (IT). For example, technology acceptance models (TAM), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), the Motivational Model (MM) Diffusion of Innovation (DOI), the Model of PC Utilization (MPCU), Social Cognitive Theory (SCT), the model combined between TAM and TPB, and finally, the most recent model, the Unified Theory of acceptance and Use of Technology (UTAUT) could be used. The aim of the UTAUT model is to give a further complete explanation and prediction of users' behaviours that any older individual models could not have achieved alone. Each model mentioned above aimed to explain user behaviour and usage of new technology with a variety of independent variables; in fact, the UTAUT Model is proposed based on the similarities of these independent variables from each models cited above. According to the number of prior studies, the UTAUT model is the benchmark and most predictive model in the technology acceptance literature [2] [5]. The UTAUT model contains different factors that either directly affects usage behaviour as facilitating conditions or, affect behavioural intention by other determinant factors like performance expectancy, effort expectancy, and social influence. Also the UTAUT model considers moderator variables influencing the four direct determinant factors of behavioural intentions and usage behaviour such as gender, age, experience and voluntary use. This study adapts the UTAUT model. However, since this paper is a result of a preliminary study of the factors influencing e-government adoption in Saudi Arabia and the role that intermediaries play in the adoption process, the adapted UTAUT research model does not consider these moderators.

3 Conceptual Model and Research Hypothesis of E-Government Adoption in Saudi Arabia

The literature review and theoretical background in section 2 has encouraged the authors of this paper to employee the UTAUT model as a framework to study the adoption of e-government in a Saudi context. While the research model used in this research was amended to suit the context of the study, the theoretical constructs included in the study are based on the literature reviewed above. A model depicting the impacts of e-government factors and intermediary roles in perceptions of enhancing intentions to e-government usage at the individual level (citizens) is presented in Figure 1. As such, the conceptual model proposed in this study uses the following factors from the UTAUT model.

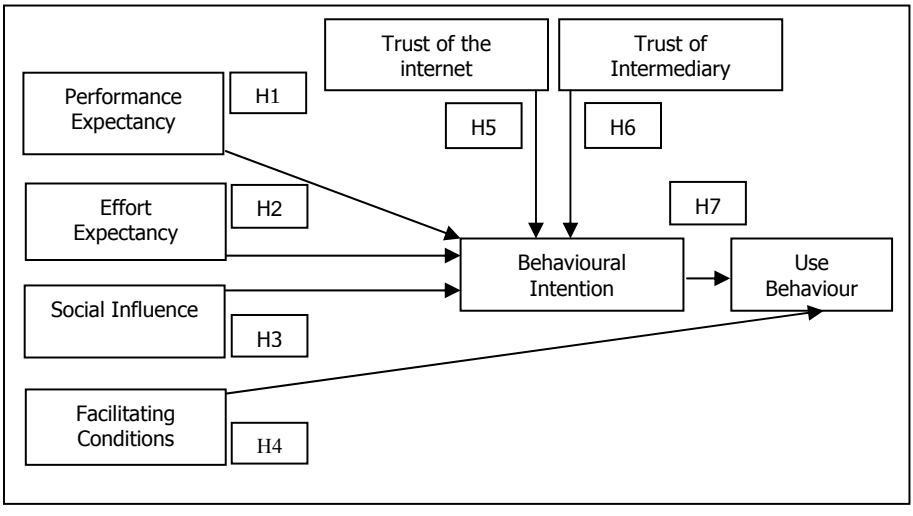

Fig. 1. Conceptual Model of Citizen Adoption of E-Government in Saudi Arabia

A number of studies have applied UTAUT to explore citizens' acceptance of e-government in developed and developing countries, with many factors seen to be influential [9][2][10][5]. Therefore, it is very important to this study to consider these factors when investigating the role of intermediaries in relation to citizens' intention to use e-government services. In addition, it is necessary for this study to consider and incorporate additional factors into the UTAUT model that are specifically related to the Saudi Arabian context, for instance using intermediaries to facilitate e-government adoption. Table 1 presents a summary of constructs, definitions, and scales among the eight measures of e-government adoption used for this study.

Table 1. Summary of Constructs, Definitions, and Scales of Intermediaries in E-government Model

Constructs	Definition	Item Code	Items
Performance Expectancy [28][13][14] [21].	In this research, performance expectancy refers to the degree to which an individual believes that using the e-government or intermediary's (e-office) system will help him or her to attain gains in personal performance	PE1	Using the Traffic department website will enable me to renew my driving license more quickly
		PE2	If I use the Traffic department website I will enhance my social status
		PE3	Traffic department website would enable me to access Traffic department information and services when I need them – 24 hours/day, 7 days/week
		PE4	If I use the Traffic department website I will spend less time processing my driving license renewal application
		PE5	I think interacting with the Traffic department face to face would be preferable rather than interacting online
		PE6	I think interacting with the Traffic department through intermediaries (e-offices) would be preferable to interacting face to face with traffic department officials
		PE7	I think interacting with the Traffic department through intermediaries (e-offices) would be preferable to interacting directly with the traffic department website
Effort Expectancy [28][14]	In this research, effort expectancy refers to the degree of ease associated with use of e-government services	EE1	My interaction with the Traffic department website would be clear and understandable
		EE2	It would be easy for me to become skilful at using the Traffic department website
		EE3	Learning to interact with Traffic department website would be easy for me
		EE4	I find it easy to get the Traffic department website to do what I want it to do
		EE5	It would helpful to use intermediary (e-offices) to interact with Traffic department online
		EE6	It would be helpful to interact online directly with Traffic department
Trust of Intermediary	The degree which individual (citizens) believes that intermediary is a reliable tool to be used to obtain e-government services	TOI1	I think I can trust intermediary organisations.
		TOI2	In my opinion, intermediary organisations are trustworthy
		TOI3	The intermediaries (e-offices) have enough safeguards (passwords, secure computers etc.) to make me feel comfortable using it to interact with the Traffic department online
		TOI4	I am not concerned that the information I submit through the intermediaries (e-offices) could be misused
Use Behaviour [28] [14]	The actual use and associated behaviour of the e-government services.	UB	Have you ever completed a transaction with the Traffic department online?
Social Influence	In the current study, social	SI1	People who influence my behaviour think I should use the online Traffic department

Table.1 (*Continued*)

[28] [15] [14] [2]	influence is defined as the important people pressure (family or friends) that influences the intentions to use e-government, and the influence of an intermediary in increasing the awareness and the social marketing to adopt e-government services		services
		SI2	I would use the e-government services if my friends use them
		SI3	My Friends think intermediaries (e-offices) are helpful for using the Traffic department online service
		SI4	The intermediaries (e-offices) encourage the use of online Traffic department services
		SI5	People who are important to me think that I should use the Traffic department website facilities
Facilitating Conditions [28] [2]	The degree which citizens believe that organisational (intermediary) and technical infrastructure support in using e-government services and remove barriers in such relationships	FC1	I have the computer devise necessary to use the Traffic department website
		FC2	I have access to the internet to use the Traffic department website
		FC3	I have the internet experience necessary to use the Traffic department website
		FC4	Given the resources, opportunities and knowledge it takes to use the Traffic department website, it would be easy for me to use the Traffic department website
		FC5	Guidance was available to me in the selection of the system
		FC6	A specific person (or group) is available for me in the intermediaries (e-offices) to provide assistance with Traffic department website difficulties
Trust In Internet [9]	The degree which citizens believe that internet is reliable to be used in communicating with government online.	TI1	The internet has enough safeguards to make me feel comfortable interacting with the Traffic department website
		TI2	I feel assured that legal and technological structures adequately protect me from problems on the internet
		TI3	I feel secure sending sensitive information across the internet
		TI4	In general, the internet is now a robust and safe environment in which to transact with the Traffic department
Behavioural Intention [28] [2][13]	In this study the behavioural intention is defined as the degree to which citizens intend to use the Internet or an	BI1	I intend to use the Traffic website in future
		BI2	I intend to use the Traffic department website directly
		BI3	I intend to use the Traffic department website through intermediaries (e-offices) in the future
	intermediary for e-government services in the future.		

According to the above discussion and UTAUT literatures [28] the authors have formulate the following hypotheses:

H1: Performance expectancy will have a positive influence on behaviour intention to use e-government services.

H2: Effort expectancy will have a positive influence on behaviour intention to use e-government services.

H3: Social influence will have a positive influence on behaviour intention to use e-government.

H4: Facilitating conditions will have a positive influence on e-government usage behaviour.

H5: Behavioural intentions to use e-government services will have a positive influence on e- government usage behaviour.

H6: Trust on in the Internet will have a positive influence on behavioural intentions to use e-government services.

H7: Trust in the Intermediaries (e-offices) will have a positive influence on behavioural intentions to use e-government services.

4 Research Approach

A quantitative approach is the primary method that was used to collect the data for this research. To assess the research model proposed in the study, a questionnaire survey was used. The advantages of using the questionnaire are that it is easy to distribute in different locations at the same time and costs less [7]. The questionnaire used for this study consisted of 43 questions and included single answer, multiple choice, closed-ended, and 5-point Likert scale questions, which ranged from strongly disagree to strongly agree. After the questionnaire was built, a pre-test was done using six researchers and three practitioners in order to improve the questions and enhance the comprehension of respondents before final distribution [25]. As the questionnaire was designed in English and the targeted research context is an Arabic country (Saudi Arabia), the authors converted the questionnaire into Arabic and validated the translation by sending the questionnaire to four academic staff from a Saudi university. In the questionnaire, a brief explanation about e-government and purpose of the study was provided for the benefit of the participants. The main aim of this study was to explore the roles of intermediaries in the adoption of e-government; therefore, the sample selected was influenced by the objectives of this study to examine the impact that intermediaries may have on digital divide factors that affect individuals' (citizens) adoption of e-government. Thus, the sample of this research was aimed at all citizens in Madinah. The survey questionnaires were then distributed randomly to 750 citizens in Madinah, from September to December 2010 of which 626 respondents were found to be useful (83.4% of total survey), and 124 were discarded because of incomplete answers (90), or because they were completed by females (34). All of the participants were males; this is because this research looked at the Saudi traffic department as the example of e-government services in Madinah city, and females were eliminated from the questionnaire survey since they do not have the

right to drive in Saudi Arabia. The items of this survey were adopted from Venkatesh et al. [28] and modified to meet the research objectives. In addition, some items were built based on intermediaries' literature in order to understand the roles of intermediaries in facilitating e-government adoption.

5 Data Analysis

The proposed research model consisted of six independent variables: performance expectancy, effort expectance, social influence, facilitating conditions, trust of Internet, trust of intermediaries, and two dependent variables: intention behaviour and use behaviour. To check the responses of these questions, the first stage consisted of checking the responses and tagging them with a unique number. The author generated the descriptive statistics (percentages and tables) and used Linear Regression analysis by utilising SPSS (Version 18.0). Descriptive data analysis provides the reader with an appreciation of the actual numbers and values, and hence, the scale that researchers are dealing with [12].

5.1 Descriptive Statistics

Out of the verified respondents, the descriptive statistics are as follows. In terms of age, 50.8% of the respondents were between the ages of 18 and 30, 40.4% were between 31 and 45, and 6.95% were between 45 and 54. Additionally, 1.9% of respondents were younger than 18 or older than 54 years old. As summarised in table 2, the average scores for respondents of performance expectance ranged from 3.88 to 3.01 (where 1 = minimum and 5 = maximum). Descriptive statistics show that these scores are high. For effort expectance, the score ranged from 3.42 and 3.82, which is also high. Concerning social influence, the result shows that the mean ranges from 3.42 to 3.66. According to the facilitating conditions construct the score ranges between 3.38 and 3.89. The score for behaviour intention construct ranges between 3.34 and 3.80. For trust of internet construct the mean score ranged between 3.32 and 3.55. Finally the trusts of intermediary construct score range between 3.26 and 3.38.

As presented above in table 2, most of the respondents scored to be neutral, this is due to the fact that the concept of e-government services in Saudi Arabia is relatively new. According to the statistical results of the questionnaire, the 30-44 age group has the most usage of Internet applications (37.6%). This is followed by the 25-29 age group (27.7%) and the 18-24 age group at approximately 21.4%. The age group between 45 and 54 years old has around 5.5% who are Internet users in Saudi Arabia. The under 18 age group and older than 54 age group are combined to be 1.26% of Internet users. As for adopting e-government services among citizens in Madinah, it has been found that the age group between 30 and 44 years (26.6%) were the highest adopters. This is followed by the 25-29 age group (18.05%) and the 18-24 age group at around 13.4%. Those younger than 18 and older than 54 age groups are collectively represented by 1.1%. These statistical result shows that the Internet and e-government is distributed between 18 and 44 years.

Table2. Descriptive Statistics

Factors	Mean	Std. Dev.	Factors	Mean	Std. Dev.
1- Performance Expectancy			5- Behavioural Intention		
PE1	3.86	1.210	BI1	3.73	1.213
PE2	3.37	1.229	BI2	3.80	1.160
PE3	3.88	1.138	BI3	3.34	1.278
PE4	3.87	1.172			
PE5	3.01	1.391			
PE6	3.30	1.357			
PE7	3.09	1.330			
2- Effort Expectancy			6-Trust Of Internet		
EE1	3.68	1.063	TI1	3.55	1.161
EE2	3.81	1.069	TI2	3.50	1.164
EE3	3.79	1.096	TI3	3.32	1.181
EE4	3.67	1.162	TI4	3.54	1.162
EE5	3.42	1.277			
EE6	3.81	1.131			
3- Social influence			7-Trust Of Intermediary		
SI1	3.66	1.054	TOI1	3.38	1.196
SI2	3.63	1.093	TOI2	3.38	1.184
SI3	3.46	1.169	TOI3	3.38	1.225
SI4	3.55	1.190	TOI4	3.29	1.275
SI5	3.42	1.212			
4- Facilitating Condition					
FC1	3.57	1.247			
FC2	3.56	1.217			
FC3	3.78	1.152			
FC4	3.89	1.102			
FC5	3.54	1.138			
FC6	3.38	1.219			

Notes: Std.Dev. = Standard Deviation
Scores Range from 1 to 5, where 1 = Strongly Disagree and 5= Strongly Agree.

5.2 Reliability Analysis

Cronbach's coefficient alpha values were chosen to examine the internal consistency of the measure [17]. Hinton et al. [17] have suggested four different points of reliability: excellent (0.90 and above), high (0.70-0.90), high moderate (0.50-0.70) and low (0.50 and below). The reliability for each construct is illustrated in Table 3.

The high Cronbach's Alpha value indicates that the constructs were internally consistent and the reliability is measured from the same construct. The Cronbach's results varied between 0.785 for the performance expectancy and 0.897 for the trust of intermediary constructs. According to the above results (table 3), all five constructs present high reliability in predicting intention behaviour toward e-government services. The Cronbach's value showed that the appropriate level of internal consistency of the model construct is satisfied. A regression analysis was used to measure the influence of independent variables on the behavioural intention to adopt e-government services promoted by the roles of intermediaries in a Saudi Arabian context. Five factors were proposed to predict behavioural intention: performance

Table 3. Reliability Test of the model

Model Constructs	Cronbach 's Alpha	Number Of Items	Result	No Of Participants
Performance Expectancy (PE)	.758	7	High Reliability	624
Effort Expectancy (EE)	.801	6	High Reliability	611
Social Influence (SI)	.763	5	High Reliability	621
Facilitating Conditions (FC)	.797	6	High Reliability	601
Behavioural Intention to Use(BI)	.677	3	High Moderate	598
Trust of Internet (TI)	.863	4	High Reliability	621
Trust of intermediary (TIO)	.897	4	High Reliability	615

expectancy, effort expectancy, social influence, trust of technology (Internet) and trust of intermediary. The R square accounted for 0.454 (table 4), which means that independent variables of Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Trust of Internet (TI) and trust of intermediary (TOI) explain an additional 45% (0.454 × 100) of the variance in behavioural intention to use e-government services; and this is a statistically significant contribution (Sig.= .000). Further, the result showed that the model is statistically significant ($F(51.096) = 102.989$, $P < 0.001$).

Table 4. Regression analysis coefficients (dependent variable)

(a) Predictors – ANOVA (b) – Coefficients (c)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.674(a)	.454	.449	.704

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	255.482	5	51.096	102.989	.000(a)
	Residual	307.604	620	.496		
	Total	563.086	625			

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta (β)		
1	(Constant)	.397	.150		2.656	.008
	PE	.087	.048	.074	1.794	.073
	EE	.379	.052	.321	7.319	.000
	SI	.088	.048	.076	1.820	.069
	TI	.213	.036	.221	5.952	.000
	TOI	.140	.032	.157	4.320	.000

(A) Predictors: (Constant), PE, EE, SI, TI, TOI.
(B) Dependent Variable: BI
(C) Coefficients

Table 5. Logistic Regression of Saudi e-government Model

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1a	FC	.339	.124	7.497	1	.006	1.404
	BI	.099	.107	.854	1	.355	1.104
	Constant	-1.895-	.415	20.884	1	.000	.150
a. Variable(s) entered on step 1: FC, BI.							

Three predictors of the current model were found to be significant. According to the above results (table 4), the significant variables are as follows: effort expectancy (β=.321, p=.000), trust of Internet (β=.221, p=.000), and trust of intermediary (β=.157, p=.000). Further, in this study, the beta (β) size showed that the most important factor influencing the behaviour intention to adopt e-government services is effort expectancy. The second influential factor that impacts the explanation of the behaviour intention is trust in Internet construct, followed by trust of intermediary construct. Further, performance expectancy and social influence construct are not making any unique significant contributions to the prediction of behaviour intention in the Saudi Arabia e-government context. Nonetheless, when dependent variables of the study are categorical (e.g. usage behaviour construct in this study represented by Yes/No) logistic regression was found to be suitable [22]. In this research the dependent variable (usage behaviour) was coded as 1= Yes and 0= No. As shown in table 5 facilitating conditions contribute significantly to the usage behaviour of e-government services (p= .006 <.05). However, behaviour intention showed to have no unique contribution in usage behaviour of e-government (p= .355 >.05).

6 Discussions and Conclusions

While a strong relationship between age differences and e-government adoption has been reported in the literature, the statistical analysis of this study shows that the people most adopting e-government in Saudi Arabia is between 18 and 44 years. This shows that the older people can be categorised as non-adopter of e-government, and may therefore need further help and support towards e-government adoption. Furthermore, in reviewing the prior studies, no statistical data was found on the association between intermediary and e-government adoption. This study found that there is a significant relationship between three constructs (effort expectance, trust of internet and trust of intermediary) and e-government adoption behaviour, showing that there is strong support for the hypotheses proposed in this study (β=.321, p<.01), trust of Internet (β=.221, p<.01), and trust of intermediary (β=.157, p<.01). The resulting implication is that, having these three constructs plays a strong role in determining e-government adoption. Further, this study found that there is a significant relationship between the facilitating conditions construct and usage of e-government services, which clearly indicates that the more facilitating conditions (intermediaries) Saudi e-government have the more barriers that will be removed, furthering the citizens engagement with e-government.

Cronbach's Alpha was found an appropriate tool to measure the reliability of independent variables in accordance with behavioural intention to adopt e-government services. Literature indicated that reliability in an exploratory study should be equal to or higher than 0.60 (Dwivedi et al., 2007; Straub et al., 2004). The current study showed that (see table 3) all constructs were found to be above 0.60 which means all of them obtained the level of internal consistency of measurement. Further, the present study adds to our understanding of the role of intermediaries in working in parallel with different constructs in explaining behavioural intentions with regard to the adoption of e-government and confirms previous findings (Chatterjee, 2008). Intermediary theory suggests that the most important roles of intermediaries are to enhance trust between two parties (Bailey & Bakos, 1997). This is confirmed by the empirical findings in this study. Furthermore, Carter and Belanger (2005) stated that trust is an important factor that affects citizens' adoption of e-government services. Also, this study suggests that intermediaries are essential, particularly for developing countries as they develop their infrastructure to bridge technical gaps and digital divide. The major theoretical implications of these research findings are that citizens' adoption and usage of e-government can be explained by trust of intermediaries; the intermediary organisations can enhance trust between government and citizens increasing adoption. A second implication for e-government theory is that, using intermediaries in e-government can facilitating e-government usage, and be able to predict usage behaviour. Since this paper is a result of a preliminary study, several limitations need to be considered. In particular, this study does not measure the moderator variables in UTAUT. Therefore, considering the moderator variables could further explains the main constructs that determine behavioural intention to use e-government services and usage behaviour. Furthermore, the empirical work can be further extended to cover other e-government services beyond the traffic department example used in this study which only considered males.

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User Acceptance of SMS-Based eGovernment Services

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Abstract. Delivering public services through the SMS channel is becoming popular and has demonstrated its benefits. Some of the initiatives involved big investment. However, citizens' acceptance of the services is still an issue. This paper presents a study on user acceptance of SMS-based e-government services. It assesses the adequacy of four prominent models of technology adoption (TRA, TAM, TPB, and DTPB) to explain intention to use SMS-based e-government services and proposes a generic model of individual acceptance of SMS-based e-government services. Constructs of the proposed model were derived from a survey on citizens' motivations for using SMS-based e-government services, theories on individual acceptance of technologies, and user acceptance determinants of SMS and e-government services. Data for validating the models were collected from 589 citizens in three cities in Indonesia. The proposed model may explain why individuals accept or reject SMS-based e-government services and how user acceptance is influenced by the service characteristics.

Keywords: SMS, e-government, user acceptance, DTPB, TPB, TAM, TRA.

1 Introduction

SMS-based e-government refers to the use of SMS technology for providing information and public services to citizens (G2C), business (G2B), and government employees or other government organizations (G2G). The services are available as notification, pull-based information, communication, and transaction services. Some of them have been integrated with existing Internet-based e-government systems [1].

Currently, benefits of SMS-based e-government are harvested by many local authorities. They include reducing time and cost for public services; introducing a cheaper, easier and faster information-accessing channel; improving transparency, accountability, communication and the relationship between government and citizens; making the services and procedures easier for citizens to use; improving the district political image; increasing citizens participation; and promoting e-Democracy [2, 3].

In light of these benefits, SMS-based e-government is becoming popular and some of the initiatives have involved big investment. The Australian government, for example, allocated $15 million for setting up a *National Emergency Warning System* (NEWS) that will send text alerts to the mobile phones of residents threatened by bushfires, disease epidemics, sieges, cyclones, terrorist attacks, locust plagues and heat or smog.

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Despite the important roles of SMS-based e-government and substantial growth in the development of the services, some cases revealed that user acceptance of SMS-based e-government services is still an issue. Lallana [2] and Alampay [4] reported that even though SMS is very popular in the Philippines, some SMS-based e-government services in the country did not have many users. Similar cases in Denmark and Sweden also suggested that there are factors other than the popularity of SMS and awareness of the services which influence people to use SMS-based e-government services [5]. The popularity of SMS and awareness of the benefits of SMS-based e-government do not guarantee most citizens will use the services. It is a serious issue, since governments may not obtain the potential benefits of SMS-based e-government and cannot justify the investment in SMS-based e-government systems unless citizens actually use the services. Accordingly, studies on user acceptance of SMS-based e-government services are needed.

This paper is a part of a study investigating factors that may influence individuals to use SMS-based e-government services. It proposes a model of individual acceptance of SMS-based e-government. The model aims to understand why non-adopters reject SMS-based e-government services and what factors would influence them to use the services. From a practical standpoint, this study is interesting not only in explaining why an SMS-based e-government service is unacceptable to a set of users, but also in understanding how to improve user acceptance through the design of the system and the service. This knowledge should be important for government and e-government practitioners to predict user acceptance of a new SMS-based e-government service and to evaluate present SMS-based e-government service

2 Research Methodology

To formulate a model of user acceptance of SMS-based e-government services, the current study involved two main activities. The first is to formulate a research model and the second is to empirically compare four prominent models (TRA, TAM, TPB, and DTPB) and the proposed model.

To formulate a research model, this study used both inductive and deductive approaches. For the inductive approach, this study collected empirical data on individuals' motivations for using or not using SMS-based e-government services. A *triangulation* method combining a web-based survey, a paper questionnaire and a phone-call interview was used to improve the validity of the collected data. For the deductive approach, this study assumed that determinants of adopting SMS-based e-government services are composed by determinants of adopting SMS and e-government services. Hence, this approach derived the acceptance factors theoretically from prominent models of individual acceptance of technologies and user acceptance of SMS and e-government services found in four research directions' literatures: adoption research, diffusion research, uses and gratifications, and domestication studies. The study extracted the factors to formulate a conceptual model of individual acceptance of SMS-based e-government services.

To validate the proposed model empirically, this study used data from citizens in three cities in Indonesia, structural equation modelling (SEM) and AMOS 18. It empirically compared the adequacy of the four models to explain intention to use SMS-based e-government services, validated the research model and generated a better fit model.

3 Formulation of a Research Model

To identify the adoption factors of SMS-based e-government services, a survey investigating citizens' motivations for using or not using SMS-based e-government services has been conducted over three months (April – June 2010) collecting 159 responses from 25 countries. The majority of the respondents were from Indonesia and India (66.7%), male, 31-40 years old and included respondents who have Internet access and ones who do not. The survey identified 15 beliefs which may influence individuals to use or to reject an SMS service: perceptions about ease of use, efficiency in time and distance, value for money, responsiveness, relevance of the information, flexibility to access the services, trust in SMS technology, quality and reliability of the content, risk to user privacy, reliability of the system and the mobile network, trust the government and quality of public services, risk to money, availability of the device and infrastructure, compatibility, and self efficacy to use SMS [6].

Further, to compose the factors into a research model, this study reviewed extant technology adoption models and user acceptance of SMS and e-government services. The proposed model focuses on factors determining *usage intention* since this study aims to discover what factors influence non-adopters to use SMS-based e-government services and usage intention is confirmed as the strongest predictor of actual usage [7,8,9,10]. Usage intention has been also confirmed as the strongest predictor of usage behavior of SMS-based services [11].

Among prominent technology adoption models, in order to compose a research model, this study adopted the decomposed theory of planned behaviour (DTPB) for the following reasons. First, the DTPB was developed especially for understanding information technology use [7] and effectively explained individual intentions and behavior in adopting e-government services [12] and mobile services [13]. Second, the acceptance of SMS-based e-government services is not entirely in citizens' control: the condition satisfies core assumption of the DTPB that the presence of constraints including self-efficacy and facilitating conditions (such as the absence of mobile device or lack of skills to use SMS) can inhibit both the intent to use the service and the usage behavior itself. Third, the DTPB incorporates social influence that seems relevant for collaborative systems in the everyday life context like SMS-based e-government [14]. Fourth, the DTPB with its decomposition approach offers two advantages over other prominent models with monolithic belief structures (such as TRA, TAM, and TPB): studies showed that monolithic belief structures, representing a variety of dimensions, are not consistently related to the antecedents of intention [7]; the decomposition approach, on the contrary, can provide a stable set of beliefs which can be applied across various settings overcoming some of the disadvantages in operationalization noted with other traditional intention models [15]. Moreover, due to the elaborate nature of the TPB, the DTPB provides a more complete understanding of usage behaviour relative to parsimonious models such as the TAM and the TPB [7]. The last but not least is the survey conducted by this study

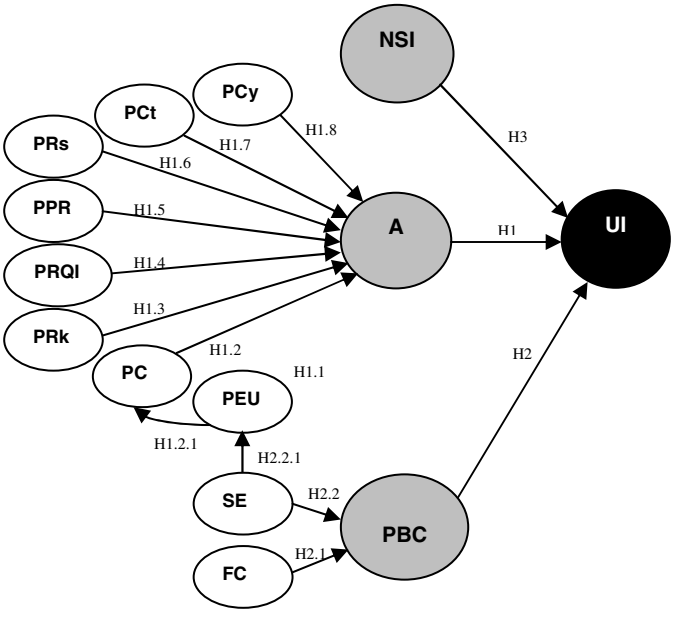

Fig. 1. Research model

also revealed that individuals' motives for using SMS-based e-government services include attitudinal beliefs, social beliefs, and control beliefs as suggested in the DTPB model.

This study hypothesizes that attitude towards using SMS-based e-government services (A), perceived behavioral control (PBC) and normative social influence (NSI) will play a significant role as direct determinants of usage intention of SMS-based e-government services. PBC is composed of two beliefs: *facilitating conditions* (FC) and *self-efficacy* (SE); social influences are composed of one belief: *normative social influence* (NSI); and attitude are composed of eight beliefs: *perceived ease of use* (PEU), *perceived convenience* (PC), *perceived reliability and quality of the information* (PRQI), *perceived cost* (PCt), *perceived personal relationship* (PPR), *perceived responsiveness* (PRs), *perceived risk* (PRk), and *perceived compatibility* (PCy).

Compared to the original DTPB model, this study introduced six attitudinal beliefs specifically for user acceptance of SMS-based e-government services: *perceived convenience* (PC), *perceived reliability and quality of the information* (PRQI), *perceived cost* (PCt), *perceived personal relationship* (PPR), *perceived responsiveness* (PRs), and *perceived risk* (PRk). Instead of using general term of perceived usefulness, it proposed *perceived convenience*.

Figure 1, Table 1, and Table 2 present the research model, definitions of the constructs, and a summary of the hypotheses and the supporting studies consecutively. Further discussion on the constructs and the theoretical justification for the research model can be read in a previous publication of this study [16].

Table 1. The constructs and definitions

Construct	Definition
Usage intention (UI)	a measure of strength of individual's intention to use an SMS-based e-government service [9].
Attitude towards use (A)	The degree to which a person has a favourable or unfavourable evaluation of using an SMS-based e-government service in question [8].
Perceived behavioral control (PBC)	The extent to which a person perceives that the required opportunities and resources to use an SMS-based e-government service are available for him/her [8].
Normative social influence (NSI)	A person's perception that most people who are important to him think he should or should not perform the behaviour [8]. In the context of SMS-based e-government, the survey revealed that individuals perceived *normative social influence* (NSI) dominantly from family, friends or peers, and government [6].
Perceived ease of use (PEU)	The degree to which a person perceives that using an SMS-based e-government service is easy [9]. This perception covers usability on the registration and unsubscribe methods, the text format for requesting information, the service number (whether it is easy to remember or not), and the way to use all of the service's functions [6].
Perceived convenience (PC)	The degree to which a person believes that using an SMS-based e-government service would give him/her flexibility and efficiency in time, place, effort and control in accessing public services [6]. It represents *perceived usefulness* construct in TAM relevant for SMS-based e-government services.
Perceived risk (PRk)	The degree to which a person believes that using an SMS-based e-government service may cause problems for him/her. The concerns include risk of the SMS technology, risk to user privacy and security, and perceived financial risk [6].
Perceived reliability and quality of the information (PRQI)	The degree to which an individual perceives that the information delivered by an SMS-based e-government is relevant for him/her, reliable and up-to-date [6].
Perceived personal relationship (PPR)	The degree to which an individual perceives that using an SMS-based e-government service enables him/her to communicate directly and in-person with the decision maker [6].
Perceived responsiveness (PRs)	The degree to which individual perceives that an SMS-based e-government service respond any incoming messages quickly and satisfactorily [6].
Perceived cost (PCt)	The degree to which a person perceives that an SMS-based e-government service is costly. The perception covers individual consideration whether the service charges users more than a standard SMS rate [6], comparison between the SMS cost to other communication channels such as phone call or Internet cost [8], and comparison between the cost and benefits they might obtain from using the service [11, 17].
Perceived compatibility (PCy)	The degree to which individual perceives that an SMS-based e-government service is consistent with the way the one communicates, the existing public service channels and the popular communication media, and perceives the service or the information contents is suitable being delivered by SMS [6, 23].
Facilitating conditions (FC)	Individual's belief on the availability of resources needed to use an SMS-based e-government service, such as a mobile phone and phone credit [6, 10].
Self-efficacy (SE)	Individual's self-confidence in his/her capability to use an SMS-based e-government service, including self-confidence in capabilities to use SMS, to register to and unsubscribe from an SMS-based service, and to utilize an SMS-based service's functions [6, 7].

Table 2. The research hypotheses and the supporting studies

Hypotheses		Supporting studies
Usage intention constructs		
H1	A → UI	[7, 9, 12,17, 19]
H2	PBC → UI	[7, 12, 19]
H3	NSI → UI	[7, 12, 19]
Attitudinal and control beliefs		
H1.1	PEU → A	[6, 7, 9, 12, 14, 17, 19,20]
H1.2	PC → A	[6, 7, 9, 12, 14, 17, 19,20]
H1.3	PRk → A (negative relationship)	[6, 12]
H1.4	PRQI → A	[6, 17, 21]
H1.5	PPR → A	[6, 14, 22]
H1.6	PRs → A	[6, 14]
H1.7	PCt → A (negative relationship)	[6, 11, 17]
H1.8	PCy → A	[6, 7, 12, 16, 23, 24]
H2.1	FC → PBC	[6, 11, 12]
H2.2	SE → PBC	[6,7, 12]
Crossover effects between underlying beliefs		
H1.2.1	PEU → PC	[9, 25, 26]
H2.2.1	SE → PEU	[25, 27]

4 Empirical Validation

To perform an empirical validation of the model, this study conducted five main activities: developing measures for each variable of the model, data collection, assessing the validity and reliability of the measures, validating the model using the collected data, and modifying the model until the model-fitness parameters were satisfactory.

4.1 Developing the Measures

To ensure the validity of the measurements, this study initially generated the questionnaire by adopting related-question items validated in prior studies and modified them specifically to SMS-based e-government context. Items measuring *usage intention* were adopted from Turel et al.'s [11] and Venkatesh et al.'s [10] studies. *Attitude*, *perceived behavioral control*, and *normative social influence* scales were adopted from Ajzen's [8], Taylor and Todd's [7] and Nysveen et al.'s [19] studies. Items measuring the dimensions of *attitude*, *perceived behavioral control* and *normative social influence* were mainly adopted and generated from Davis et al.'s [9], Ajzen's [8], Taylor and Todd's [7] studies, and the survey findings on individuals' motivations for using or not using SMS-based e-government services [6]. Table 3 presents sources of the scales.

The questionnaire was available in two languages: English and Indonesian (*Bahasa*). The English questionnaire was translated in Bahasa then evaluated using back-translation method by bilingual reviewers. The questionnaire in *Bahasa* was also pretested on monolingual *Bahasa*-speaking respondents and modified based on the feedback.

Table 3. Constructs and source of the scales

Construct	Source of the scales
Usage intention (UI)	[10,11]
Attitude toward using the services (A)	[7, 8, 19]
Perceived ease of use (PEU)	[6, 9,10, 19, 24, 27]
Perceived convenience (PC)	[6, 19]
Perceived reliability and quality of the information (PRQI)	[6, 17, 22, 24]
Perceived cost (PCt)	[6, 11]
Perceived personal relationship (PPR)	[6, 14, 22]
Perceived compatibility (PCy)	[6,7, 12, 24]
Perceived risk (PRk)	[6, 12, 24, 25]
Perceived responsiveness (PRs)	[6, 14]
Perceived behavioral control (PBC)	[7, 8, 19]
Self-efficacy (SE)	[7, 8, 14]
Facilitating conditions (FC)	[6, 7, 8, 10, 25]
Normative social influence (NSI)	[6, 7, 8, 10, 12, 19, 24]

Initially, the measurement instrument was a questionnaire using a five-point *Likert scale* with anchors ranging from "strongly agree" to "strongly disagree". It contains 4 questions asking information about the used SMS applications, 4 questions about demographics, and 110 questions to measure the constructs of interest. To verify the questionnaire, a face validity test was conducted in turn.

Face validity refers to an assessment whether each question-item in the questionnaire seems like a reasonable/logical way to gain the information about the factor of interest, is well designed, clear and not ambiguous, concise, has adequate time limits, appropriate level of difficulty, appropriate patterns of the answers, and the instructions are clear. To conduct face-validity test, the questionnaire was reviewed by an expert in e-government, three statistics consultants, reviewers of the *Behavior and IT journal*, and pre-tested by 8 respondents (consisting English-speaking respondents as well as *Bahasa*-speaking respondents) who were asked to complete the questionnaire and to comment on any aspects of the questionnaire. Based on the feedback, the instruction and some questions were reworded slightly, some questions were worded with proper negation to reduce the potential monotonous responses (such as all answers are 'strongly agree' or 'strongly disagree'), and the redundant questions were eliminated. As result, the face validity test produced a modified questionnaire which used a seven-point *Likert scale* containing 4 questions about the SMS applications, 4 demographics questions and 59 questions to measure 14 constructs of interest.

4.2 Samples

Since the model focuses on factors that may influence non-adopters' intention to use SMS-based e-government services, this study validated the measures and the proposed model using data collected from individuals who have never used SMS-based e-government even when the services are available for them. It involved citizens in three cities in Indonesia which have delivered SMS-based e-government services (i.e. Yogyakarta, Surabaya, and Solo). The respondents were told about available SMS-based e-government services in their cities and were encouraged to try the services before answering the survey. Data were collected using a paper-based survey.

The participants were 589 citizens in three cities in Indonesia: 248 people (42.1%) are residents of Surabaya, 191 people (32.4%) are Solo's residents, and 150 people (25.5%) are Yogyakarta's residents. With respect to the type of SMS-based e-government service, 121 respondents (20.5%) evaluated Notification services, 235 (39.9%) evaluated Pull services, 67 respondents (11.4%) evaluated Listen services, 90 respondents (15.3%) evaluated Transaction services, and 76 respondents (12.9%) did not specify the service's type [1]. The majority of the respondents (522 people or 88.6%) are students in a bachelor degree with the last completed education level the high school, 58 respondents (9.8%) have completed a bachelor degree, 6 respondents (1.0%) have completed master degree, 2 respondents (0.3%) completed primary school, and one respondent (0.2%) did not answer his/her education level. In terms of age and gender, the majority of the respondents are male (52.6%), ages 18 up to 30 years old (97.3%).

Before analysing the collected data, this study removed data from respondents who answered less than 75% of the questions as they were considered to not be serious or genuine in their answers. It was also checked for errors such as values that outside the range of possible values for a variable and the number of missing cases.

The collected data have relatively very small number of missing data that is 0.4%. Since AMOS requires complete data to compute parameters of the model fit and modification indices, this study replaced missing data with the mean for the variable's data series based on the respondents' location [28]. For example, a missing datum of question UI1 (usage-intention1) of a respondent from Yogyakarta who evaluated an SMS-based e-government service in city of Yogyakarta was substituted with the mean for question UI1 of respondents from Yogyakarta.

4.3 Measurement

In addition to the *face validity test*, this study also ensured the *construct validity* and *internal consistency-reliability* of the measurement scale before assessing the models. Using SEM, AMOS 18, and data from the 589 samples, each construct (factor) with its items were modelled in conjunction with every other construct and the items in the model. It added curved arrows representing covariance between every pair of latent variables and left in the straight arrows from each latent variable to its indicator variables as well as left in the straight arrows from error and disturbance terms to their respective variables [28]. This study dropped items which have multiple regression weights (r^2) less than 0.20 and there than remained 52 items all statistically significant (p value < 0.01) indicating convergent validity has been achieved [29]. The remaining items were assessed with respect to the discriminant validity using the *correlation method* [28, 30]. Discriminant validity was achieved since there was not a single item correlating more highly with a construct different from the one intended and all correlations between pairs of factors are less than 1.00. Moreover, the values of Conbrach's alpha for all constructs are between 0.616 – 0.865 indicating the scales provided a reliable and consistent measure of the intended dimensions [31, 32 pp.675].

Next, in order to determine which model best explains intention to use SMS-based e-government services, this study conducted *alternative models* (AM) and *model generating* (MG) strategies. Initially, it compared four prominent technology adoption models (i.e. TRA, TAM, TPB, and DTPB) followed by validating the research model and generating a better-fit model. For each model, overall fit, predictive power (R^2) and the significance of the paths were considered, presented in Figures 2 and 3 and Tables 4.

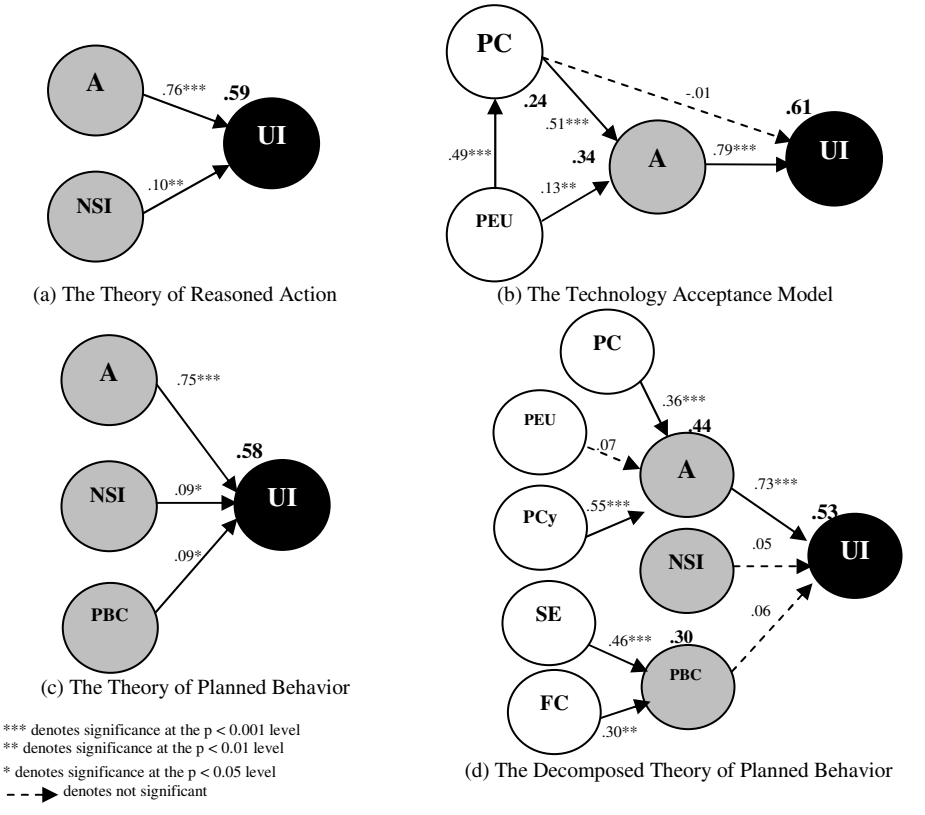

Fig. 2. SEM of TRA, TAM, TPB, and DTPB

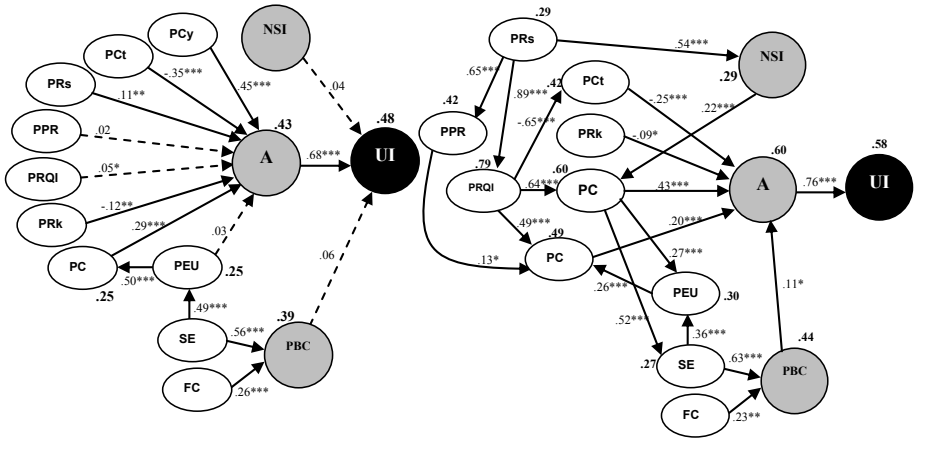

Fig. 3. The research model (left) and the final model (right)

Table 4. Fit statistics and explanatory power of TRA, TAM, TPB, DTPB, the research model and the final model [30, 33]

Parameters	Recommended	TRA	TAM	TPB	DTPB	Research Model	Final model
λ^2	The lower the better	217.642	286.545	363.870	1757.358	3648.895	2540.039
λ^2/df	< 2 or < 5	4.267	2.581	3.639	3.207	2.907	2.035
RMSEA	< 0.05 or < 0.08	0.075	0.052	0.067	0.061	0.057	0.042
IFI	≥ 0.95 or > 0.90	0.950	0.967	0.928	0.865	0.826	0.906
TLI	≥ 0.95 or > 0.90	0.935	0.959	0.913	0.852	0.816	0.900
CFI	≥ 0.95 or > 0.90	0.949	0.967	0.927	0.864	0.826	0.906
PRATIO	The closer to 1.0 the better	0.773	0.816	0.833	0.921	0.946	0.941
R^2_{ui}	The higher the better	59%	61%	58%	53%	48%	58%

4.4 Results and Discussion

Overall, the fit statistics indicate that TRA, TAM, and TPB models provide good fit to the data, while DTPB slightly below of the recommended criteria. The TAM model accounts for 61% of the variance in usage intention, the highest explanatory power of the other three prominent models. The TPB model provides a good fit to the data and explain usage intention lower than TAM. The addition of social normative influence does not, in this case, help to better understand usage intention relative to TRA and TAM. The DTPB and the research model (which is also an extension of the DTPB model) provide a bit lower fit-indices to the data in terms of IFI, TLI and CFI, but a good fit in terms of λ^2/df, RMSEA, and PRATIO indices. Thus, the research model was modified and re-estimated based on modification indices and theoretical basis. Figure 3 (the right image) presents the final model, which is called *SMS-based E-Government Acceptance Model* (SEGAM).

In addition to the original constructs of the DTPB model, the SEGAM introduced six beliefs specifically for SMS-based e-government services: perceived convenience (representing perceived usefulness of SMS-based e-government), perceived risk, perceived reliability and quality of the information, perceived personal relationship, perceived responsiveness, and perceived cost. Nine hypotheses of the research model were accepted (H1, H1.2, H1.3, H1.7, H1.8, H2.1, H2.2, H2.2.1, H1.2.1), while the other six hypotheses were rejected (H2, H3, H1.1, H1.4, H1.5, H1.6). The SEGAM can explain 58% of the variance in usage intention with all paths significant, which is better than the original DTPB model and comparable with the TPB model. The introduction of the six attitudinal beliefs, even does not provide a better prediction of usage intention relative to TPB, provides a better prediction of attitude relative to pure DTPB and TAM (R^2_A=60%, relative to R^2_A=44% for DTPB and R^2_A=34% for TAM).

All of the examined models suggest that individual's attitude towards using an SMS-based e-government service plays a central role in influencing intention to use the service. The SEGAM suggests that the other beliefs influence intention indirectly through attitude and the attitudinal beliefs. The explanation for such a finding is based on the fact that SMS-based e-government services are present in daily live setting and fully voluntary, so intention to use the services will be formed based simply on personal likes or dislikes with respect to utilizing the services rather than due to social pressure. Moreover, by currently high penetration of SMS and mobile phone, availability of the mobile network in most places, simplicity of the SMS technology and low SMS cost, perceived behavioral control on using an SMS-based service may

not be a problem for most citizens. To promote an acceptable SMS-based e-government service, government should develop citizens' positive attitude towards using the service.

In order to improve a positive attitude towards using an SMS-based e-government service, the SEGAM suggests government and the system designers to pay attention more on the compatibility of the service with other public services and common communication channels, to provide free SMS-based service or the cost should not be more expensive than standard SMS rates, the service should provide more convenient access to public services, to promote a safe SMS-based channel, and to improve perceived behavioral control (such as to ensure reliability and availability of the SMS-based service 24/7). When a person perceives that an SMS-based e-government service is compatible with the way they communicate, they may perceive the service is easy to use and their self-efficacy to use the service may also increase. Social influence may influence attitude through perception on compatibility of the service. Perception about quality and reliability of the information may influence perceptions about the service cost, compatibility and benefits of the service. When an SMS-based e-government service provides a fast and satisfactory response any time users request the service, it may improve the users' perception on quality and reliability of the information, users may have a feeling to communicate more in-person with the government rather than with a machine, and a social pressure for using the service is likely present. People may feel more convenient to access a public service when they perceived they communicate in-person with government. Finally, individuals' perceptions of their self-efficacy to use the service and availability of the resources (such as mobile phone or phone credit) may improve their perceived behavioral control, which leads to a more favorable attitude towards using the services.

The proposed model, which includes details of attitudinal beliefs, control beliefs, and social beliefs (i.e. the measures include normative social influences from government, friends/colleagues/peers, family, respected people, and people around), provides a fuller explanation of usage intention of SMS-based e-government services and better predictive power of attitude, perceived behavioral control, and normative social influence (R^2_A=60%, R^2_{PBC}=44%, R^2_{NSI}=29%) relative to the other models. This study argues that decomposing attitude, perceived behavioral control, and social norms into more specific beliefs can give more practical benefits [7]. It provides beliefs specifically relevant for the SMS-based e-government context that may be manipulated through systems design and implementation strategies.

5 Conclusions

This study compared four prominent models and proposed a model of user acceptance of SMS-based e-government services. It proposed 13 beliefs that may influence individuals to use or to reject SMS-based e-government services. Among the factors, attitude towards use is the strongest predictor of intention to use SMS-based e-government services and perceived compatibility is the strongest predictor of the attitude towards use. In order to have acceptable SMS-based e-government services, government should accommodate all of the factors when developing and delivering the services. Government particularly should pay attention more on how to develop a

positive attitude of citizens towards using the services through perceived compatibility of the services. The proposed model may enable governments to predict user acceptance of a new SMS-based e-government service and to evaluate existing services.

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Components of Trust Influencing eGovernment Adoption in Germany

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Abstract. User acceptance plays a pivotal role in success of all IS projects. Yet, most of the e-government endeavors worldwide have fallen short of their potential. Online transactions with public administrations are plagued with concerns of data protection and privacy resulting in reluctance to engage in e-government. Although trust is confirmed to be an effective instrument for dealing with the anxiety of the faceless transactions, the majority of trust studies have been conducted in the context of e-commerce. Until now, relatively little research has focused on the role of trust influencing willingness of citizens to use e-government services. Based on a nationwide representative survey, our study contributes to prior literature by delivering the empirically-validated components of trust influencing the adoption of e-government in Germany. Enhanced with a research model of trust, this paper promotes a better understanding of the factors that halt or slow down e-government adoption in the German household.

Keywords: Trust, e-government, adoption, household, Germany.

1 Introduction

Lack of user acceptance is a significant impediment to the success of new technologies [1] which makes user acceptance the pivotal factor in determining the success or failure of any IS project [2]. Research about why users accept or reject information systems and factors to increase adoption has long been a popular topic in adoption of online services [3].

Electronic government is being increasingly recognized as a key facilitator for transforming public governance. Despite huge investments, e-government initiatives continue to lag far behind their expected potentials [4]. Most internet users are still reluctant to use online methods to interact with public authorities. It is remarkable to see that people participate in social networking sites, use e-commerce applications, perform their banking transactions online but hesitate to use internet to communicate with public authorities. In Germany, 72 percent of the population use internet [5]. The number of Facebook has nearly doubled only in the last nine months [6]. Last year, 75 percent of the German internet users purchased goods and services online, 49 percent used online banking, but only 39 percent downloaded forms of public authorities [7]. Citizens consider data protection and security as the most important issues in online

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banking however more than four out of every five people continue using it [8]. Considering the economical crises and worldwide data scandals, it is a notable result.

Skepticism, however, increases when government is the service provider. Particularly, citizens tend to suspect that government watches everything and gathers data about citizens through various channels [9]. Citizens do not exactly know how the collected data is used by the public authorities and consequently do not trust government. Moreover, due to the inherent nature of online transactions, citizens experience some level of risk and uncertainty. Various data scandals and harsh critics of nationwide projects involving transfer of sensitive personal data intensify concerns of citizens towards online public services. In these uncertain situations, enhancing trust becomes a crucial strategy for dealing with the risk and uncertainty of the transactions with the public authorities. Given the increasing prevalence of trust in e-government research, building trust of citizens in e-government has recognized as the top research priority in Europe [10].

Previously, trust in e-government services was accepted as a single construct. With the increasing amount of trust research in this context, the authors have started distinguishing among the components of trust. We also believe that trust is a very broad concept with various dimensions in e-government research. Thus, it would be an oversimplification to observe trust as a single construct. Besides the concerns of technology, privacy concerns point out to the existence of trust to government. Recognizing the importance of trust as an underlying source of motivation for e-government usage [11], the research questions for this paper are targeted to understand the particular role of trust in e-government adoption: What are the trust-related barriers impeding the adoption of online public services in the German household? Which specific components and sub-components of trust can be identified in this context?

As the national culture and trust are proven to be closely related [12-14], many authors analyze the role of trust a specific national culture [11, 15] or compare them in cross-cultural studies [16]. The need for a specific empirical study focusing on the role of trust in e-government research of Germany was pointed out recently [17]. Hence, the focus of our paper is to provide insights into the components of trust that are valid for the national culture of Germany. In particular, our research is important for practitioners, policy makers and academics as it includes a nationwide representative survey reflecting the current perceptions of the German households.

The document is organized as follows. The next section reviews the existing trust literature in the context of e-government adoption, particularly focusing on the components of trust. Having argued the necessity of trust for the success of the ongoing and future projects, the following three sections focus on a recent, nationwide representative survey about the awareness and adoption of e-government in the German household. Section three describes the method applied to carry out the research and section four summarizes the main findings. This is followed by a discussion in the subsequent section, which also includes implications, limitations and future directions of this research. We conclude by summarizing the key findings arising from our research.

2 Literature Review

Trust is a ubiquitous feature that is essential to all types of transactions [18]. Particularly in the context of attracting new customers, trust is found to be "an extremely important economic factor" [19]. It is accepted as a main antecedent influencing customer loyalty in e-service context [20]. Thereby, trust is an important driving force to influence the initial and continued use of an e-service. Researchers have long acknowledged that the need for trust arises only in the presence of risk [21]. Risk causes uncertainty and insecurities, whereas trust is an effective coping mechanism and "willingness to take risk" [22] by changing its perception.

E-government services are by nature online services which require involvement of technology, citizens and governmental organizations. There exists an extensive amount of literature about the role of trust, its antecedents and implications influencing the online shopping behavior [23-25]. However, we see that research in the context of e-government has recently started to emerge. Although some studies have underlined the importance of trust for the e-government adoption previously [16, 26], most of the empirical work have been conducted in the last couple of years. Most studies have mentioned trust as a significant predictor of usage among others [27-29]. Recognizing the importance of the issue in the context of e-government, studies have emerged focusing mainly on trust as an acceptance factor in e-government [30].

Previously, trust in e-government services was accepted as a single construct [16]. With the increasing amount of trust research in this context, the authors have started conceptualizing trust as a combination of different components such as disposition to trust, trust in technology and trust in government. The literature reveals no consensus on the categorization of sub-factors as dimensions, constructs, components or determinants of trust. The study of Carter and Belanger [28] was among the first research in the context of e-government that conceptualizes trust in two different components: (1) trust of government and (2) trust of internet. Similarly Srivastava and Teo [31] discussed the component of trust on government and extended the trust of internet to a more broader term of trust on technology. Following these publications, the dimensions of trust in government and trust in technology have been subject to other researches [32]. There has not been a consistency in terms of trust components. Some studies have analyzed trust as a single component: trust in e-government services [33] or trust in government [34, 35]. A few authors have used a combination of component and sub-component in the same research: trust in e-government services and trust in government [36]. The study of Belanger and Carter [37] was a milestone which analyzed purely the role of trust and risk in e-government adoption, rather than observing trust as one of the several antecedents among the others. In their research, the authors have expanded the number of trust dimensions compared to their previous work [28]: disposition to trust, trust of the internet, trust of the government and added the factor perceived risk, which is a commonly included construct in online trust research.

There has been no consensus on the components of trust in e-government research. Colesca [38] analyzed trust in technology and propensity to trust among the factors of increasing trust on e-government. Alsaghiar et al. [39] used the components of

disposition to trust and used institution-based trust in the e-government context. Institution-based trust was previously used in the context of online shopping [40] referring to the belief that needed structural conditions are present to enhance the probability of achieving a successful outcome. Some researchers analyzed components of trust in other categorizations. Liet et al. [41] discussed the concept of trusting bases to the context of e-government (personality, cognitive, calculative, institutional), which have been previously applied in trust research for the context of online shopping [42]. Recently, Dashti et. al. [43] introduced the concept of felt trust influencing trust in e-government. Despite the different categorizations and naming conventions, the recognition of the need to divide trust into various components rather than observing it as a single antecedent is a proof of advancements in the trust research in e-government.

3 Methodology

The findings presented here are taken from the nationwide e-government survey, which has been conducted together with TNS Infratest. The study was carried out between 7th and 20th of June 2010. Interviews were conducted online with a nationwide representative sample of 1,002 internet users in private households by an online panel weighted by central features like gender, age and formal education. The study focuses on the e-government usage for the internet users of private households in Germany. Participants answered questions about the importance of e-government services, barriers to adoption of e-government, concerns of data security and privacy. The final sample comprised n=1,002 adults (46% female and 54% male) who are older than 18 years. Thirty-two percent (32%) are between the ages 18 to 34 years, forty-four percent (44%) are in the 35-54 age group and twenty-four percent (24%) of the sample are over the age 55. The importance of factors for using e-government services was measured on a five-point Likert-scale (1=least important to 5=crucial) and the barriers to adoption of e-government services were measured on a four-point Likert-scale (1=strongly disagree to 4=strongly agree). The numbers given in the figure and tables are calculated using the top two-box scores.

4 Results

The study has revealed valuable insights about the concerns of citizens impeding adoption of e-government in Germany. By taking part in this nationwide survey, we aimed to gain insights to specific role of trust and its components in the adoption of e-government in Germany. The survey included other aspects such as the familiarity and satisfaction with the e-government services as well as the future potential usage of mobile services (m-government) which goes beyond our research. In order to stay focused, we only include the questions that are directly relevant for our research.

The first question investigated the importance of the factors influencing e-government usage. As shown in Figure 1 below, various factors affect the use of

online public services. Among them, data protection/privacy has strongest impact on the citizen engagement in e-government. This is closely related to trust in government since the government is responsible from protection of the data transmitted. However, the respondents might have also referred to the security concerns such as the third party access. Such a concern would point out to concerns related to the medium of transaction, which would be categorized under trust in technology. This issue will be analyzed further in another question.

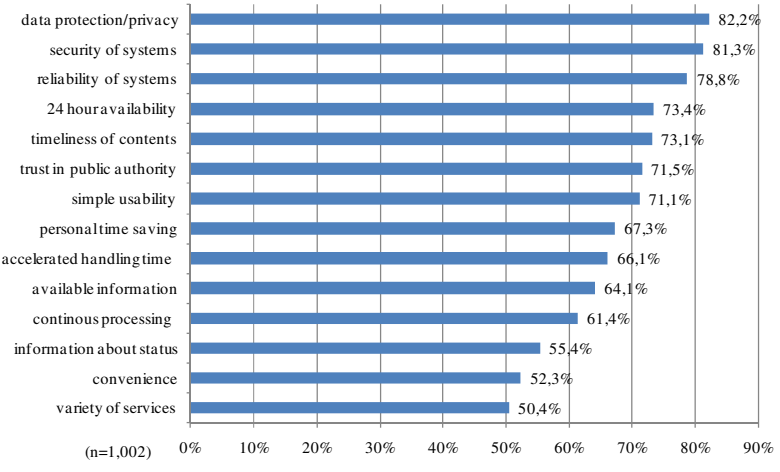

Fig. 1. Factors influencing use of e-government services [based on 5]

The next two important factors influencing use of e-government services were given as security and reliability of systems. These issues are also closely related to trust in technology, including the underlying infrastructure and transmitting medium. Moreover, the sixth factor trust in respective public authority is a clear statement referring to trust in government. For more than seventy percent of citizens, trust in the public authority was stated as an important requirement for engaging in online public services.

In the second question, the specific barriers to use of e-government services were questioned. As summarized below in Table 1, lack of data protection/privacy (33.8%) and lack of trust in public authority (26.5%) were among the barriers to usage of e-government services. These findings intensify the importance of trust in technology and trust in government respectively. The survey revealed other important barriers including impersonability of the services, lack of consistency, unclear structure, complicated services, lack of help and assistance. While it may be possible to discuss the indirect influence of these factors on trust – especially for the factor of lack of help – these aspects are not considered directly relevant to the issue of trust or to its components. Instead, they signify the low maturity level of e-government services in Germany [4].

Table 1. Barriers to use of e-government services [based on 5]

(n=1,002)		gender		age groups			degree of education		
	total	female	male	18 -34	35 -54	55+	low	med.	high
lack of data protection/ privacy	33.8%	38.1%	30.1%	37.3%	34.8%	27.2%	36.5%	31.0%	33.3%
lack of trust in authority	26.5%	28.4%	24.9%	26.0%	29.4%	21.8%	29.6%	24.5%	24.8%
impersonability	24.0%	25.6%	22.7%	22.7%	23.0%	27.7%	27.9%	24.1%	19.2%
lack of consistency	41.8%	42,7%	41.1%	42,5%	46.4%	32,5%	35.1%	44,7%	46.9%
unclear structure	41,5%	40.6%	42.2%	42.9%	41.8%	38.9%	38.2%	43.0%	43.9%
complicated services	34.4%	34.0%	34.7%	33.1%	33.6%	37.5%	35.4%	35.5%	32.0%
lack of help	40.8%	43.5%	38.5%	41.4%	40.7%	40.3%	40.7%	43.5%	38.3%
other	33.8%	39.1%	30.5%	34.0%	34.4%	33.0%	21.7%	42.0%	41.9%

Due to our special research interest, respondents who have specified data protection/privacy as a barrier to adoption were asked to specify their concerns further in the third question (n=337). Our intention was to receive insights about the specific concerns underlying data protection/privacy, which was stated in the first question. The results of the third question delivered valuable information regarding to underlying risk perceptions, which lead to trust components. The results are summarized in Table 2 below.

Table 2. Concerns regarding data protection/privacy [based on 5]

(n=337)		gender		age groups			degree of education		
	total	female	male	18 -34	35 -54	55+	low	med.	high
inadequate security of transferred data	70.5%	68.5%	72.8%	75.0%	69.4%	64.8%	72.7%	68.8%	69.4%
fear of "transparent citizen"	60.8%	61.0%	60.5%	52.8%	65.3%	65.1%	55.7%	62.9%	65.4%
confidential handling of sensitive data	57.9%	55.7%	60.3%	50.2%	61.8%	63.2%	55.7%	60.8%	58.1%
none of the above	6.7%	4.4%	9.2%	5.9%	6.8%	7.9%	5.3%	5.2%	10.0%
do not know	2.2%	3.2%	1.2%	2.8%	1.6%	2.4%	3.6%	0.8%	1.7%

We see that respondents referred not only to government related aspects. They had also technology related concerns under the data protection/privacy. The respondents state mainly three specific concerns regarding data protection/privacy. The first one is the inadequate security of transferred data, which can be categorized under trust in technology. The other two important factors were about protection of personal private sphere which necessitate trust in government as an important precondition.

With this survey, we have questioned the factors influencing the use of e-government services, with a specific focus on barriers and concerns. It is remarkable to see most important aspects are related to a competent of trust. This validates the increasing importance of the issue of trust in e-government research. The results are generalizable to the entire population in Germany, which are summarized in the next section.

5 Discussion

Findings of the survey indicate that concerns about data protection, privacy, security and lack of trust in respective public authority are important barriers to use of e-government services in Germany. One out of every three citizens states concerns of data protection/privacy as a barrier to use of e-government. Among them, more than seventy percent (70 %) have concerns regarding the security of transmission, sixty-one percent (61 %) report the fear of becoming a transparent citizen and fifty-eight percent (58 %) state concerns about confidential handling of sensitive data.

The results of study reveal that perceived risk in the case of online public services is quite high in Germany. This result confirms the belief about the German nation which is "widely considered to be risk-averse" [44]. We suggest the usage of trust as an effective instrument to deal with the perceived risk and uncertainty. Potential users should be assured that the data transmission is secure and the underlying infrastructure is reliable. Moreover, they must be ensured that governmental agencies will respect to their privacy and handle their sensitive data confidentially. They need to be assured that e-government services are offered to provide benefits rather than monitoring the society. It is not an easy goal and will likely to be quite tedious to achieve. Even one data scandal in this context can damage public trust severely. Citizens can change companies as service providers but government is and will be the one and only provider of e-government. Thus, building trust of citizens is essential for increasing the adoption and continued usage of online public services.

Having underlined the importance of trust, this study provides also valuable insights for future empirical research. Based on the survey, we propose the following research model.

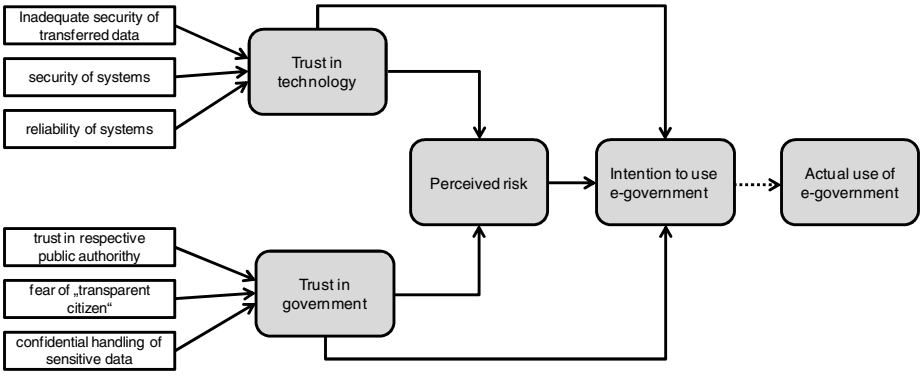

Fig. 2. Proposed research model

This research model includes the two main components of trust and their further sub-components. Our research model draws its theoretical foundation from the basis conceptual framework underlying models of well-known theories TAM [45], TRA [46] and TPB [47] explaining individual acceptance of information technology. As discussed by Venkatesh et al. [48], well-known adoption theories have the same basis conceptual framework: individual beliefs to using IS - intentions to use IS - actual use

of IS. According to this theoretical basis, an individual's behavior is predicted by his or her intention to perform this behavior. Intention to perform the behavior is further influenced by the underlying beliefs. The actual behavior being the use of e-government services, our model should deliver the influence of trusting beliefs and perceived risk on the intention to use e-government services, which is found to be an accurate predictor of actual behavior in many IS and human behavior studies [49].

Based on the survey, constructs of the proposed research model are summarized below. As the third question revealed specific concerns underlying the factor of data protection/privacy, these factors were included in the model, rather than the data protection/privacy as a single construct, which has reflections on both in trust in technology and trust in government.

- **Trust in technology:** The results of the survey shows that citizens perceive risk in the areas of system robustness and security of the transferred data. These issues can be summarized under the aspect of trust in technology, which is the first factor of trust.
- **Trust in government:** Trust in public authority has been stated explicitly and constitutes the second factor of trust. Fear of becoming a "transparent citizen" and concerns regarding confidential handling of sensitive data are aspects regarding privacy by the government. Thus, these two sub-components of trust are categorized under trust in government.
- **Perceived risk:** Although this item was not specifically stated, respondents stated several concerns about using the online public services. Moreover, trust is closely related to risk in question and the need for it arises only in the presence of risk [21, 50, 51]. In prior research, an online user's perceived risk has been found to influence his or her online decision [52]. Therefore, we believe any research model of trust in e-government should also include the construct of perceived risk.

Although this paper provides valuable insights into the factors of trust affecting citizen decision making in Germany, it has certain limitations. First, survey questions were not developed based on a theoretical framework. This may have reduced the number of synthesized components of trust such as the frequently discussed disposition to trust – which is defined as one's general propensity to trust others [42] – and trust in personal skills and knowledge regarding the usage of online services. Second, due to our specific focus on the national culture of Germany, foreigners living in Germany were not included who are also potential users of e-government services in Germany. We suggest future research to broaden the model with trust constructs based on previous studies in literature and empirically validate them. Another interesting area for future research is the comparison of the differences of intention to use among various age groups. We expect that the young generation is more comfortable in providing personal data about themselves due to their common usage of online social platforms. On the other hand, the confidential handling of the collected data may be among the main concerns of the relatively older generations due to their conservation. Future research should also consider integrating dimensions of national culture [53] as a construct in order to enable cross-cultural analysis.

Despite its limitations, however, this paper yields valuable insights about the role and components of trust affecting the adoption of online public services in Germany. It suggests a trust-based research model for future researchers in order to question the

role of trust in the adoption of e-government. Besides the discussed theoretical implications, the findings of this research have also practical implications for practitioners and policy makers. From a practical standpoint, the results highlight the importance of trust for dealing with the risk perceived of using online public services. Hence, any effort to increase adoption of e-government in Germany should ensure various trust constructs stated in this study. Citizens have to be convinced that security and privacy mechanisms are in place. Considering the maturity of trust research in e-commerce context, the trust-building mechanisms of well-known, trusted online companies and Web 2.0 applications should be analyzed for adaptability in the context of e-government.

6 Conclusion

The adoption of e-government initiatives in the household context depends on citizens' willingness to adopt them. However, the expected potential of e-government services has not been exploited in many countries. Citizens worldwide are concerned about the risks of online transactions and increasingly aware about their privacy. News in global media about cybercrime and invasion of privacy increases the sensitivity of people, which impedes the nationwide acceptance of e-government projects. They have considerable reluctance to use e-government services compared to making transactions with companies and participating in social media platforms and weblogs.

Despite its importance, the role of trust influencing the adoption and continued use of e-government is still relatively under-researched. We argue that the decision making of citizens towards online public services can be better understood with a comprehensive analysis of the issue of trust. If the citizens perceive public authorities as "data collectors" and hence do not trust them, the adoption of e-government will remain a lasting problem. Our research sheds light on explaining and predicting the process of e-government adoption by citizens in Germany. The suggested research model includes two empirically validated components of trust – trust in government, trust in technology – and six sub-components influencing use of online public services. Integration of new constructs based on prior literature could support obtaining a more complete picture on the aspect of trust. For instance, disposition to trust, trust in personal skills and knowledge are likely to be relevant in the context of e-government. Researchers aiming cross-cultural studies should add relevant cultural constructs. In order to derive conclusions about the citizens of Germany, however, the extended model needs to be empirically validated in a nationwide representative study.

Besides its theoretical implications, this research has important practical implications. Since, one out of every three citizens considers data protection as a barrier to use of e-government; the government in Germany needs to closely examine the approaches to build trust of its citizens to decrease the perceived risk of citizens. Our research reveals that citizens have concerns regarding both the technology and the public authorities. Trust-building mechanisms of online banking, e-commerce and Web 2.0 applications such as third party seals, structural assurances and effective communication should be analyzed for adaptability to e-government.

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Public Sector IS Maturity Models: Legal Pluralism Invades Public Schools

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Abstract. Online applications and processing of tax forms, driver licenses, and construction permits are examples of where policy attention and research have been united in efforts aiming to categorize the maturity level of e-services. Less attention has been attributed to policy areas with continuous online citizen-public interaction, such as in public education. In this paper we use a revised version of the Public Sector Process Rebuilding (PPR) maturity model for mapping 200 websites of public primary schools in Denmark. Findings reveal a much less favorable picture of the digitization of the Danish public sector compared to the high ranking it has received in the international benchmark studies. This paper aims at closing the gap between the predominant scope of maturity models and the frequency of citizen-public sector interaction, and calls for increased attention to the activities of government where the scale and frequency of the interaction between citizens and government will challenge our concepts of maturity.

Keywords: Public sector, IS; adoption, maturity models, public schools, primary schools.

1 Introduction

In 2002, the Danish government published the "Act on transparency and openness in education" (2002 Act), introducing the requirement for public primary schools to use the Internet to provide data regarding student grades and wellbeing. The results of the take up of such measures in public primary schools are indeed very far from the objectives set out in the act. The "360 degree review of schools," a recently published report, calls for a much stronger focus on results, thus reemphasizing the recommendations from the 2002 Act.

The objective of this paper is to highlight the potential tension between law-driven digitization of public sector activities and adherence to the legal acts. Digitization represents a challenge in relation to the numerous ways of interpreting how the rules and regulations are actually implemented in a satisfactory manner, leading to the phenomenon of stage models and also to the, by now somehow dated, debate on the digital divide.

These observations have driven this study of how Danish publish schools live up to the objectives of the 2002 Act. Three main issues have formed the basis for this study on public schools' use of the Internet:

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- Can grades for each school be accessed simply and quickly on the school website?
- Are assessment criteria and indicators of the achievement of objectives for grade levels available through the website?
- Does the school website provide a comparison of objectives and grades with other schools?

Our tool to analyze the public school websites is the Public Sector Process Rebuilding (PPR) model [1, 2]. The PPR model provides a natural extension of the political statements about openness and comparison mediated through the digital channels. Its essential premise is that the central challenge for the public sector is to organize performance with the user in focus, and to do this with activity content as the focal point in each public agency using ICT.

In the following section we present and discuss a revised version of the PPR model, used as analytical framework to analyze the data of this study. In section 3 we outline the methods used for sampling, data collection and analysis, and highlight some limitations of the study. In section 4 we present and discuss the findings. In the conclusion section we provide a summary of the study results, reflections on the findings, and outline implications for future research on the topic area.

2 Analytical Framework

2.1 The Maturity Model as a Tool of Categorization of e-Government

The maturity model we have used to assess school websites is a normative model with four maturity levels (see Figure 1 below). It has as its assumption that the overall goal is to move up to the highest level possible. This assumption is shared with other maturity models for IT in government [3, 4, 5, 6, 7]. It is obviously debatable whether it is a unified and shared objective to pursue the evolutionistic target of ranking on the highest level of a given maturity model [8]. For example, for some schools it can make more sense, from an economical point of view, to remain at a level rather than to rush towards a higher and initially cost-driven level. It is also debatable whether maturity models capture the objectives of being online. For example, Layne and Lee's [3] maturity model has data integration and technological complexity as the two key dimensions; on the basis of these two dimensions, it develops four maturity levels: catalog, transaction, vertical integration and horizontal integration. In comparison with the PPR model and the Gartner Group Open Government Maturity Model [9], the Layne and Lee [3] model is less ambitious in relation to services for citizens because its focus is more technical and organization-oriented.

The PPR maturity model has two dimensions. The horizontal dimension is the activity orientation, while the vertical dimension reflects the user/ customer focus of the homepages. The maturity level of each website is assessed depending on the extent to which the activities and the clarity of user/ customer are in focus. In comparison with the original PPR model, in this study we rephrase the levels of maturity, and adjust the variables for assessing each website. In addition, we add the dimension "sophistication of IT use" to improve the visualization of using IT as a cornerstone of maturity.

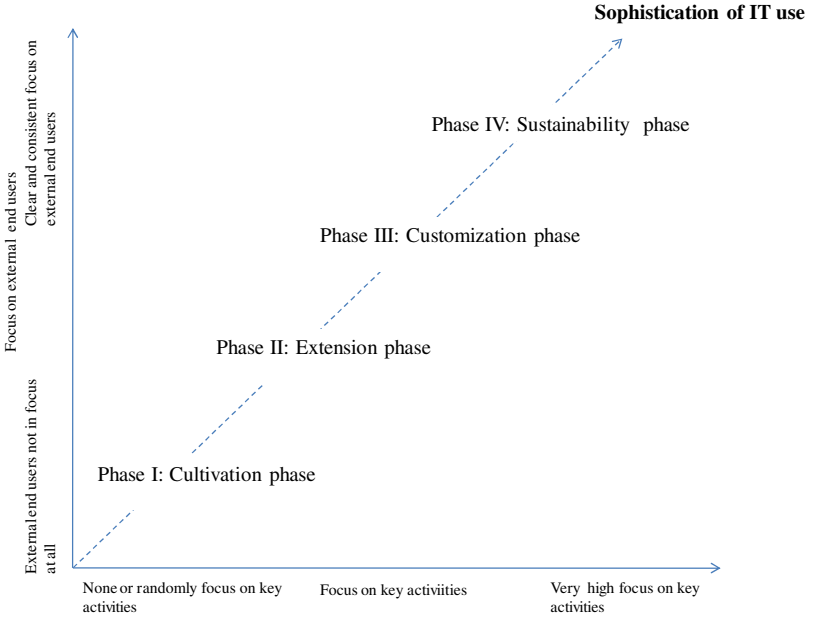

Fig. 1. The adjusted PPR maturity model for analysis of the websites in primary schools

The model has four phases of maturity. The first phase (cultivation) is characterized by having no links to key data. In the public school case, this refers to parameters such as marks for grade levels. At this level, there is a long time gap between updating of information on targets and follow-up on previous data; thus websites are designed without a visible focus on user needs. However, this does not mean that public schools in this group are not using IT.

The second phase (extension phase) represents schools with unclear objectives and strategies for the extent to which the Internet should be used, and there is a strong element of reservation towards greater openness about grades. Although general objectives are available and there are links to websites whereby the user can click on data about the school, there are no direct links to the school's data, and users of the website are not encouraged to consult the data. One characteristic of this group of schools is that it seems unclear whether the aim of the website is to create openness, to give as little and as unbiased information as possible, or whether the aim is to keep the user away from pursuing the data. There is thus great risk that the website does not live up to what the digital user wants.

The third phase (customization phase) has unique links to websites where information about grades can be found, as well as links to the school's objectives, and indicators for the retrieval of these are available. There is a solid effort to create credible and visible processes. There are individual user interfaces, and the Internet is used as a key tool to increase transparency. The strategy for these sites seems clear: Internet technology is used for users to easily and simply gain insight into key output targets.

Finally, there is the fourth and final step (sustainability phase). Schools classified at this level use Web 2.0 tools and rich media for dialogue and engagement with

current and / or future users. At this stage, it is simple to find data about grade average and variation. There is also data on teachers' job satisfaction and other information that supports the user's assessment of whether schools have clear objectives and whether these are being met. This group of schools is characterized by seeing the Internet not as a means to insulate themselves from users, but as a means of improving transparency and openness - with end users in focus. The four steps can be seen as an expression of legal pluralism.

2.2 Legal Pluralism

In the field of sociology of law, the concept of legal pluralism caught our attention due to an observable difference in the implementation of the 2002 Act. Legal pluralism focuses on how informal norms shape behavior independently of the explicit rules stated in the law. Legal pluralism has been defined as "the presence in a social field of more than one legal order" [10]. Legal pluralism represents a deviation from the legal centralist conception [11], which is how most non-lawyers perceive law: an exclusive systematic and hierarchical ordering of normative propositions [10]. This view is supported by an acceptance of laws and rules as instruments to maintain a civil society where citizens accept common norms stated in the law [12]. None the less, the acceptance of more than one legal order is well recognized in society where interpretation of legal rules plays a central role. This is best depicted in TV-series such as "Law & Order" where the excitement is the verbal battle of the interpretation of rules and regulation.

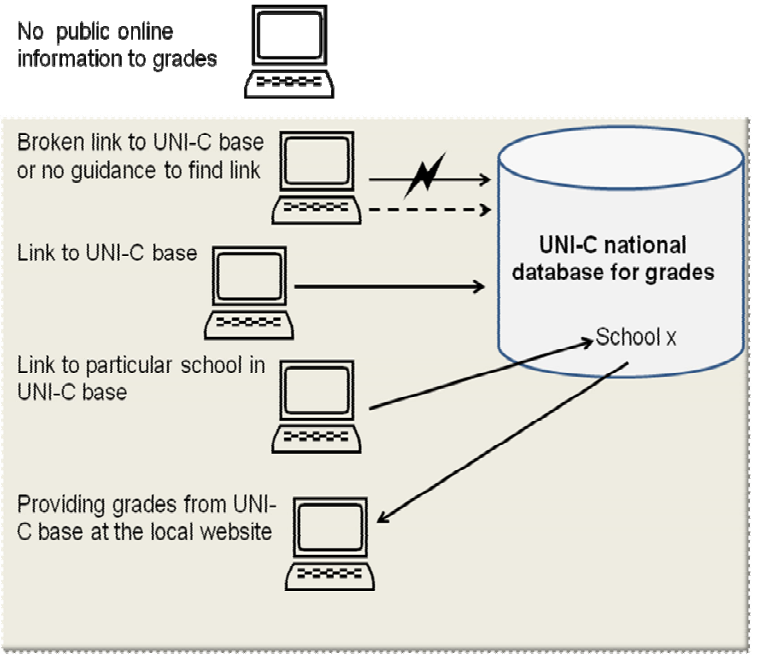

Fig. 2. Four types of legal pluralism in relation to the 2002 Act

The popular court-room dramas get to the root of a dilemma which jurisprudence has been struggling with for centuries: justice. Is justice given e.g. by God or is it socially constructed? Legal pluralism belongs to the latter view " legal centralism would be "a myth, an ideal, a claim, an illusion", whereas legal pluralism would be the fact" [13]. The view points to law as a means of social control where groups of individuals determine what is socially acceptable within a given range of possible outcomes. Regulation such as the 2002 Act is in other words not a binary code of legal or illegal. Adherence to the Act depends on the expectations of the social group exposed to the publishing of grades. If parents expect grades to be published in a Phase IV format (the sustainability phase) then the school would receive complaints if there were broken links or misleading links represented by Phase I in the maturity model. If the school does not provide the necessary information parents would make use of the commands provided by the 2002 Act.

Figure 2 shows how we have interpreted the four maturity steps with respect to linking to grade information related to legal pluralism. The school outside the grey area might provide information to parents through their intranet, but does not provide information via public websites. These schools do not live up to the 2002 Act at all. In the grey area, there are four types which, to some extent, live up to the 2002 Act. Schools in the cultivation phase make it difficult for users to find information because the link to the UNI-C national base provides information about all public schools, or no direct link/ guidance for accessing the central UNI-C base. A variation of the cultivation phase is the case where the school web-site provides a broken link. The broken link can reflect that there is infrequent maintenance of the web-site or it can reflect that it has low priority to allocate qualified staff which can secure a robust web-site. The next level, the extension phase, provides a link to the UNI-C base, thus leaving it up to users to find the school in the list of +1,500 public schools included in the UNI-C base. In the customization phase, there is a deep link to specific schools. In the fourth phase, the sustainability phase, the school draws its information on grades from the UNI-C base, thus ensuring that information is automatically updated but also making certain that the data fit into the layout of the overall school website.

3 Data Collection

Based on the normative maturity model presented in Figure 1, we have analyzed 200 public school websites. The total number of public primary schools in Denmark is 1,510. The 200 schools analyzed in this study have been selected based on their location. Denmark is divided into five regions that vary in population density. The ratio between population density and number of schools in each region determines the number of schools selected from each region.

The categorization of sites is based on an assessment of the accessibility of the websites. The method is seen as an appropriation of how a real user would use the website. We have lent inspiration from the Human-Computer Interaction discipline and applied the cognitive walkthrough method [14]. Our application of the cognitive walkthrough method means that we perform the assessment of the schools' interface in a task-specific manner (i.e., if the school posts grades on its website), where the assessment is guided by a questionnaire that draws on the parameters in the PPR model.

We have set twelve variables to guide the scoring and assessment of the individual sites. We have used an unweighted distribution of points from the 12 criteria reflecting the degree of user orientation and activity orientation. Each variable has a scale from 1 to 5, with 5 being the highest. The value of zero has been given in those cases where it was not possible to access the variable. The total score thus ranges from 0 to 60 points. The twelve variables are:

- Output such as grade average and variation is clear from the website
- Cost data, satisfaction surveys, etc., centrally located and communicated
- Use of Web 2.0 and rich media for dialogue and mediation
- Unique link to websites where ratios for school outputs can be found
- Customized user interface
- The school's objectives and progress indicators are available
- General data on quality is available
- Specific output indicators of educational objectives for each grade are available, but kept in general terms
- Links to websites with key figures exist, but with strong reservations about this data
- No links to key data quality or quantity of teaching
- Simple websites where the general / average user is in focus
- The content update is not frequent

As a result, each website has been classified in one of the four phases, with 0-24% of the maximum score (60) for placement in the first group, 25-49% of the total score for placement in the second group, 50-74% in the third group, and 75% or more of the maximum score for placement in the last group.

In assessing the 200 individual sites, we have devoted no more than 15 minutes to assess the 12 variables. It is our assumption that additional time for assessment would not be in line with what actual users would expect to require for finding information. If, for instance, there was a link to relevant information and this information was last updated in 2005, we coded the website to be in phase 2 of the maturity model presented in Fig. 1.

It should also be noted that we did not systematically examine whether there were historical data on the grades available on the websites. Obviously, it would be more interesting for users if there were time series available on the website. It could be questioned whether variables are additive, and whether discrete variables could be considered as a continuum. Both these problems were present in the analysis of the collected data, where a number of schools ranked relatively high on some variables and lower on others. We acknowledge that an unweighted classification is a source of potential errors, leading to an underestimation of the degrees of maturity.

The assessment of websites was meant to represent a broad range of schools by region. We evaluated 28 schools in the North Jutland region, 30 schools in Zealand, 52 in South Denmark, 50 in Mid-Jutland, and 40 in the Capital Region. Table 1 illustrates the number of schools assessed, and the total number of primary schools in the regions. Data on the number of schools can be retrieved from www.nogletal.dk. Despite the attempt to create a stratified selection, there is a minor anomaly in the data, which theoretically could give a biased result. However, it is our assessment that this would not be the case if we had taken the samples outside the selected data population.

Table 1. Number of primary schools and total number of schools assessed by region

	Number of public schools	Number of schools included	Average size of school	Average number of students per class
North Jutland Region	211	28	292	19.1
Mid-Jutland Region	381	50	358	20.4
South Denmark Region	394	40	313	20.1
Denmark Capital Region	299	30	514	21.6
Zealand Region	225	52	387	20.4
TOTAL	1,510	200	372	20.5

Scores have been given from a general assessment of the websites. We did not make an assessment of website design, but only of its usability and ability in providing openness and transparency. We assumed identical digital user skills and similar levels for digital inclusion among the various schools. We have not investigated any correlations with the size of the school in terms of number of students or budget and use of the Internet. We acknowledge that there could be different resources and prioritization of information on the Internet in larger schools, compared to smaller schools. It should also be noted that there may well be websites with high aesthetic value and high general IT maturity, as well as profound internal digitization, all of which do not necessarily translate into high value in the digital portal and in business focus. The schools that ranked low on our scale could indeed be good in reaping the benefits of IT in areas other than openness and the transparency of grades given to pupils.

The cognitive walkthrough as research method has recently been criticized for its tendency to focus on surface issues related to the interaction, overlooking more complex behavioral issues in the interaction between user and device [15]. However, for the purpose of this particular study, the objective is precisely to see if and how public schools manage to translate the spirit of the law into a public access of grades, regardless of complexity.

4 Main Results

In Table 2 we have summarized the main results of the survey of the 200 schools. Nearly two thirds of the schools are placed at maturity phase 1 (66%). Twenty percent of schools (39 schools) are located on phase 2, while a total of 30 schools (15%) are in phases 3 and 4. Seventy-five percent of schools in the first phase have fewer than 5 points.

The overall conclusion is that the majority of the schools are in the cultivation phase. At the opposite end of the scale, in the sustainability phase (step 4), four of the total twelve schools in this category barely match the requirement for this category. None of the 200 schools has received a maximum score.

Table 2. Main Results: Maturity Levels by number of schools (n,%)

	Number of schools	Percentage distribution
Phase 1: Cultivation	131	66%
Phase 2: Extension	39	20%
Phase 3: Customization	18	9%
Phase 4: Sustainability	12	6%
TOTAL	200	100%

We have applied the measures in a liberal manner, thus leaving no doubt regarding the benefit of the school. In practice, this means that if there has been uncertainty whether there are clear links to grades, we have consistently coded them as though there were links to grades. The main result is that more than two thirds of the schools do not live up to the goal of openness and transparency on grades online, and could even have been higher if we had used more rigid coding than we did.

In our assessment, 131 of the 200 surveyed schools are located at the absolute bottom stages of the maturity model, namely, the cultivation phase. One example is the Holme School website which contains links to quality reports; however, the links are not active and there is nowhere on the website to find information about the average grades given to the school pupils. The website features a teaching environmental assessment, but this is not commented on, and there are no plans for how the evaluation is followed up. The Holme School website well represents schools in the cultivation phase category.

At the second stage of the PPR maturity model, the extension phase, there are 39 schools, approximately 20% of the 200 schools included in our sample. At this stage it is possible to find links to grades granted by the school, but no direct links to the grades within the schools' own website. The user is guided to sites and must then choose from a list of all Danish schools. Typical of this stage is also a widespread reluctance to make even that information available. For example, on the website of the school of Langmark, we found a document questioning the benefits of having student grades available on the web. The school website makes it clear that it is a legal requirement to publish grades online, but it further emphasizes that it is difficult to see how this could be beneficial if published in isolation. In a website page it is stated that the students' "social, personal, professional and democratic competencies represent equal values" – and these are not necessarily reflected in the grades. This statement somehow discourages the parents' interest in monitoring the grades.

A discussion on the appropriateness of publishing grades online falls outside the scope of this paper, but it is obvious that the user of the Langmark school website is not exactly encouraged to search for grades. It should be emphasized that schools at this stage are on a higher scale than what more than two thirds of the schools are, namely, the first step in the maturity model.

Twenty percent of the schools have taken a step up in the maturity model, albeit reluctantly. The Langsø school, for instance, is in this category. The website provides links to the grades of ninth graders, but not for other classes, and does not give access

to historical data. There is no link to compare with other schools, and the majority of information on this website has not been updated since last year or longer. The latest information on objectives, for instance, is from 1999.

In the third stage of the model (customization), there are clear and unambiguous links to information about grades for students. There are only 9% of schools in this category. These include the Mariager Fjord School, which has links to grade data in several places on the site, but data appear to remain relatively fragmented. We have found examples outside the selected population of a number of private and independent schools within this stage.

The sustainability phase (stage 4 of the PPR model) clearly provides grade average scores and other figures on the website. The Karise school and the Western High school fall into this category. The two schools located in the Zealand and Jutland regions are examples of extensive information about the grades. One of the schools has the information integrated on the website, and the update of this content is generated using the direct link to the data provider. We could classify only 12 of the 200 schools in this fourth and most advanced stage of the maturity ladder. This corresponds to only 6% of schools. However, four of the schools in this category scored barely enough points to be categorized being at the fourth step.

5 Conclusion and Further Research

Using a revised version of the Public Sector Process Rebuilding (PPR) model [1, 2] for mapping 200 websites for public primary schools, this paper reveals a much less favorable picture of the Danish public sector, as compared to the high ranking received in the international benchmark studies. This study has attempted to answer three overarching questions;

- Can grades for each school be accessed simply and quickly on the school website?
- Are assessment criteria and indicators of the achievement of objectives for grade levels available through the website?
- Does the school website provide a comparison of objectives and grades with other schools?

The answer to these questions is: only to a limited extent. The majority of the schools do not live up to the objectives of transparency and openness with respect to the measures we have studied. Of the 200 schools surveyed, only 15% come up to a level where they have fully implemented the spirit of the law on transparency, comparability and openness over the Internet. The remaining schools (85%) are far behind the goals of the 2002 Act on transparency and openness in education.

The study indicates that it is difficult to see how the law is internalized in the digital management and communication to end-users. There may be two possible reasons for this. Either schools are unaware of how to put information on the Internet, or they are trying to deliberately avoid comparability and accessibility. Whether it is due to ignorance or reluctance, the result is that Danish children and parents in practice do not have access to information about the quality of teaching in the different schools.

In the beginning of this paper we point to legal pluralism, which suggests that we find the explanations in the deliberate avoidance, or at least in the different interpretations, of implementing the law as it was intended. There seems to be acceptance of more than one legal order or interpretation of the law [10]. In this particular case, the shaping of the norm [12], which appears not to create full and user-friendly transparency and openness, can be excused, to some extent, by the complexity of handling the relatively new channel of communication, the Internet. This challenges the perception of successful e-government implementation in Denmark. It is critical because the domain under investigation holds the position of a high degree of scale and frequency of the ongoing interaction between citizens and government. It is further critical because the particular activity of making grades publicly available represents a task that has a relatively low level of discretion as soon as the grade is granted to a student. The discretion is present when the grade is granted to the student; however, as soon as grades from all students are granted, the fulfillment of the 2002 Act is to publish the grades online without further discretion, and does not involve redistribution of resources or individual case assessment.

In many of the websites included in this study it is explicitly argued by the schools that data on grade point average is misleading. It is mentioned that publication of grades can be counterproductive to other objectives of the school, such as welfare, and that the publication of grades may lead to a unilateral focus on those. Furthermore, on several websites it is argued that parents' and pupils' intranets are already in use, and that the information about grades and student action plans are disseminated through this forum, and thus not visible on the public Internet.

This set of arguments may be subject to further investigations. As far as the use of parental and pupil intranet is concerned, it must be stressed that this platform is closed to students and parents with a direct membership of each class. The parents' and pupils' intranet does not enable future school customers to obtain information. Instead, the publishing and dialogue on grades have to rely on costly physical or asynchronous digital channels that are not necessarily accessible to interested parents who might want to enroll their children in a particular school.

As stated earlier, the PPR model provides a natural extension of the political statements about transparency, openness, and comparison, but has as essential premises not only that the central challenge for the public sector is to organize the performance with the user in focus, but also to do this with content in the activities as the focal point in each school using ICT. In several previous studies, we have found that it appears to be the opposite: IT solutions in the public sector have employees and/ or internal business operations as the focus [16]. Furthermore, it appears that the institutional interests and structures, rather than individual actors and activities, govern the use of IT [17].

This development might be expected, but compared to benefits of objectives, including transparency and openness by means including the Internet, this can act as a limitation to individual teachers. Teachers have particular objectives and goals for their teaching which go beyond high grades and direct measurable outcomes. They may be interested only somewhat in open dialogue mechanisms to achieve their objectives.

The thesis behind the PPR model is such that the litmus test of whether digitization has led to more openness and transparency is not whether one can find information on

the web by sacrificing enough time and resources, but rather if the user can simply and quickly find the information. It is a normative model and there is not necessarily an obvious and clear link to the core services of providing quality teaching and high ranking in the maturity model.

The study has not been intended to explain the differences or lack of digital maturity. We acknowledge that in the search for possible causes for the lack of maturity through interviews with school management, it is the teachers and other school employees or other government agencies who would potentially lead to a more varied picture of the individual schools. We aim at conducting such interviews in follow-up research to the data presented in this paper. Also, we acknowledge that we did not do a reverse-link check of links to nationally stored data on the Ministry of Education website. Clearly, an investigation of hyperlinks from the schools' websites to the data stored at the Ministry of Education and the use of the centrally stored data would be another valuable avenue for further research. Finally, we want to call for research attention to the design of maturity models, a fundamental issue that should be addressed with more care when using maturity models to classify multi-faceted institutions, such as public schools. In the ongoing search for maturity models that can cover the areas with most ongoing citizen interaction, attention needs to be given to accounting for the dynamics and transformative elements within each phase.

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"IT's Complicated…": Influence of Perceived Sacrifice and Trust on eService Adoption

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Abstract. In order to increase usage of e-government services, there is a need for better understanding of factors driving citizens' use of such services. This study addresses the following research problem: How do trust, perceived sacrifice, and optimism bias influence citizens' intentions to use public e-services? A model of e-service adoption is proposed and tested on a random sample of Swedish citizens. The model confirms the influence of trust and optimism bias, and the results also suggest that perceived sacrifice in terms of time and effort can be a strong predictor of behavioral intentions.

Keywords: E-government, intention to use, trust, perceived sacrifice, optimism bias.

1 Introduction

During the last two decades, governments have invested heavily in developing electronic government (e-government). Today, it is viewed as an important way to provide better services to citizens and make public administration more efficient [30]. However, this great potential only can be realized if citizens are willing and able to adopt the e-services offered by the government. For many years, e-government has been developed based on governments' internal needs, rather than from the perspective of users' needs and wants [20]. The assumption was that citizens were waiting for e-services to be developed and all that was needed was more rapid development of such services [20]. Yet, the acceptance and usage of available e-services has not been as extensive as expected [15].

In order to increase usage of e-government services, there is a need for better understanding of factors driving citizens' use of such services [19]. Previous research has identified lack of trust as a major barrier for the adoption of e-services [7, 26, 33]. For e-commerce in general, several studies have explored the relationship between trust and behavior, but with respect to e-government adoption, researchers are just beginning to empirically investigate the role of trust [e.g., 4, 29]. In order to add to the understanding of trust as a salient predictor of consumer behavior, and in response to calls for further research [e.g., 26, 31], this study proposes a model of e-service adoption that incorporates trust, perceived sacrifice, and optimism bias.

According to the theory of planned behavior, the intention to engage in a particular behavior is a good predictor of performing the behavior [1]. Intention to use

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subsequently has been found to be highly correlated with actual use of information technology [e.g., 4, 23]. To be able to include non-users as well as current users, thus making results more generalizable, this study applies intention to use government e-services as the dependent variable. Hence, the following research problem is addressed: *How do trust, perceived sacrifice, and optimism bias influence citizens' intentions to use public e-services?*

The remainder of this paper proceeds as follows: Section two presents the theoretical foundations of the proposed research model and the hypotheses. The methodology of the study is described in section three, which is followed by a presentation and discussion of the results. Finally, conclusions are drawn and limitations of the study are discussed, along with suggestions for further research.

2 Conceptual Background and Hypotheses

2.1 Trust

Trust has been explored and defined in numerous research studies within different areas. A widely used definition of trust is "an expectancy that the promise of an individual or group can be relied upon" [25]. As trust reduces behavioral uncertainty, it gives the citizen a perception of having some control over potentially uncertain situations [23]. McKnight et al. [22] pointed to the importance of distinguishing among different types of trust, and developed multi-dimensional trust measures. Other authors have adapted these measures and used them in diverse contexts, including e-government. For governmental web sites and e-services, trust has been conceptualized as consisting of *trust in the Internet* as the facilitating technology for e-government (also referred to as institutional trust), and *trust in the government* as the provider of the service [4, 26, 27, 29]. In addition, research suggests that a person's general propensity to trust others; i.e., his/her *disposition to trust*, is important as it can affect behavioral intentions via its influence on trust in the Internet and government [4, 22]. We therefore expect that:

H_1: Disposition to trust is positively related to trust in the Internet
H_2: Disposition to trust is positively related to trust in the government

If citizens trust the service provider (i.e., government), they also might be more inclined to trust the medium through which the service is delivered. Though not hypothesized, Bélanger and Carter's [4] study showed a very high correlation between trust in the government and trust in the Internet. Similarly, Teo et al. [29] as well as Horst et al. [14] found that trust in the government had a significant positive correlation with trust in an e-government website. Hence, we hypothesize:

H_3: Trust in the government is positively related to trust in the Internet

Moreover, a number of studies have found that trust influences behavioral intentions such as the intention to use, or continue using, an e-service. The relationship has been tested as a direct link [4, 8, 21, 23, 26], as well as indirectly, via for example

perceived risk [26, 27], attitude [15], and e-service quality [29]. Considering the emphasis on trust in institutions and technology as a precondition for e-commerce and e-government acceptance [e.g., 22, 27], the following hypotheses are stated:

H_4: Trust in the government is positively related to intention to use
H_5: Trust in the Internet is positively related to intention to use

2.2 Optimism Bias

Trust in the Internet has been shown to reduce the perceived risk of using e-commerce and e-government services [e.g., 8, 23, 26]. However, some studies suggest that even when citizens perceive high levels of risk, they still are willing to use e-services [4, 8]. This behavior might be explained by *optimism bias*, which is "a systematic discrepancy between individuals' risk perceptions and their actual risk for negative life events" [5]. That is, people tend to think that because of their knowledge and ability, they are less susceptible to risk than the average person [26, 27]. For example, Campbell et al. [5] found that heavy Internet users were significantly more optimistic than light Internet users about positive and negative Internet events. In the context of e-government, it seems likely that a higher level of trust in the Internet as a facilitating technology could enhance the degree to which citizens feel that they are more competent than the average Internet user [cf. 26, 27]. Thus:

H_6: Trust in the Internet is positively related to optimism bias

In addition, research has found that optimism bias significantly increases the intention to use government e-services, presumably because it diminishes the impact of risk [6, 26, 27]. These authors therefore point to optimism bias as an important factor in e-government adoption and call for further research on its influence. Consequently, it is hypothesized that:

H_7: Optimism bias is positively related to intention to use

2.3 Perceived Sacrifice

As indicated above, several studies in the information systems area have integrated constructs of perceived risk, primarily in terms of privacy and security, in models of trust. Within marketing and consumer behavior research, however, negative influences on purchase or usage intentions sometimes also are conceptualized in terms of *perceived sacrifice*, consisting of the total monetary and non-monetary costs associated with acquiring the product or service [e.g., 9, 16, 28]. While monetary costs (e.g., purchase price) usually are not relevant in the context of e-government services, it can be argued that non-monetary sacrifice, such as the perceived time and effort involved, could work as a barrier toward e-service adoption. That is, if citizens expect that using e-services will be time-consuming and complicated, they are more likely to choose traditional means of receiving the service.

Based on in-depth interviews with taxpayers, Rotchanakitumnuai [24] suggested that time and effort would not influence intention to use online tax filing for frequent Internet users. However, the relationship has not been tested empirically on a larger sample including both users and non-users of public e-services. In other contexts,

perceived non-monetary sacrifice has been shown to negatively affect behavioral intentions [e.g., 3, 18]. Therefore, we expect that:

H_8: Perceived sacrifice is negatively related to intention to use

Further, as trust reduces uncertainty [23, 26], it is possible that trust in the Internet channel contributes to decreasing perceptions of e-services as time-consuming and complicated to use. This notion is mirrored in Pavlou's [23] study, in which trust had a significant, positive influence on perceived ease of use. We therefore hypothesize that trust in the Internet would have a significant, negative influence on perceived sacrifice. Formally stated:

H_9: Trust in the Internet is negatively related to perceived sacrifice

Finally, it seems probable that citizens who feel that they are more competent than the average Internet user would anticipate lower levels of time and effort involved in using an e-service. Specifically, optimism bias, which we conceptualize in the same way as Carter et al. [6], Schaupp and Carter [26], and Schaupp et al. [27], is expected to reduce the perceived sacrifice. Hence:

H_{10}: Optimism bias is negatively related to perceived sacrifice

Figure 1 displays graphically the proposed research model incorporating the ten stated hypotheses and the relationships among the constructs.

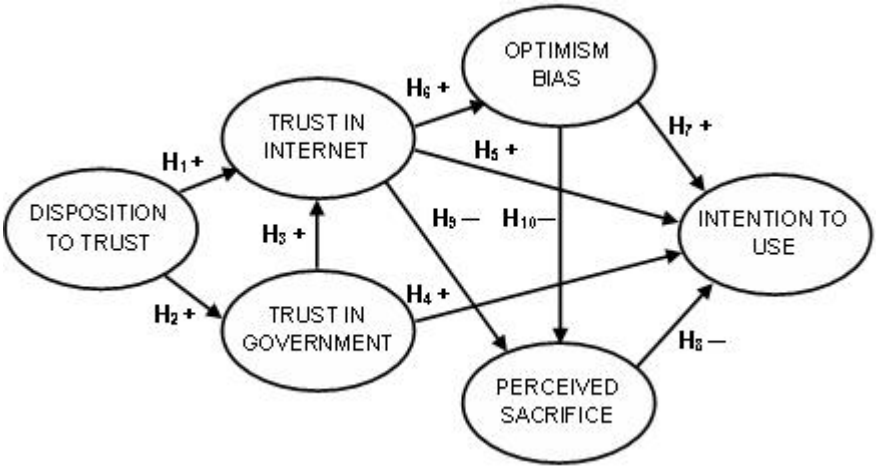

Fig. 1. Research Model

3 Data Collection

To measure the studied constructs, we developed a questionnaire derived primarily from previous literature (see Appendix A). A few items were added based on results from eight focus group interviews with citizens. Seven-point Likert-type scales indicating the strength of agreement with statements were used for all constructs,

except optimism bias, for which we used a seven-point scale anchored by 1 (much less able than the average Internet user), 4 (average ability), and 7 (much more able than the average Internet user) [cf. 26, 27]. Questions covering background information such as demographics and Internet use also were included in the instrument. "E-service" was described in the beginning of the questionnaire as making applications, as well as changes or supplements to applications, via the municipality's web site. It also was emphasized that no previous experience of such e-services or the municipality's web site was needed to be able to answer the questions.

After pre-test on a small sample of citizens, followed by some adjustments, questionnaires were sent via regular mail to 1,600 randomly selected Swedish citizens between 20 and 64 years of age. We obtained a total of 422 valid responses, corresponding to an effective response rate of 26.4%. Assuming that late respondents are similar to those who do not respond, non-response bias was checked by comparing demographics and Internet use variables between the first and last quartile of responses [cf. 2]. T-tests and Chi-square tests did not result in any significant differences between early and late respondents, indicating that non-response bias was not a main concern.

Gender distribution among respondents was fairly even, with 56% being males. The mean and median age of the sample was 44 and 42 years, respectively. 88% of the respondents were working (i.e., employed or owners of businesses), with the remaining respondents being students, retirees or unemployed. Half of the respondents had a university education, and 92% of the sample indicated that they used the Internet daily. On average, respondents considered themselves to be experienced Internet users – on a seven-point scale representing strength of agreement with the statement "I am an experienced Internet user", the mean was 5.75. A vast majority of the sample (86%) indicated that they generally visit the municipality's web site at least once in a while, but most of them rather infrequently (less than once/month). This means that 14% of the respondents said they never visit the municipality's web site.

4 Results

4.1 Measurement Validation

Overall, there were few missing values in the dataset, and all variables could be retained. Little's MCAR test was non-significant ($p = 0.32$), indicating that data were missing at random. Since we wanted to test the hypotheses through structural equation modeling, which does not comply with missing data, the few remaining missing values in quantitative variables were replaced by series mean.

To evaluate and refine the scales, we performed a confirmatory factor analysis using AMOS 18 software. Modification indices and standardized residual covariances pointed to possible problems with two items; one in the trust in government construct and one in optimism bias. These items therefore were removed one by one, which improved model fit. The final measurement model had a normed $\chi 2$ value of 2.24, GFI .94, CFI .97, and RMSEA .05, suggesting good fit between the model and data. Descriptive statistics of the resulting factors are shown in Table 1 below. It can be noted that the means of all three trust dimensions are fairly high, whereas the average

level of perceived sacrifice is low. The mean of the optimism bias construct is almost exactly the same as in the study by Schaupp and colleagues, where it was 4.83 [6, 26]. A one-sample t-test showed that the mean of the optimism bias measure is significantly higher (t = 13.25) than the scale midpoint, which corresponds to "average ability". This suggests that respondents overall rate themselves as more Internet savvy than the average Internet user.

Table 1. Descriptive Statistics

Construct	Min.	Max.	Mean	Std. Dev.
Disposition to Trust	1.00	7.00	5.35	1.06
Trust in Internet	1.00	7.00	5.04	1.31
Trust in Government	1.00	7.00	4.89	1.30
Optimism Bias	1.00	7.00	4.81	1.25
Perceived Sacrifice	1.00	7.00	2.22	1.26
Intention to Use	1.00	7.00	5.45	1.57

Next, discriminant and convergent validity among constructs were assessed by examining whether (1) all standardized factor loadings were significant and higher than .50; (2) the squared correlations between each pair of constructs were less than the variance extracted for each construct; and (3) the average variance extracted for each construct was higher than .50 [10, 13]. Table 2 displays the average variance extracted (diagonal values) and the squared correlations between constructs (off-diagonal values). Since all constructs met the stated criteria, they were considered to show sufficient validity.

Table 2. Correlation Matrix

Construct	Disposition to Trust (DtT)	Trust in Internet (TiI)	Trust in Government (TiG)	Optimism Bias (OB)	Perceived Sacrifice (PS)	Intention to Use (ItU)
DtT	.70					
TiI	.10	.77				
TiG	.11	.13	.74			
OB	.01	.24	.02	.78		
PS	.01	.18	.04	.17	.69	
ItU	.04	.32	.09	.26	.37	.67

Table 3. Construct Reliability

Construct	No. of Items	Cronbach's α	Item-to-Total Correlation
Disposition to Trust	3	.87	.73 – .78
Trust in Internet	3	.91	.77 – .88
Trust in Government	3	.88	.65 – .85
Optimism Bias	3	.91	.78 – .88
Perceived Sacrifice	3	.89	.66 – .88
Intention to Use	2	.76	.64

Further, the reliability of the constructs was assessed. As Table 3 shows, Cronbach's alphas were well above the suggested cutoff point of .70 and all item-to-total correlations exceeded .50 [cf. 13].

4.2 Hypotheses Tests

To test the stated hypotheses, we specified a structural model in AMOS 18 according to the research model (see Figure 1). Table 4 below summarizes the results.

Table 4. Structural Model Results

Hypothesized Path	Hypothesized Direction	Standardized Path Coefficients	Result
H_1: DtT → TiI	+	.22**	Support
H_2: DtT → TiG	+	.33**	Support
H_3: TiG → TiI	+	.29**	Support
H_4: TiG → ItU	+	.10*	Support (weak)
H_5: TiI → ItU	+	.27**	Support
H_6: TiI → OB	+	.48**	Support
H_7: OB → ItU	+	.20**	Support
H_8: PS → ItU	−	-.40**	Support
H_9: TiI → PS	−	-.29**	Support
H_{10}: OB → PS	−	-.27**	Support
Construct	R^2	Model Fit	
Trust in Internet (TiI)	.18	$\chi 2$/df	2.17
Trust in Government (TiG)	.11	GFI	.94
Optimism Bias (OB)	.23	CFI	.97
Perceived Sacrifice (PS)	.24	RMSEA	.05 (*PCLOSE* .30)
Intention to Use (ItU)	.53		

*) $p<.05$
**) $p<.01$

As the table shows, model fit indexes suggest that the structural model is not disconfirmed by the data, and all ten hypotheses receive empirical support. Altogether, the model explains a fairly high portion (53%) of the variance in the intention to use municipal e-services.

The relationships among the three trust constructs (H_1 – H_3) work as expected. Disposition to trust appears to be more strongly connected to trust in the government than to trust in the Internet. However, the correlation between trust in the government (TiG) and intention to use (ItU) is low (albeit significant at $p<.05$), thus lending only weak support to H_4. Even though the mean of the trust in government measure was very similar to previous research conducted in the US (this study: 4.89, [4]: 4.62, [26]: 4.92), it seems that Swedish citizens' intentions to use municipal e-services are affected mainly by other factors. Hence, trust in the Internet (H_5), optimism bias (H_7), and perceived sacrifice (H_8) all have stronger influence on the intention to use.

In particular, the degree to which citizens expect the use of municipal e-services to be complicated and time-consuming (i.e., the perceived sacrifice) appears to hamper usage intentions. Considering that some earlier studies have found non-significant (see [8] for a summary) or even positive [4] correlations between perceived risk and intention to use, it is possible that the expected hassle involved is a better predictor of

behavioral intentions than risk, at least in a context in which the majority are frequent Internet users.

Regarding the influence of optimism bias, the result is similar to previous findings [6, 26, 27], but the effects of trust differs from the studies of Schaupp and Carter [26] and Schaupp et al. [27], in which trust in the Internet did not have a significant correlation with the intention to use e-government services. This perhaps could be explained by the fact that the results in those two papers were based on a student sample, while a broader, random sample of citizens was used in this study.

Trust in the Internet is strongly correlated with optimism bias (H_6), explaining 23% of the variance in the construct, and it also decreases perceived sacrifice, as suggested in H_9. In addition, feeling more competent than the average Internet user appears to lower the degree to which one expects using e-services to be cumbersome (H_{10}).

5 Conclusions

This study integrated three dimensions of trust, optimism bias, and perceived sacrifice in a model to explain Swedish citizens' intentions to use municipal e-services. While the model confirms the influence of trust and optimism bias, the results also suggest that perceived sacrifice in terms of time and effort can be a strong predictor of behavioral intentions. That is, as people in general use the Internet frequently, they become more familiar with possible privacy risks and feel that they can handle them, but if they expect that using an e-service will be time-consuming and complicated, they would rather use traditional means of receiving the service. Hence, municipalities and other government agencies should focus on offering as easy-to-use e-services as possible, and also inform citizens about these services and how they can be used.

Moreover, municipalities could integrate trust building in their market communications. Enhanced trust in the government as a service provider and, primarily, trust in the Internet as the facilitating technology for e-government contribute to higher intentions to use, and also indirectly by increasing optimism bias and decreasing perceived sacrifice.

5.1 Limitations and Suggestions for Further Research

Although the results in this study are based on a random sample of citizens of varying ages and backgrounds, there are some limitations that should be considered when interpreting the results. First, while the tests for non-response bias did not reveal any significant differences between early and late respondents, the fact that almost 74% did not respond means that generalization to the population should be made with some caution. Still, the response rate of 26.4% is well in line with, or above, similar studies that have used postal surveys. Our sample size of 422 also is relatively large compared to many other user studies in the e-government area.

Second, the use of a cross-sectional survey means that we cannot ascertain causal relationships between constructs in the model. Therefore, additional longitudinal or experimental research is warranted.

Our model was tested in the context of Swedish municipal e-services. While citizens' adoption of e-government in municipalities is relatively under-researched compared to e-government on a national level, it could be worthwhile to study whether this model also applies on other levels and in other countries.

The inclusion of perceived sacrifice in a model of trust and e-government adoption shows promising results. To keep the model parsimonious, we used a unidimensional, three-item measure of perceived non-monetary sacrifice. Future research could address the influence of sacrifice using more comprehensive scales. If there are governmental e-services that involve some kind of economic transaction, it also would be interesting to include a monetary sacrifice construct in the model.

Finally, it is possible that some of the relationships among the studied constructs can vary between different groups of citizens. Further studies can explore moderating variables; for example, users vs. non-users of e-government services, younger vs. older citizens, or frequent Internet users vs. non- or low Internet users.

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Appendix A: References to Questionnaire Constructs

Construct	No. of Items	References
Disposition to Trust	3	[4, 11]
Trust in the Internet	3	[4, 22, 32]
Trust in the Government	4	[22, 29], focus groups
Optimism Bias	4	[26, 27], focus groups
Perceived Sacrifice	3	[12], focus groups
Intention to Use	2	[12, 17]

Government as a Launching Customer for eInvoicing

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Abstract. The invoice is an important business document. Despite a large number of convincing arguments, overall adoption rates of electronic invoicing disappoint. Several European countries try to accelerate diffusion speed, some by law, others by stimulating market drivers. This paper focuses on the question whether the government can make a difference as a launching customer of eInvoicing. Results from a large scale survey show that both organisational and situational factors explain the adoption of eInvoicing. Companies that conduct business with governmental organisations are more prone to start implementing eInvoicing. Consequently, this group of suppliers is the obvious target group to launch this innovation. By doing so, government could accelerate the diffusion of eInvoicing.

Keywords: Electronic Invoicing, eGovernment, Adoption of Innovations.

1 Introduction

The invoice is an important business document. It represents billing and payment information related to commercial transactions. Besides its role between trading partners, the invoice is essential to tax administration. VAT-related inspection and collection processes rely upon the integrity and authenticity of the invoice. Electronic invoicing is the electronic transfer of this billing and payment information via the Internet or other electronic means between trading partners. Unlike paper-based invoices, e-invoices provide all data in digital format. Such eInvoicing offers substantial benefits over paper invoicing. It allows for shorter payment delays, fewer errors, reduced printing and postage costs and, most importantly, fully integrated processing [1]. In Europe it is estimated that there were 15 billion business-to-business invoices in 2007 [2]. Removing VAT barriers to electronic invoicing for example is expected to lower the administrative burden on enterprises in Europe by up to a maximum of EUR 18 billion in the medium term [3]. The European Commission estimates that replacing regular paper invoices by e-invoices across the EU could result in approximately EUR 240 billion in savings over a six-year period [2], [4].

Despite these compelling arguments, overall adoption rates of eInvoicing disappoint. Average market penetration of eInvoicing in 2009 in Europe was estimated at around 5% of all invoices annually exchanged in business-to-business

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relations [1], [5]. Thus, hampering businesses individually and society in general to reap the benefits of this e-business innovation. Likewise, individual governmental organisations, being large *buyers*, can also save on paper handling and billing process costs. These potential governmental cost savings were the main driver for the Danish and Finnish government to mandate the private sector to send all invoices to the public sector via electronic means [6].

Next to internal cost savings, "stimulating an environment that creates maximum reach between trading partners exchanging invoices" [7] is another driver behind governmental interventions within the e-business market place. The European Commission underlines the importance of governments promoting ICT adoption to the further development of e-business [8]. Next to the general awareness arising the Commission points to *the role model* of the public sector, e.g. by using public e-procurement. The Italian government for example has proposed to make the adoption of eInvoicing mandatory for central government administrations by mid 2008. Amongst others their explicit goal was to support the adoption of eInvoicing by Italian companies.

In this paper we elaborate on this second 'market stimulation driver' and focus on the specific role of *eGovernment as a launching customer*. In that case government deliberately chooses to be one of the innovators or early adopters of an electronic means of invoicing [1], [9]. Thus hoping and aiming to eliminate market failures by: enhancing network externalities, creating critical mass, setting a de facto standard and/or lowering price per unit. The question answered in this paper is: *can eGovernment make a difference as a launching customer of electronic invoicing?* We answer the question by analyzing and comparing the *adoption intention* of two groups of businesses in the Netherlands, one group solely conduction commercial business-to-business (B-to-B) transactions and another group also conducting commercial transactions with governmental customers (B-to-BG).

This paper proceeds with a brief theoretical analysis of strategies for accelerating the diffusion of eInvoicing. After that we will present an overview of adoption factors by making use of a situational approach towards the diffusion of innovations. The next paragraph then describes our research method. Results and statistical analysis are presented in the following paragraph. The paper finalizes with conclusions and a discussion of our findings.

2 Theoretical Background

The introduction of eInvoicing is an innovation to most companies, especially to small and medium scale enterprises (SME's) [10], resulting in "new ways of doing business" [1]. In this study, the specific eGovernment context adds extra dimensions to this adoption issue [11]; thus influencing governmental adoption strategies and adoption factors.

2.1 eGovernment: Seduce or Enforce?

Large buyers in many cases posses the power to enforce suppliers to send invoices according to their specific (electronic) standards [12]. Thus resulting in, often

EDI-based, domain specific hub-and-spoke architectures [13], [14]. Governments can apply an additional enforcement instrument to exercise external pressure: legislation. Countries like Denmark, Sweden, Spain, Italy, Finland and Brazil have chosen (or announced) to legally oblige eInvoicing to governmental organisations [6]. Agostini and Naggi [15] question the effectiveness and legitimacy of this forced adoption of procedures and standards, "which have not achieved an established consensus under 'normal' circumstances". The risk is to improve internal efficiency for public bodies, while negatively affecting enterprises, which are in fact obliged to duplicate their invoicing and invoicing-connected procedures [15].

Arendsen et al. [11] have examined factors influencing the adoption of governmental high impact applications by small and medium scale businesses. They suggest that (especially smaller) businesses follow another adoption approach towards governments than towards fellow businesses. Expected benefits and external competitive pressure are important adoptions factors in the business-to-business context, stimulating businesses to follow an *offensive strategy*. Within the business-to-government context companies on the contrary seem to tend to a more *defensive strategy*. A lack of organisational readiness (and willingness) makes them reluctant to invest in a long term e-relationship with governmental organisations. Malone [16] shows that the provider of this kind of a relation is more than others capable of realising significant benefits. From that perspective, many electronic data exchange relations between businesses and governmental organisations can be characterized as an electronic hierarchy. A case study of the mandatory tax filing by Dutch businesses [17] showed this was one of the dominant arguments for businesses to outsource these governmental e-services to intermediary parties.

The 'government as a launching customer'-strategy's primary objective has to be the homogeneous gain of efficiency throughout the whole economic system, with consequent positive repercussions on enterprises themselves, by winning the SMEs' typical "excess in inertia" [15]. Countries like the Netherland in that respect have chosen for a less coercive, but more 'public policy encouragement' [1] strategy focussing on enterprises institutional dynamics, needs and beliefs [15]. The next paragraph presents an overview of factors influencing the adoption of eInvoicing.

2.2 eInvoicing Adoption Factors

e-Invoices can be generated and transferred automatically and directly from the issuer's or service provider's financial supply chain systems to those of the recipient. Most of the economic benefits therefore do not arise from savings in printing and postage costs but rather from the full process automation and integration from order to payment between trading parties [2]. Consequently, much of the eInvoicing literature has centred the analysis about eInvoicing mainly with a focus on the supply-chain management and inter-organisational systems (IOS) theories. The adoption of IOS innovations in general has been broadly studied [18], assessing adoption drivers like efficiency, effectiveness and competitive position [15]. Azadegan and Teich [19] present an overview of adoption models and factors and assess the applicability to the eInvoicing domain. The adoption of business-to-government systems however has hardly been studied yet [11].

eInvoicing adoption factors can be defined from different perspectives. Rogers [9] defines adoption as: a decision to make full use of an innovation at the best course of action available. He suggests that technology adoption is the result of the effect of five groups of variables: the perceived attributes of the innovation, the type of decision making, communications channels used, change agent's efforts and the nature of the social system. Especially the five perceived attributes of innovations, *relative advantage, complexity, trialability, observability* and *compatibility* have been used in many studies concerning the adoption of (inter-)organisational information systems, like for instance financial systems [20] and EDI systems [21]. Several researchers however question the applicability of the theory for studying organisational adoption of the adoption of complex inter-organisational systems based on electronic data exchange relations [19], [22].

Tornatzky and Fleischer [23] have developed an alternative model to study the adoption of technological innovations by organisations. Their TOE-model contains three variables influencing the adoption decision making process: the technological, organisational and the environmental context. Kuan and Chau [24] used the model as a basis for their study of the adoption of the business-to-government system for the filing of import and export declarations in Hong Kong. Zhu et al. [25] used it as foundation for their Electronic Business Adoption Model. They conclude that *firm size* is a significant adoption factor. They also show *competitive pressure* has a significant positive relation with the decision to adopt. Hong and Zhu [26] use the TOE model to explain how the integration of inter-organisational systems affects e-commerce adoption in US and Canadian businesses.

Iacovou et al. [27] have developed a model focussing on the adoption of inter-organisational systems and more specifically electronic data interchange systems by small and medium scale businesses. The model consists of three factors expected to positively influence the organisations adoption decision: p*erceived benefits*, *organisational readiness* and *external pressure*. Chwelos et al. [28] refined and extended this EDI adoption model. Their empirical study showed that especially *perceived benefits, financial resources and IT sophistication* had a positive relation with *the intention to adopt*. Grandon and Pearson [29] expanded the model towards application and adoption of e-commerce by SME's. In general it seems that the foremost indicator of adoption is the business's readiness to adopt, i.e. the internal capability in implementing a new technology. Azadegan and Teich [19] add network factors like network size and interconnectedness to their theoretical framework for e-procurement technologies.

3 Research Method

Similarly to Chwelos et al. [28] our research focuses on *the intention to adopt*. Figure 1 presents the research model that was used in this research. As can be derived from figure 1, we deliberately left out the 'classic' TAM/UTAUT variables of 'Perceived usefulness' and 'Perceived ease of use'. As [34] points out, these concepts are largely tautological when it comes to explaining intention to adopt. Instead, our model uses two types of determinants: organisational factors and network (situational) factors. The intention to adopt was measured through a single choice question in which the

answering categories characterised different phases of the adoption process. Respondents were asked to state which phase characterised their position best. The *organisational factors* were measured as follows:

- *Organisational size* was measured in terms of the number of employees on a seven point scale, varying between 'Single person company' and '250 or more employees'. In addition we measured invoicing volume by looking at the number of suppliers, customers, invoices received and invoices sent. The volume was measured on a four point scale (0-10; 10-50; 50-100; 100+).
- *IT-readiness*, *Innovativeness and Attitude* were measured through seven-point Likert scale items. The translated and shortened version of these items can be found in table 2.
- *Knowledge* was measured through a set of ten true or false questions about eInvoicing. The number of correct and incorrect answers were counted. In addition the number of times a respondents answered 'Don't know' was counted a measure of absence of knowledge.

Based on the theoretical framework in section 2, the situational variables that were taken into account were:

- *Adoption by others*: the number of network parties that have adopted eInvoicing.
- *Social influence*: the degree to which the direct environment of respondents is positive (or negative) about eInvoicing.
- *Cost of investment*: the perceived technical and organisational costs that need to be made to implement eInvoicing within the organisation.

Besides a general intend to adopt, the intention to adopt *given specific practical circumstances (situational factors)* has been investigated. In order to measure this, we took a vignette approach [30]. In this approach respondents are presented with hypothetical situations. A specific case is a unique combination of values and variables. The vignette approach deals with network complexities by combining the strengths of survey and experimental research. One of the vignettes used in the study, illustrates the practical use of the approach:

> Suppose that you have been made responsible for the strategic choice whether to adopt eInvoicing in your company. From the research you have performed, you gather that eInvoicing is hardly being used in your sector. You estimate the technical and organisational costs for implementing eInvoicing within the organisation are reasonable. You have seen some examples of companies using eInvoicing successfully. Moreover, your industry organisation is positive about eInvoicing.

After this vignette, respondents were asked how likely it is that their company switches to eInvoicing within 12 months, given the described situation. For this we used a seven-point Likert scale. By systematically varying the vignettes, the effect of differences between situations could be investigated. In addition, respondents were presented with two cases. In order to prevent order effects the cases were rotated differently for different respondents. Analysis of the data shows that there were no significant differences between the two rounds.

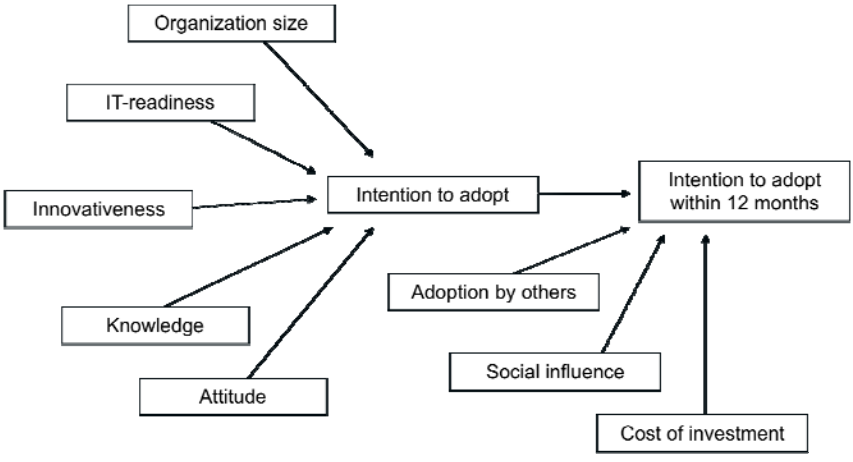

Fig. 1. Research Model

Data gathering and data analysis

In May 2010 data has been gathered via the online panel of a commercial organisation. In total 5150 people were invited to participate in the research. Of the 1221 respondents that started the online survey 512 respondents (42%) were filtered out because they did not meet the selection criteria. Another 78 respondents (6%) stopped during the survey. In the end 613 respondents filled out the questionnaire completely. This sample is representative with regard to industry sector. However, this study is biased in favour of larger size companies. A representative number of smaller sized companies would pose serious statistical challenges: it would cause a lack of statistical power to detect significant effects. Hence, proportional representation of companies by size is not a viable alternative for the present study.

Data analysis concentrated on two questions: to what extent do the two groups (B-to-B and B-to-BG) differ with regard to organisational factors? (see paragraph 4.1) and to what degree do the adoption factors influence the intention to adopt eInvoicing for both groups? (see paragraph 4.2). In order to obtain an answer to the first question we used descriptive statistics and t-tests. The second question is answered by making use of structural equation modelling with WARP PLS [31].

4 Results

4.1 Analysing Organisational Adoption Factors

*Intention to adopt eInvoicing***.** In the questionnaire we asked companies how soon they were thinking of switching to eInvoicing as a general measure of adoption intention. Figure 2 directly compares B-to-B and B-to-BG within each category of adopters. From the figure we conclude that B-to-BG are more inclined to switch to eInvoicing than B-to-B. Using independent t-test, this difference is significant ($t=-6.082$; $p<.00$).

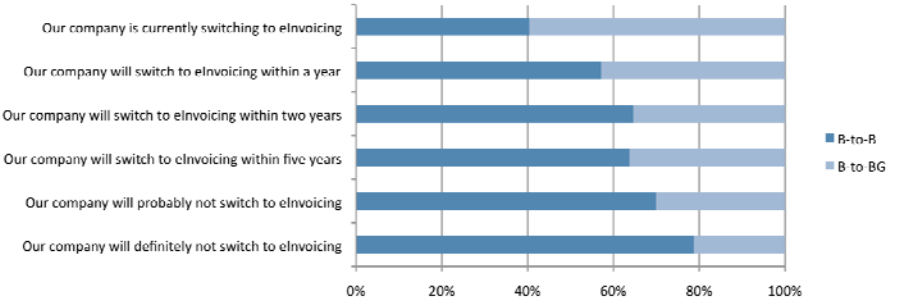

Fig. 2. Intention to Adopt: phases in the adoption process

Organisation size. The larger an organisation, the more often it not only has other businesses but also governments as their customer. This is also reflected in the number of suppliers and customers and the number of invoices sent and received. All differences are significant as can be derived from table 1.

Table 1. Differences between B-to-B and B-to-BG for organisation size

	Mean B-to-B	B-to-BG	t	p
Organisation size[1]	2.57	3.83	-9.54	0.00
Number of suppliers[2]	1.96	2.54	-9.33	0.00
Number of customers[2]	2.55	2.97	-6.29	0.00
Number of invoices received[2]	1.74	2.25	-7.89	0.00
Number of invoices sent[2]	1.92	2.37	-6.32	0.00

[1] Measured on a seven point scale
[2] Measured on a four point scale (1 = 0-10; 2 = 10-50; 3 = 50-100; 4 = 100+)

Other organisational factors. Table 2 shows the scores for B-to-BG and B-to-B for the organizational factors Innovativeness, IT-readiness, Attitude and knowledge. First thing that stands out is that all items score higher than 4 on a five point scale. This result might indicate that all items load on one grand underlying construct. In order to check this we ran a factor analysis on the scale items. Results shows that, as was intended, the items represent the three different underlying constructs.

A second thing that can be deducted from table 2 is that organisations that conduct business with governmental organisations (B-to-BG) systematically score higher on *Innovativeness* and *IT-readiness* than businesses from the B-to-B group. Results in Table 2 show that almost all differences between the two groups are significant. Regarding the factor *Attitude* the differences are smaller but still the scores for B-to-BG are systematically higher than for B-to-B. The factors *Knowledge* shows a slightly different picture. Organisations that do business with the government answer more questions correctly but more incorrectly as well. Businesses solely conducting business with fellow businesses more often “do not know” the answer.

Table 2. Differences between B-to-B (n=373) and B-to-BG (n=196) for Innovativeness, IT-readiness, Attitude and Knowledge (all items have been recoded so that higher scores represent a positive direction)

	B-to-B	B-to-BG	t	df	Sign.
Innovativeness					
The management actively seeks new ideas	4.33	4.64	-2.45	567	0.01
Innovations are easily incorporated in projects	4.32	4.61	-2.50	567	0.01
Innovations in processes are encouraged	4.52	4.89	-3.25	439	0.00
Innovation is part of our culture	4.25	4.58	-2.58	567	0.01
IT-Readiness					
IT provides more control in daily business	4.73	5.06	-2.71	427	0.01
IT improves the way our company operates	4.88	5.28	-3.33	567	0.00
Thanks to IT we are in business 24-hours a day	4.85	5.25	-2.91	567	0.00
We use the latest IT applications	4.17	4.30	-1.07	567	0.29
We use IT to meet our companies goals	4.64	4.98	-2.71	567	0.01
We work more efficient with IT	4.90	5.26	-3.06	457	0.00
IT opens new opportunities	4.26	4.65	-2.97	567	0.00
IT gives us more freedom	4.59	5.01	-3.53	448	0.00
Our company relies on IT	4.72	5.06	-2.62	567	0.01
Attitude					
It is harder to get paid with eInvoicing	4.82	4.90	-0.72	567	0.47
eInvoicing helps to work more efficient	4.26	4.61	-3.37	567	0.00
The tax office will not accept eInvoicing	4.86	4.90	-0.40	567	0.69
eInvoicing is too expensive for our company	3.90	4.27	-3.05	372	0.00
It more work to send an e-Invoice	4.78	4.89	-1.00	567	0.32
It is easy to deceive people with eInvoicing	4.59	4.83	-2.19	567	0.03
Knowledge					
Number of questions correct	4.28	4.51	-1.09	443	0.28
Number of questions incorrect	2.15	2.36	-1.44	567	0.15
Number of questions 'Don't know'	3.54	3.11	1.54	567	0.12
Intention to adopt (general)	2.78	3.31	-4.12	358	0.00
Intention to adopt (within 12 months based on scenario)	3.06	3.29	-1.84	567	0.07

4.2 Explaining Adoption Intention

The results from the previous section show that B-to-B and B-to-BG differ when it comes to size, innovativeness, IT readiness, attitude and knowledge. The question that can now be asked is, do these factors *predict* adoption and do they predict adoption *differently* for B-to-B and B-to-BG. In order to answer that question we use the structured equation modelling (using WARP PLS) to predict adoption for both groups separately. The result of this analysis is presented in table 3.

Results show that for both groups of business the resulting research model has a good fit and explains over 30% of the variance. All relationships are significant in both models and the differences between the two groups are small. (The average inflation factor is low for both models. Moreover, the individual items load as intended on the latent variables.)

Table 3. SEM analysis for B-to-B (n=373) and B-to-BG (n=196)

	B-to-B		B-to-BG	
Average Path Coefficient	0.22	**	0.22	**
Average R Squared	0.31	**	0.33	**
Average Inflation Factor	1.19	good if <5	1.18	good if <5
Adoption intention	Intention to adop	Intention in 12 months	Intention to adop	Intention in 12 months
R squared	0.30	0.33	0.27	0.40
Organisation size	0.19	**	0.23	**
Innovativeness	0.16	**	0.19	**
IT-Readiness	0.22	**	0.09	*
Knowledge (# correct answers)	0.20	**	0.13	**
Attitude	0.19	**	0.22	**
Adoption intention (in general)		0.45 **		0.48 **
Critical mass		0.15 **		0.13 **
Costs for implementation		0.12 **		0.16 **
Social influence		0.32 **		0.37 **

* p<0.05; ** p<0.001

Results presented in table 3 show that the general adoption intention and the intention to adopt within 12 months are, quite logically, strongly connected to each other. It is more interesting to see that the predictive power of the general (organizational and individual) factors explain equally well as the situational factors that explain the intention to adopt within twelve months. This means that situational factors form a strong component in eventual adoption. In addition we would like to stress that social influence is the most important predictor of the situational factors.

5 Conclusions

The question answered in this paper is: *can eGovernment make a difference as a launching customer of electronic invoicing?* As opposed to the mandatory strategies of some European governments, this study focussed on the voluntarily adoption behaviour of businesses and on factors influencing their intention to adopt eInvoicing.

Results show that companies that conduct business with the government are more inclined to switch to eInvoicing than companies that only do business with other companies. In addition we observe that these companies that carry out business with the government are in general larger, more innovative, more IT-ready and have a more positive attitude towards eInvoicing.

Further analysis shows that these are all relevant and explaining factors for the adoption of eInvoicing. Both organisational and situational factors contribute to the adoption of eInvoicing. Both groups of factors explain approximately one third of the total variance. A general intention to adopt is explained well by organisational factors whereas a more specific likeliness of adopting can very well be related to situational factors. We conclude that situational factors should be taken into account when predicting the diffusion of eInvoicing and new technologies in general.

Together these results provide a positive answer to the question whether or not eGovernment can make a difference as a launching customer of electronic invoicing. Companies conducting business with governmental organisations are *more willing and able* to start implementing eInvoicing. To governmental organisations, this group of suppliers is the obvious target group to launch this innovation. Stimulated by their (governmental) customers this group of businesses is more than others in the position to become the early adopters, to increase network externalities and to start the snowball rolling. By focussing on this group of businesses first, government can make a difference.

6 Discussion

Results show that companies that conduct business with the government are larger than companies that only do business with other companies. This indicates that governmental procurement strategies in general have a bias towards larger suppliers. This may be explained by the fact that governmental organisations have a tendency to reduce risks and prefer relationships with stable, proven and mature organisations. This however hampers competition and decreases small companies' possibilities to conclude long term contracts with larger customers.

In the case of eInvoicing this might put a brake on the rate of diffusion. As a launching customer government primarily reaches businesses having a larger than the average company size. This asks for additional policy measures to stimulate adoption amongst (very) small companies. Governmental organisations could for example stimulate their suppliers, as part of the overall launching customer strategy, to motivate their (smaller) suppliers to start eInvoicing with them. Results of this study show that situational factors like *Social influence* and *Adoption by others* are powerful adoption factors.

This research does not only yield practical implications. From a scientific point of view, this research has a contribution as well. The combined approach of organisational and situational (network) factors proved to be fruitful. Using this approach we were able to omit the variables central to adoption models such as TAM [32] and UTAUT [33] (i.e. perceived usefulness and perceived ease of use). By doing this we have build a model that may not yield the high levels of explained variance custom in TAM-like research. However, we did create a model that explains the diffusion of an innovation from the *situation* rather than a model that explains technology use from its own usefulness. Having said that, we do acknowledge that we have to improve the models by gaining more in depth insight into network factors. Future research will be aimed at this.

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Transformational Government Citizens' Services Adoption: A Conceptual Framework

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Abstract. Despite the need expressed in the literature for shedding light upon the mechanisms that underpin the transformational process of t-Government, there is still research to be conducted regarding the critical factors that affect the citizens' adoption of local government transformational services. To address this gap, this research reports on the findings of the use of the structured-case approach and suggests a framework to investigate the success factors for t-Gov in a Greek context. The paper reveals that transformational government is not a state, but a process entailing experiential judgement. Existing acceptance theories, hence, need to be complemented by additional variables that affect citizens' adoption of transformational services.

Keywords: Transformational government, interpretivist school, theory building.

1 Introduction

The successful delivery of public policy is increasingly dependent upon the effective use and application of new technologies and Information Systems (IS) [1]. However, significant issues are raised when policy conceptualizations travel through the many and often labyrinthine levels of public administration. To address these issues and change the way citizens interact and communicate with each other, as well as to enhance the relationship between citizens and government, transformational government (t-Gov) comes to the fore [2][3][4].

The study reports on the use of the structured-case approach to investigate the success factors for a massive Greek t-Gov initiative in Greek Local Government Organisations (LGOs) to investigate the parameters that ensure the smooth use of the Local Government Application Framework (LGAF) [5]. The paper outlines the contribution of the structured-case approach to build t-Gov theory following the interpretivist approach [5] [6] [7] [8] [9]. The structure of the paper is as follows: after a brief review of t-Gov and factors affecting its success, the research methods and context of the study are discussed. It follows the discussion of the study results and the presentation of the improved framework. The last section concludes the paper.

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2 Technology Acceptance Theories

Past research on e-Gov has focused on implementation by using diffusion models. In particular, research has used Diffusion of Innovation (DOI) Theory [10]. Relevant studies [11] [12] [13] [14] focusing on the role of administration size and professionalism on the adoption of computer technology [15]. Furthermore, literature has referred to the IS Success Model [16] and the Technology Acceptance Model (TAM) [17] as another means for discussing the particularities of the e-Gov implementation by measuring perceived usefulness (PU) and perceived ease of use (PEOU). TAM [17], based on the Theory of Reasoned Action (TRA) [18], is one of the most well established theoretical frameworks that describe how users accept and use a technology [19]. The factors discussed by the TAM [20] [21] [22] have been utilised in various studies of acceptance of technology, IS, [23] [24] and e-commerce [25] [26] [27]. Building on these TAM versions, the Unified Theory of Acceptance and Use of Technology (UTAUT) was introduced by [28], consisting of three factors namely performance expectancy, effort expectancy, and social influence and relevant studies have emerged [29] [30] However, Paul et al. [31] suggest that TAM is not conclusive and suffers from the absence of factors regarding social and human processes. Moreover, PEOU is not consistently linked to adoption [25] [32] [33] [23]. Finally, TAM is criticised for representing subjective user assessments of a system [15] [30].

Literature [34] [30] suggests that since there are many similarities between e-commerce and e-Gov, TAM factors in e-commerce [25] [26] [27] [35] could be used in the case of e-Gov [30]. However, the use of TAM has not been used extensively in the case of t-Gov, taking under consideration its nature [36] [37]. Therefore, this study aims to: understand the factors that affect citizens' adoption and on going usage of LGAF, and suggest a conceptual model explaining the dynamics of citizens and acceptance of the LGAF.

3 Motivation for the Study

This paper uses LGAF to study the smooth implementation of t-Gov. LGAF reshapes access to information by integrating almost two hundred and fifty electronic government services in many different domains of the public administration such as in health, social care, education, public transportation, cultural, and other sectors and creates various organizational and technological constraints [39] [40] [41] [42]. LGAF is Greek/European co-funded initiative for the Central Union of Municipalities and Communities of Greece (www.kedke.gr). It aims to bring together the central and local governments, the private sector, and the society, by providing advanced, secure, privacy-aware, interoperable, and high-administrative national electronic services.

4 Research Method and Case Description

This research follows the interpretive paradigm [6] [43] [7] [44] [8] [45] [9]. The authors adopted a methodological approach based on the structured-case research method [46] [47] [48] [49][50].

4.1 Conceptual Framework (CF1)

The limited research undertaken regarding LGOs' citizens adoption of transformational services enforced the authors mainly to use TAM as baseline to develop the initial CF1. The initial CF1 (Figure 1) includes constructs derived from the literature and existing technology acceptance theories.

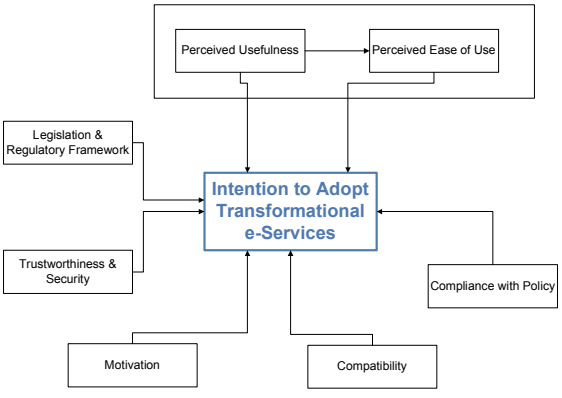

Fig. 1. Initial Conceptual Framework for Transformational Government

The model attempts to capture the complex relationships involved in t-Gov services adoption. Apart from PU and PEOU, the adoption of t-Gov services raises important political, cultural, organizational, technological, human and social issues. CF1 thus includes:

Ease of Use: significant field research has taken place the past two decades regarding the effects that the construct PEOU has on both PU and intention to use [19] [51]. Hence, PEOU will have a positive effect on both PU and behavioral intention to keep using LGAF.

Usefulness: Individual behavioral intention to use a provided service is strongly affected by users' PU [19] [51] [52]. Hence, it is likely that high citizens' PU will lead them to positive evaluation of the necessity of LGAF.

Motivation: Potential individual differences in motivation to use a technological innovation were suggested to be one of the most relevant variables in the adoption and use [53] [54]. Active use of new technology with greater motivation has been found to produce stronger behavioral effects on the use of it [55].

Compatibility: Based on DOI, authors consider as an important proposition the fact that higher levels of perceived compatibility are associated with increased intentions to adopt t-Gov. Users will be willing to use services congruent with their preferred way of interaction [30].

Legislation and Regulatory Framework: Current legislation frameworks are characterized by the assignment of significant powers to public bodies and the recognition of relevant formal guarantees for citizens, based typically on observance

by public administrations of a legally predetermined bureaucratic-based sequence of steps. Many rules become barriers to the effective implementation of t-Gov and erode its confidence among citizens, since they are made too rigid to accommodate the changes by ICT professionals.

Trustworthiness and Security: perceived trustworthiness and security are considered as a significant construct. Trustworthiness can be divided into "trust to the initiative" and "trust to the LGO" [56] The authors hypothesize that higher levels of perceived trustworthiness are positively related to intention to use LGAF, considering past studies on trust, security, and technological innovations [30] [57].

Compliance with Policy: The authors suggest that governmental policy can establish communication channels that may either promote citizens' adoption and use of t-Gov services, or induce resistance [19] [58].

4.2 Methodological Approach of the Research Cycle

The first research cycle aimed to validate and further revise the CF1. The case studies took place in twelve LGOs that participated as 'pilots' LGOs. A variety of primary (e.g. interviews) and secondary data sources, such as internal and technical reports for LGOs operations and requirements were used. A two-day workshop took place in five different places around Greece with the participation of total of two hundred and fifty stakeholders (experts from the LGOs, the Greek Ministry of Interior, the ICT industry and people from the local regions) (Table 1). Based on these data, the authors synthesized a set of key factors that citizens consider as important. Afterwards, a set of requirements for the effective design and implementation of LGAF were consolidated as the first user scenarios. During the workshops, more than fifty in number, regional and national individual interviews, were conducted with the LGOs employees, the chief technology officers, the administrators, the consultants, and the citizens as potential users. The duration of each interview was approximately forty five minutes.

5 Findings and Discussion

The data analysis demonstrates that adoption agenda is influenced by a combination of issues at the individual level. Hence, a multi-disciplinary approach is essential to its investigation and research, involving an effective management of systems, information, policies, processes, and change. To this point, debates during the workshops were about the fit of technology on LGOs' processes and operations rather that developing the right technology. Some of the variables identified in the CF1 were found to be inter-reliant. The authors followed the classification of t-Gov terminology and attempted to group the findings as human and social constructs, organizational constructs and technical constructs, allowing for more specific concepts to emerge within such groupings.

Table 1. Workshops' participation

Workshops	Duration	Participants No	Profile of Participants
WS1	1st day: 6h 2nd day: 5h	65	Male: 58; Female: 24 Academia: 7; LGOs: 31; Industry: 13; Citizens: 30
WS2	1st day: 5h 2nd day: 4h	47	Male: 19; Female: 12 Academia: 1; LGOs: 12; Industry: 9; Citizens: 9
WS3	1st day: 5h 2nd day: 5h	40	Male: 37; Female: 22 Academia: 1; LGOs: 24; Industry: 5; Citizens: 29
WS4	1st day: 6h 2nd day: 4h	36	Male: 17; Female: 21 Academia: 3; LGOs: 16; Industry: 8; Citizens: 11
WS4	1st day: 5h 2nd day: 3h	36	Male: 26; Female: 16 Academia: 3; LGOs: 21; Industry: 11; Citizens: 7

Human and Social Constructs: "Compatibility" was found to have a significant relationship with use intentions in t-Gov. The participants strongly suggested that LGAF should operate in a manner that "is consistent with individuals' values, beliefs and experiences" and provide information and work support in a manner that is "consistent with what citizens are used on".

Another significant concern was "trustworthiness". Citizens, who perceived the reliability and security of the internet to be low, presented obstacles when using LGAF [57]. There was a long debate between participants in the workshops regarding the notion of initial trust to LGAF that refers to "trust in an unfamiliar trustee, a relationship in which the actors do not yet have credible, meaningful information about, or affective bonds with, each other" [57]. Regarding trustworthiness, citizens who perceived Greek government to be trustworthy consider the introduction of LGAF as a welcome initiative. Governmental-based trust was mainly associated with citizens' perceptions of the governmental environment, such as the structures, regulations and legislation that make an individual feel safe and trustworthy [59].

Another important construct was the motivation or the perceived need for working 'over the wire'. In demographic terms, the data analysis revealed that a percentage of 76% of the interviewees stated they intend to immediate use LGAF (early LGAF adopters) were people in young age, more educated (80% of them holding a University degree) and with relatively high incomes (40% of them had a net family income more than thirty thousand per year). This indicated that individual demographic characteristics were also influencing the adoption of provided services. The cases analysis proved that a group of individuals were more likely to keep using LGAF than others. Consequently, we examined two factors namely, the level of prior Internet usage and the citizens innovativeness. Individual innovativeness can be defined as 'consumer acceptance' of new ideas [4]. The findings supported that higher Internet usage led to LGAF adoption. Domain-specific innovativeness, i.e. innovation linked to certain domains was found to influence LGAF adoption. Finally, there was a group of users persuaded very quickly of the LGAF's significant advantages

compared to prior institutional systems. This proved that individual perceived relative advantage enforced the individual intention to use.

Organizational Constructs: The discussions concerned the coordination and ownership between and across LGOs and departments, the political engagement regarding the delivery of technology supported services, the LGO capacity including available resources (human, technical, etc.), change and risk management issues as well as the appropriate legal and legislation framework. Participants discussed about the nature and mission of LGOs and their relationship with the electronic services provided. There was a clear concern regarding potential future developments and change [4]. Clear policies for LGOs were seen to be critical. Key issues included sense of ownership and the required organisational transformation. A key concern was about ways to cope with organisational inertia. A particularly important area of risk was the access to governmental services and the issue of community inclusion. Furthermore, it emerged that measurement and evaluation techniques were necessary to realise the learning perspectives of t-Gov. To achieve successful transformational implementations it is necessary to establish coherent legitimacy and establish trust relationships between government and citizens. Since the legal framework regarding the provision of electronic services is 'still in infancy', a cohesive legal framework is required to speed the adoption of t-Gov. The research has revealed that four main sets of legislation are considered: personal data protection laws; privacy and security laws; information (provision) laws; and administrative laws.

Technical Constructs: Various technical parameters that might affect LGAF adoption and regular use were revealed. The supporting staff in LGOs stressed the need for a less complex framework and more user-friendly in its user interface, and the forms and templates. The majority of interviewers and workshop participants were sceptical about the use of innovative technological tools, by aged users; the authors labelled this attribute 'computer anxiety'. IT experts identified the need for flexible and scalable technology, privacy and security, shared services and common identity management, standards, coordination and integration between LGOs operations and departments, identification and authentication. Regarding the notions of scalability and flexibility of governmental systems, the cases revealed that there is need to create flexible systems that can adapt and change on demand in accordance to the changing nature of t-Gov [2] [3]. There was no definite agreement regarding what constitutes valid and appropriate access to information. Finally, issues of interoperability and standardisation arose, stemming from the way different LGO's departments can be managed, the technical tools needed for integration and the standardisation of certain data and services. To this extend, the notions of open standards and open source software were highlighted.

5.1 Conceptual Framework (CF2)

The research findings resulted in the modification of the CF1 to a revised framework (CF2) (Figure 2).

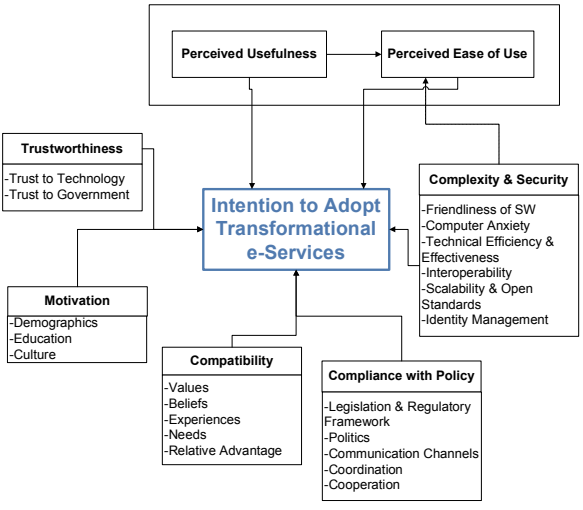

Fig. 2. Final Conceptual Framework for Transformational Government

The proposed CF2 can be used as the basis for further research. The adoption of LGAF from citizens is presented as the initial crucial step in the diffusion process for government to capture its goals, enable an environment for social and economic growth, and contribute to the process of transformation of the Greek local administration towards a leaner and cost-effective administration. The real benefit of LGAF lies not in the use of technological framework per se, but in its application to processes of transformation in the Greek bureaucratic public sector.

6 Conclusions

T-Gov initiatives have been identified as one of the top central government priorities. Citizens' acceptance of LGAF raises important political, cultural, organisational, technological and social issues that must be considered carefully. In this research a framework which consists of concepts and details about the key adoption factors of t-Gov was developed, which can be used as a tool to determine the roadmap for adoption of a t-Gov initiative. Further research could include the study of how the perceived attributes of trialability and observability may affect the adoption of transformational services by citizens. Although the nature of the study does not allow the generalisation of findings, we could suggest that future research should also aim at exploring the applicability of this framework to other e-government projects.

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The eGovernment Services Delivery of the Italian Municipalities

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Abstract. This paper focuses on factors associated with the development of e-government services by local public administrations (PAs) in Italy. Using data from 1,176 municipalities in 2005, we show that the combination of internal competencies and context-specific factors is different when explaining decisions to start e-government activities vs. the intensity of such activities. Local PAs involved in e-government are larger, carry out more in-house ICT activities and are more likely to have intra-net infrastructures than PAs offering no digitized services. They are also located in regions having large shares of firms using or producing ICTs, where many other municipalities offer digitized services, and where population density is low. The range and quality of e-gov services increase with their stock of ICT competencies, their efforts to train workers, and their ability to organise interfaces with end-users. Moreover, the range and quality of services is correlated with the broadband infrastructure development of regions.

Keywords: Innovation system, Dynamic capabilities, Technology adoption, Electronic government, Innovation in services, Two-part model.

1 Introduction

In advanced economies the public sector has been under pressure to increase transparency in administrative procedures and decision making processes as well as increase the efficiency of its services to citizens and business enterprises. These pressures are the result of a combination of factors, including increasing competition in political arenas, institutional changes and technical progress. The use of digital technologies at all levels of Public Administrations (PAs) and the development of "e-government" services are a key aspect of this transformation [1]. Studies on digital technology adoption and on ICT based services supplied by public organisations, however, reveal the existence of a considerable heterogeneity across EU countries and regions [2, 3]. In other words, not all PAs are equally prone to involvement in e-government nor are they equally active in this field. Using data on 1,176 Italian

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municipalities in year 2005, this paper contributes to our understanding of this diversity. More precisely we analyse the factors that are associated with PA decisions on whether and how to become involved in e-government activities.

The analysis carried out in this paper can be cast in a general framework that explains innovation as the result of a process wherein the competencies of innovating entities co-evolve with the technological, institutional and economic environment in which they are active [4]. In this case, we shall focus on a specific category of innovators, namely local-level public administrative bodies, which we shall call "municipalities" from now on. We shall use the provision of digitalised front office services to the citizens, firms and other institutions (e-government) as a measure, though partial, of municipality innovation. Furthermore, we consider the relevant technological, institutional and economic context for innovation to be largely represented by the "regions" in which municipalities are located. While the choice of territorial aggregation is always arbitrary, we thought it sensible and feasible in terms of data availability to utilise the Eurostat NUTS2 level of analysis for Italy, which corresponds to the 21 sub-national regions that were institutionalised in 1970 following a constitutional provision of 1948. In this general framework, we shall show that different competencies and contextual factors matter when considering innovation rate *between* or *within* municipalities.

The rest of this paper is organised as follows. Section 2 draws together different streams of literature to single out the key factors that can help explain innovation in public services in general and e-government in particular. Section 3 illustrates our datasets and discusses the empirical strategy we follow. Section 4 examines the results of the econometric exercise carried out on innovative activities of Italian municipalities. Section 5 concludes.

2 Background Literature on Innovation and Implications for Public Services

Innovation in services has attracted increasing, albeit still limited, attention in economic literature [5, 6, 7]. As particularly stressed by the evolutionary approach, our understanding of innovation can greatly benefit from the analysis of *competencies of firms and institutions*. This stream of literature views innovators as depositories of largely tacit knowledge incorporated in such firm-specific assets as routines, skills, technical and organisational capabilities [8, 9]. Such assets, normally identified with the comprehensive term "competencies", are the result of conscious efforts to invest in training of human capital and in institutionalised R&D. Moreover, competencies originate from learning processes associated with production, the use of technology and the interaction with external parties (other producers, users, and institutions) which are themselves depositories of knowledge assets.

To explain better the introduction of innovation in general, and of e-government services as a special case of innovation in services, one also needs to acknowledge the importance of *context specific factors*. There is a general consensus on the role played by *demand conditions* as fundamental drivers for innovation. The hypothesis that extensive and growing demand stimulates innovation was originally proposed by Schmookler [10, 11] and tested at different levels of analysis with a focus on the

manufacturing industry [12, 13, 14]. Most contributions on innovation in services emphasise the importance of demand determinants of innovative activities [15, 16] although there are few empirical studies concerning this issue. In the public sector case, attention has been given to the role of governmental bodies in public procurement of advanced technology, hence as actors on the demand side affecting innovation carried out by supplier sectors [17, 18].

Apart from the characteristics of demand, innovation is affected by a number of other context specific factors and by the complex networks of relationships among the different actors involved in innovative activities [19, 20]. Important interdependencies can be observed between all components in innovation systems, whether the systems are defined at the national, regional or sectoral level.

The interactive and systemic nature of innovation is mediated by spatial factors, such as geographic proximity and localised knowledge accumulation. Emulation processes across innovators, user-producer interactions, knowledge exchanges and involuntary information leakages are favoured by close interaction and day-to-day contact between actors involved. There is significant evidence of inter-regional variations in the generation and adoption of new technology, revealing that innovation tends to be geographically bounded [21, 22, 23].

3 Data Sources and Empirical Strategy

In this section we illustrate the data and methods we utilize to examine the factors affecting the innovative activities of Italian PAs. As stated in the introduction, our unit of analysis is based on local PAs (municipalities), and we use their involvement in the provision of digitalized front office services (e-government) as the dependent variable in our econometric exercise. We expect different factors at the municipality and contextual levels to be associated with the introduction of e-government services. These factors were selected from the existing literature on innovation processes, as in Section 2. Let us first illustrate our data sources and then discuss how these are utilized for analytical purposes.

3.1 Data

Our empirical tests are based on data at both municipality and contextual (mainly regional) levels. For one variable only data is collected at the level of the Italian provinces.

For municipality level variables, data are obtained by merging two different surveys. One is the survey conducted by Italy's National Bureau of Statistics (Istat) in 2006 on the usage of ICT in 3,323 Italian local public administrations. It collects information on the diffusion and use of ICT in the local public administrations. The other is the survey carried out in 2006 by the National Centre for the Information Technology in the Public Administration (Cnipa) on the official websites of 1,825 Italian municipalities. It includes information on some 266 on-line services provided by the municipalities. The intersection of the two datasets yields cross-sectional information referring to 1,176 municipalities in 2005, providing the final sample size used in the econometric exercise.

Table 1. Variables description

Variable	Description	Year	Source of data
Dependent variable			
Front-Office Index	Municipality's E-gov level composite indicator	2005	EGOV (*Cnipa*)
Municipality characteristics			
Municipality ICT Empl	Number of municipality's employees who have the ability to develop, operate and maintain ICT systems; core activities of their job are related with ICT	2004	ICT-PA (*Istat*)
Municipality ICT Training	Binary variable taking on the value 1 if municipality has sponsored at least one of the following training programs: office automation, operation systems, web, data management, and European Computer Driving License	2005	ICT-PA (*Istat*)
Municipality InHouse ICT	Share of ICT-related activities operated with internal staff. ICT-related activities taken into account are: project management, software development, hardware management, software management, systems management, network management, database management, ICT-related security, web/internet technologies development and management, web content management, data entry, PC users assistance, ICT training, and e-commerce systems	2005	ICT-PA (*Istat*)
Municipality BroadBand	Binary variable taking on the value 1 if municipality has broadband access to the Internet. We consider broadband as a transmission capacity that is faster than primary rate ISDN, at 2 Mb/s	2005	ICT-PA (*Istat*)
Municipality EDP-based Activities	Share of internal activities operated through EDP-based systems	2005	ICT-PA (*Istat*)
Municipality Interface	Binary variable taking on the value 1 if municipality has single EDP-based interface to the user (identified in Italy with the terminology *"Sportello Unico delle Attività Produttive", SUAP)*	2005	ICT-PA (*Istat*)
Municipality OpenSource	Share of open-source system software used. Software considered is: operative system software for server and that for PC desktop, office automation, web server, e-mail client, Data Base Management System, and security software	2005	ICT-PA (*Istat*)
Municipality Intranet	Share of laptop and desktop PC logged in Intranet out of the total number of laptop and desktop PC	2005	ICT-PA (*Istat*)
Municipality Multichannel	Binary variable taking on the value 1 if municipality uses at least a web-alternative channel to provide its services. Web-alternative channels are: call center, mobile technology such as SMS and WAP/GPRS/UMTS, and digital television	2005	ICT-PA (*Istat*)
Municipality Size	Municipality's inhabitants	2004	RESIDENT POPULATION (*Istat*)

Table 1. Variables description *(continued)*

Variable	Description	Year	Source of data
Regional and contextual characteristics			
Capital Share Reg	Share of inhabitants living in the regional capital city out of the total regional population	2006	RESIDENT POPULATION (*Istat*)
Municipal E-gov Suppliers Reg	Share of munucipality providing at least an E-gov service out of the total number of municipalities in the region	2005	ICT-FIRMS (*Istat*)
ICT User Share Reg	Simple mean of shares of ICT user firms out of the total number of firms in the region. ICT is: using extranet, internal automated systems for purchases, internal automated systems for payments; using Internet for banking and financial services, staff training, and acquiring digital information and services; providing products catalogue on web site; purchasing products/services via Internet	2005	ICT-FIRMS (*Istat*)
E-gov User Share Reg	Simple mean of shares of e-Gov user firms out of the total number of firms in the region. E-gov is using municipality web site to: obtain information; download formats; submit formats and complete the service process	2005	ICT-FIRMS (*Istat*)
ICT Producer Ntnl Share Reg	Ratio of the number of employees in ICT sectors in that region to the national mean. To define the ICT sectors we follow the OECD classification. As for manufacturing, ICT sectors include: manufacture of office, accounting and computing machinery (sector 3000 based on ISIC Rev. 3.1), manufacture of insulated wire and cable (sector 3130), manufacture of electronic valves and tubes and other electronic components (sector 3210), manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy (sector 3220), manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods (sector 3230), manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment (sector 3312), and manufacture of industrial process control equipment (sector 3313). As for services, ICT sectors are wholesale of computers, computer peripheral equipment and software (sector 5151), wholesale of electronic and telecommunications parts and equipment (sector 5152), telecommunications (sector 6420), renting of office machinery and equipment, including computers (sector 7123), and computer and related activities (sector 72)	2001	CENSUS-FIRMS (*Istat*)
ICT Degrees Ntnl Share Reg	Ratio of the number of graduates in ICT faculties in that region to the national mean. According to the OECD definition, ICT faculties include: engineering and engineering trades, manufacturing and processing, architecture and building, life sciences, physical sciences, mathematics and statistics, and computing	2005	MIUR
BroadBand Share	Share of population out of the total provincial population reached by at least a broadband access provider	2004	BROADBAND OBSERVATORY (*Between*)

Table 1. Variables description *(continued)*

Variable	Description	Year	Source of data
Macro-Regional dummies			
Macroarea 1	Dummy for north-west regions: Valle d'Aosta, Lombardia, Piemonte, and Liguria	-	-
Macroarea 2	Dummy for north-east regions: Veneto, Friuli-Venezia Giulia, Trentino-Alto Adige, and Emilia Romagna	-	-
Macroarea 3	Dummy for center regions: Toscana, Umbria, Lazio, and Marche	-	-
Macroarea 4	Dummy for Mezzogiorno regions: Abruzzo, Molise, Campania, Basilicata, Puglia, Calabria, Sicilia, and Sardegna	-	-

Data on several regional level variables have then been drawn from different surveys. One is the 2005 survey on the usage of ICT in Italian firms with 10 employees or more. Data on employees in ICT sectors come from the 8th General

Industry and Services Census carried out in 2001. Data on inhabitants at the municipality level are taken from the Istat project "Demography in Figures". The MIUR (Italian Ministry of University and Research) survey on the tertiary education provides data on the number of graduates in ICT disciplines as a measure of human capital endowments in fields relating to e-government. For all the variables where information is available at regional level, the same value is assigned to every municipality belonging to the same region. As a result, we have no intra-regional variance and only in inter-regional variation at this level of analysis.

Finally, information on the diffusion of broadband infrastructure and services are taken from the Broadband Observatory. These are the only data to which we have access available at the provincial level. Table 1 provides a brief description of all the explanatory variables considered in the empirical application and their source.

3.1 The Dependent Variable: The Front Office Index (FOI)

The dependent variable in our econometric exercise is a composite indicator measuring the availability and the level of interactiveness of on-line services for each administration. Information on these two dimensions come from the Cnipa dataset. Examining the official websites of 1825 municipalities, Cnipa singles out 266 different on-line services. The same service can be recorded for more than one municipality. This results in an initial dataset of 21,337 observations. For each of them, using a taxonomy introduced by Capgemini [24, 25], by means of four dichotomic variables *Di*, the dataset indicates whether or not there are specific characteristics that each reflect a different degree of interactiveness in on-line services:

- the possibility of downloading administrative forms necessary to receive the service (indicated as D_1);
- the possibility of exchanging interactive information about the service, such as asking specific questions and obtaining answers (D_2);
- the presence of an authentication procedure through which the user can be identified and given a personal account as a means to enhance security (D_3);
- finally, the possibility of carrying out the whole transaction process on-line (D_4). This represents the most comprehensive level that can be provided for an on-line service.

Note that each service may show none, some, or all of these features.

For analytical purposes, we followed a two-step procedure. First, we employ Multiple Correspondence Analysis (MCA) to associate four binary variables to the 21,337 on-line services observed, so as to compute a weight for each of the four features. At the end of the first step, we have a score for each of the 21,337 entries in the dataset reflecting the "intensity" of the on-line service in terms of quantity (given by the 0/1 *Di* variables) and level (given by the weight associated to each *Di* variable) of actions it performs. For a given on-line service, the score is higher the higher the number of characteristics that service exhibits as well as the higher the degree of interactiveness of these characteristics. Second, we compute a final score for each municipality (the base unit of our analysis) by adding the scores received by all the services provided through its

official website. This is our Front Office Index (FOI). It is a positive function of both the number of on-line services offered by the administration (the higher the number of on-line services supplied by the municipality, the greater the number of non-null scores computed and hence the higher the FOI associated to the same municipality) and of the "quality" of each of these services (the higher the score of each on-line service provided by the municipality, the higher its final FOI).

3.2 Independent Variables and Controls

In light of the selective review of the literature carried out in Section 2, we singled out a set of variables associated with the development of e-government services. These variables can be divided into two broad categories: characteristics of municipalities and contextual (mainly regional) features.

Municipality level variables aim primarily at capturing a large variety of technical and organisational competencies of local administrative bodies. As discussed in sections 2, internal capabilities are considered key drivers of innovation - especially in the evolutionary and resource based views of the firm, which have also been looked at in studies on innovation in service sectors. We distinguish three different sets of internal competencies:

i. Competencies embodied in personnel employed in the municipalities

This is *Municipality ICT Empl* variable, expressed by the number of employees whose core activities are related to ICT, i.e. software design, computer based operations and maintenance. This variable reflects the actual stock of human capital qualified for the development and provision of digitalised services. *Municipality ICT Training* is a dummy to identify whether in 2005 municipality *i* has undertaken specialised training programs in any of 5 technical fields that are relevant for e-government activities. Through this indicator we mean to capture the conscious effort made by the institution to improve the quality of competencies in these areas. *Municipality inHouse ICT* is expressed as the percentage of ICT related activities carried out in the public organisation by means of internal staff. This variable indicates how capable the organisation is to take care of ICT activities with its own resources, without resorting to specialised external competencies.

ii. Competencies embodied in ICT based devices and instrumentation

Indicators we used are: *Municipality intranet*, which measures the percentage of the computers connected to a Local Area Network (LAN); *Municipality Broadband*, a dummy variable identifying whether or not the municipality's offices have broadband access to the internet; and *Municipality OpenSource* - that is, the share of open source systems out of the total number of software packages that are in use at the municipality's offices. Since open source software is less established as a technical solution, and its development is by and large based on the interaction among communities of experienced users, we consider its rate of adoption as an indicator of both the innovativeness of systems in use and of the skills of technical personnel employed by the PA.

iii. Competencies embodied in the PAs' organisation

To capture this aspect of internal competencies we introduced several indicators of how pervasive ICT is in the overall organisational structure of the municipality. Measures of this type are: *Municipality EDP-based activities*, expressed as the share of total activities carried out at the municipality level operated using EDP-based systems; *Municipality Interface*, a dummy identifying whether or not the PA has set up an ICT based system that allows the user to deal with a single on-line administrative interface (the so called "Sportello Unico" in Italian technical jargon); and *Municipality Multichannel*, a dummy indicating whether or not the PA makes use of diversified channels to provide services, other than face-to-face contacts, that are not based on the web. These alternative channels include *inter alia* call centers, mobile messaging or interactive cable TV.

As noted, there are important contextual factors which complement internal capabilities as key drivers for innovation in general and in public services in particular. Such "external factors" include:

a. Demand size

Factors at work on the demand side can be partly captured by our variable Municipality size, which is expressed in terms of the number of inhabitants resident in the territory of the local PA. While this indicator is defined at the municipality level, we suggest that it will help identify the extent of potential demand for e-government services. Consistently with the literature on demand-pull innovation, on demand externalities, and on user-producer interaction which we reviewed in Section 2, we assume Municipality size to be positively associated with e-government development.

b. Demand quality

To carry out a more detailed analysis of demand factors at a broader level (relative to the municipality level we have just considered), we first use variables that identify specific categories of users, such as *ICT User Reg* and *E-gov User Reg*. These are respectively expressed in terms of the percentage of total firms in the region that were reported in 2005 to have adopted ICT-based services in general or e-government services in particular. Unfortunately we do not have lagged data on use of digital services, which would enable us to test whether epidemic patterns of innovation diffusion, induced by previous adoption, can affect the development of e-government. Nevertheless, consistent with systemic approaches to innovation, we can expect that higher shares of companies that use digital services will be positively associated with more extensive and effective user-producer interaction, thus creating greater opportunities for PAs to offer new or improved ICT based services.

As well, we attempt to capture how polarised demand is by identifying the percentage of inhabitants of the region that are concentrated in the capital city (*Capital Share Reg*). According to the literature on spatial diffusion of innovation, technology adoption tends to be more timely and intensive in locations where larger numbers of potential users are concentrated, especially in the initial stages of technical change [26]. As e-government is in its initial phase of diffusion, one might expect that the higher the share of population in capital cities and in metropolitan areas, the more these services will be concentrated there.

c. Supply factors

E-government activities of PAs are affected by the presence of other innovative actors in the same area. Among these actors are the other municipalities offering digitalised services. We capture this factor by means of our variable *Municipal E-gov Suppliers Reg*, expressed as the share of e-government service providers out of the total number of local administrative bodies in the Region. Consistently with systemic as well as spatial innovation approaches, we expect this variable to be positively related to the innovative activities of PAs. In fact, when a high number of innovators are located in a given area, knowledge spillovers will be facilitated and greater incentives are created that push less dynamic institutions to enter the innovation race.

Interdependencies can also be observed between e-government service providers and local ICT producers. We proxy this factor with a separate variable we named *ICT Producer Ntnl Share* defined as the ratio between the percentage of employees in ICT manufacturing and service sectors out of the total number of employees in the Region, and the same percentage calculated at the national level. This factor is positively associated with the development of e-government services for two main reasons. First, municipalities located in regions with higher shares of ICT producers are in a better position to gain access to relevant technology, including both hardware and software. Second, where public and private markets overlap, as in the case of voice or image transmission over IP, a competitive presence of ICT service providers stimulates municipalities to expand the range of services offered through their city networks.

Another supply-side, context specific factor we wish to account for is the state of communication infrastructure. For this purpose we introduce *BroadBand Share*, defined as the share of total population of the province in which a municipality is located reached by at least one broadband service provider. We consider wide availability of broadband connections an important condition for the provision of advanced e-government services because it demonstrates high quality infrastructure and might also reflect the existence of (actual and/or potential) competition in the provision of network solutions. Both the technological level and the degree of competition in the provision of network infrastructure are normally associated with higher rates of generation and diffusion of advanced communication services [27].

We further control for the availability of a pool of qualified human capital, a factor particularly emphasised in studies on the generation and diffusion of innovation in ICTs [28]. To capture the role of this factor, we calculate the ratio between the percentage of graduates in ICT disciplines out of total graduates in the Region and the same percentage at the national level (*ICT Degrees Ntnl Share Reg*). Indeed, this indicator will at the same time reflect the qualitative level of actual and potential workers in ICT manufacturing and service sectors and the competencies of potential users. In both cases the impact on e-government service provision should be positive.

Finally, we also introduce controls for macro-regions. This enables us to account for a number of other observable and unobservable sources of heterogeneity which might affect the provision of e-government services, including income levels, degrees of industrialisation, and sectoral composition of the areas where municipalities are located.

3.3 The Econometric Model

The choice of the econometric model strongly depends on the distribution of the dependent variable, namely the *FOI* index. Almost 30% of the observed municipalities do not provide on-line services, i.e. the composite indicator is nil for these units. Thus, our dependent variable is continuous over strictly positive values but takes value zero for a nontrivial fraction of the sample. Given the nature of our dependent variable we argue that a standard censored model would not be appropriate. In fact, municipalities can be thought of as solving an optimization problem, wherein the optimal choice might well be the corner solution, $y=0$. The case of limited dependent variables often arises in econometric analysis, especially when the behaviour of economic agents is being modelled. The traditional approach in dealing with such a problem is the Tobit model. However, this approach requires that the censoring mechanism derives from the same model that generates the outcome variable while in our case the censoring mechanism and outcomes may be more flexibly modelled using separate processes [29]. A two-part model allowing the zeros and non-zeros to be generated by different densities enables us to specify a model for the censoring mechanism and a model for the outcome, conditional on the dependent variable taking positive values. This allows the separation of the estimation of a standard Probit model (using all observations available) from that of an OLS model (using only observations with $FOI > 0$).

We use a Probit in the first part of our model to analyze the municipality's decision to offer on-line services *via* its official website. This allows us to explain innovation differences "between municipalities", i.e. which PAs have a propensity to offer e-government services. The second part is a linear regression model to investigate the determinants of the intensity of e-government development in terms of both quality and quantity of on-line services. Using the terminology introduced earlier, this would allow us to explain innovation differences "within municipalities".

4 Results

Table 2 illustrates the results of the econometric exercise we carried out using the data and methodologies discussed in Section 3. The whole set of independent variables illustrated in Section 3.3, was used in both stages of the two part model. The last two columns of Table 2 report the results obtained from the final specification, following the entire selection procedure and controls for heteroskedasticity.

Results from the final specification are by and large consistent with the view we have developed in this paper. As we suggested earlier drawing from different streams of literature, the specific kind of innovation analysed here - namely municipalities' provision of digitalized services - is the result of a combination of internal competencies and of context specific factors. The econometric test suggests that different combinations of such variables are at stake when assessing PA decisions on whether or not to supply digitalized services and when considering the intensity of e-government activities (number and quality of services provided). In other words, factors associated with variations in innovative activities "between municipalities" are different from factors associated with differences in innovation "within

Table 2. Estimation results: Probit and OLS

Variable	Full Models		Selected Models		Heteroskedastic Robust Estimates	
	Probit	OLS	Probit	OLS	Probit	OLS
	1	*2*	*3*	*4*	*5*	*6*
Municipality characteristics						
Municipality ICT Empl	0.062	0.010**		0.010**		0.011**
	0,062	*0,004*		*0,004*		*0,005*
Municipality ICT Training	-0,077	0.192**		0.196**		0.177**
	0,133	*0,094*		*0,094*		*0,090*
Municipality InHouse ICT	0.381**	1.053***	0.447**	1.058***	0.560**	1.063***
	0,192	*0,140*	*0,178*	*0,137*	*0,219*	*0,136*
Municipality BroadBand	-0,047	0.255***		0.220***		0.251***
	0,109	*0,084*		*0,082*		*0,330*
Mun. EDP-based Activities	1.232***	0.710**	1.220***	0.641**	1.292***	0.720**
	0,419	*0,333*	*0,413*	*0,331*	*0,456*	*0,331*
Municipality Interface	0,056	0.300***		0.295***		0.281***
	0,131	*0,091*		*0,090*		*0,084*
Municipality OpenSource	0,034	0.303**		0.341**		0.265*
	0,239	*0,151*		*0,149*		*0,152*
Municipality Intranet	0.276**	0.175*	0.261**	0.195**	0.556**	0,124
	0,123	*0,095*	*0,119*	*0,092*	*0,220*	*0,094*
Municipality Multichannel	0,258	0.312***		0.288**		0.288***
	0,200	*0,112*		*0,111*		*0,106*
Municipality Size	0.065***	0.001**	0.070***	0.001**	0.094***	0.001**
	0,009	*0,000*	*0,008*	*0,000*	*0,015*	*0,000*
Regional and contextual characteristics						
Capital Share Reg	-0.019***	-0,001	-0.020***		-0.021***	
	0,005	*0,005*	*0,005*		*0,006*	
Municipal E-gov Suppliers Reg	2.642***	0,176	2.717***		3.216***	
	0,655	*0,466*	*0,629*		*0,690*	
ICT User Share Reg	1,696	1,729	2.590*		2.944*	
	1,729	*1,437*	*1,475*		*1,758*	
E-gov User Share Reg	0,058	0,081	0.104**		0.124**	
	0,077	*0,072*	*0,051*		*0,052*	
ICT Producer Ntnl Share Reg	0.392*	-0,169	0.483**		0.484*	
	0,23	*0,197*	*0,210*		*0,251*	
ICT Degrees Ntnl Share Reg	0,254	-0,234				
	0,274	*0,268*				
BroadBand Share	0,163	1.021***		0.772**		0.897**
	0,46	*0,387*		*0,338*		*0,376*
Constant	-2.037***	-5.219***	-1.987***	-4.872***	-2.293***	-5.094***
	0,480	*0,446*	*0,412*	*0,303*	*0,486*	*0,334*
Macro-Regional Controls	NO	NO	NO	NO	YES	YES
Num. Obs.	1176	815	1176	815	1176	815
Pseudo R^2 / R^2	0,322	0,343	0,318	0,338		0,352
LR-test (Wald) / F-test	466,29	24,44	461,62	37,24	(134.88)	33,99

Standard errors in italics.

** Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.*

municipalities". Outcomes from the Probit specification in column 5 can be interpreted as "between effects", while those obtained from the OLS part of the model and reported in column 6 illustrate "within effects".

More specifically, our econometric exercise yields the following sets of results.

First, the environment in which municipalities are active, seems to influence the start up of digitalised services more than their intensity.

Second, among the context specific factors we analysed, demand size and quality stimulate innovative entry into e-government service provision. Demand size at the local level is captured by the number inhabitants resident in the municipality area (*Municipality Size*). It has a positive and significant impact on differences in innovation between municipalities, reflecting demand pull considerations as well as other bandwagon effects induced by demand externalities and user-producer interactions.

Demand conditions appear to play an even more important role at the regional level. Companies which have already adopted ICT services appear to have the highest impact on the decision of municipalities to get involved in e-government activities (see coefficient of *ICT User Share Reg* in column 5 of Table 2), suggesting that capable business users are of paramount importance for PAs. Even after controlling for ICT user firms, the impact of *E-gov User Share Reg*, i.e. the percentage of firms using e-government services, still remains positive and significant in our Probit regression. Although we do not have a data panel to evaluate how previous patterns of adoption affect diffusion, this result is largely consistent with the idea that innovation is favoured by pioneer users.

Third, demand polarisation hampers innovation in public services. This is shown by the negative coefficient of *Capital Share Reg* in column 5 of Table 2, indicating that a high weight of the region's capital will inhibit innovation elsewhere, especially in the early stages of development of new services.

Fourth, emulation effects, knowledge exchanges, and competitive pressures can be observed on the supply side. The most important factor positively associated with the decision to supply digitalised services appears to be the number of e-government providers in the region (see coefficient of *Municipal e-gov supplier Reg* in column 5 of Table 2). Emulation factors matter here, especially in the presence of increasing competition in the political arena at the local level.

Fifth, advanced communication infrastructures do not influence the start up of e-government but do affect e-government intensity. The only context specific factor that seems to impact significantly on innovation within, rather than on innovation between, municipalities is the diffusion of broadband in the area in which they are located (see coefficient of *BroadBand Share* in column 6 of Table 2). The presence of broadband infrastructures does not seem to affect significantly the decision to start up the digitalization of public services. At this stage the objective of municipalities is the presence on the web of relatively simple applications and services such as information services (*e.g.* basic tourist information and guidance to the citizen on administrative procedures) and communication services (*e.g.* self-managed webspaces to be used by associations and organizations, links to other public administration sites, discussion fora). On the other hand, broadband connections become essential when the *e-government* service supply is richer (in terms of the number of services provided) and more articulated (in terms of interactivity levels and technologically complex).

Sixth, the decision to enter e-government activities is associated with a narrower range of generally less complex internal capabilities than those needed to increase the intensity of digitalised services. Differences in innovation between municipalities are

not affected by the number of workers with experience in ICT nor by the efforts made to train existing workers. Increasing the range and quality of services is associated instead with a much wider set of more complex competencies (see OLS specification in the last column of Table 2).

5 Conclusions

Using evidence on 1,176 municipalities in Italy, and combining several datasets on the characteristics of local PAs and of the territory in which they are located, we evaluated different factors associated with the development of e-government services.

In more general terms, the combination of internal competencies and context specific factors is different when explaining the decision to start e-government activities *vs.* the intensity of such activities. Regional factors concerning both the demand and the supply of services appear to affect only the decision to enter e-government activities. Competencies needed to expand and improve the quality of services are much more numerous and complex than the ones associated with the mere decision to start e-government activities.

The examined evidence is consistent with a view of e-government development as a process of gradual, step by step involvement, wherein municipalities initially engage in exploratory activities, favoured by an external context conducive to innovation and by very limited internal competencies. Once more efforts are made to expand and improve services supplied, more qualified competencies and more advanced environmental conditions need to be created. There is no guarantee that such circumstances occur, so that further development of currently embryonic e-government is at risk. This calls for increasing investments in training, human capital formation and in hardware and software devices at the individual municipality level. It also requires greater efforts to improve the technological environment in which PAs are active, including investments to improve the quality and accessibility of digital communications networks.

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The State of IT Governance: Patterns of Variation at the Central Government Level in Norway

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Abstract. The aim of this article is to analyze IT governance practices in the Norwegian government ministries. We seek to identify the ministries IT governance regimes, and, more specifically, the different government sectors policies and principles regarding the use of ICTs. Moreover, we seek to explain differences in IT governance regimes across ministries.

The empirical evidence has been collected from policy documents, budget proposals and other document. These data have been supplemented by qualitative interviews with key civil servants in the various government ministries. The analysis of the data is based on a theoretical framework consisting of four IT governance models and a classification of the functions that ICTs fulfill within the various government sectors. Our findings indicate that there is some correlation between IT governance models and ICT functions.

Keywords: IT governance, e-Government, Norwegian ministries, governance models.

1 Introduction

In 1958, the first computer was introduced in public administration in Norway. At about the same time, Leavitt and Whisler claimed, in a Harvard Business Review-article ("Management in the 1980s"), that IT would replace the traditional organizational hierarchies with a leaner structure resembling an hourglass. As the hourglass structure eliminated the need for middle management, productivity would sour, according to the authors.

50 years on, Leavitt and Whistler predictions appears dubious: the IT governance structure of the Norwegian central government, as in most other countries, is still seemingly based on the centralized and hierarchical management style that is associated with the public sector. Moreover, IT governance can be seen as a subset of general administrative policies, which rely on two unchanging principles: sectorization and line organization at the central level; autonomy and self-determination at the municipal level.

This apparent stability notwithstanding, over the last 30 years or so, new administrative policies have been introduced in Norway. The first reform program was launched in the late 1980s and incorporated certain NPM features. But this reform program contained few (if any) initiatives that could meet the challenges created by

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the use of ICTs in public administration. However, in 1990, performance-based management, Management-by-Objectives, was introduced, and since then ICTs has gradually become a more central factor in central government reforms.

These developments make it relevant to ask how and to what extent 30 years of administrative reforms have impacted on the governance of ICTs at the central government level? Can it, as Leavitt and Whistler predicted more than five decades ago, be described as a singular "hourglass phenomenon" defined by one dominant type or style of governance? Or is IT governance best understood as a plural phenomenon where we find a variety of structures and practices, including the type of governance that Leavitt and Whistler destined for extinction? If so, what characterizes the different types of IT governance and how can we explain the variations?

In this article we argue that IT governance is indeed a plural phenomenon. Thus, it can be understood in light of four theoretical IT governance models that capture the essence of the variation that we find within central government in Norway. These IT governance models are inspired by similar but much more general governance models that appear in the public administration literature.

Furthermore, we argue that the technology itself, (or more precisely, the functions that ICTs fulfill within the ministerial areas of responsibility) is an important factor that must be taken into account when we seek to explain variations in IT governance. As we will see below, we have defined five different functions that ICTs may have.

In the rest of the article, we will address three questions:

1. What IT governance model is dominant within the different areas of ministerial responsibility?
2. What is the typical function that ICTs fulfill within the different areas of ministerial responsibility?
3. What sort of correlation (if any) do we find between the dominant IT governance model and the typical ICT function?

In discussing these questions, we must analyze the ministries policies regarding the use of ICTs. We must also understand the ministries need for interaction and cooperation, both within their own sectors and across spheres of ministerial responsibility. Finally, we must identify ICT functions and the amount of resources spent on IT management.

The empirical data that we base our discussions are (1) the ministries budget documents and the corresponding assignment letters to selected subordinate agencies, (2) relevant white papers and government reports and (3) interviews with key civil servants representing all the various ministries.

2 Management and It Policy in Norway

The political-administrative system in Norway, as in most other Western democracies, is based on a complex and often ambiguous set of norms and values concerning political-administrative control, codes of professional behavior, due process and the rule of law, democratic processes, public service ethics and civic participation [3]. The historical-institutional "climate" in Norway is characterized by homogeneity of norms and values, mutual trust between political and administrative leaders, the

balancing of conflicting considerations, and a political style of extensive involvement and co-operation, all of which suggests that government reforms will be implemented in a slow, reluctant and modified fashion.

The first 30-40 years after the Second World War can be described as a period of bureaucratic expansion: government tasks and responsibilities increased dramatically [9]. In addition, civil servants, with a background from social sciences, economics and natural sciences, were recruited to government ministries and agencies.

During the 1980s, the political-administrative system came under increased pressure. And from the mid-1990s, Norway embarked on a gradual reform path that involved the implementation of performance-based management (Management by Objectives and Rules: MBOR). At the same time, Norway resisted much of the privatization and market measures that characterized public sector reform elsewhere, and adopted competitive tendering only to a limited extent [2, 5]. This period was also strongly associated with the massive adoption and use of ICTs. A series of studies proposed new initiatives that aimed at facilitating greater cooperation and coordination of the deployment of ICTs, but very few of the proposals were actually implemented [9,13]. Even so, a number of general measures (such as increased user orientation, new ways of funding ICT investments, outsourcing and changes in conditions of competition) have impacted on IT governance practices.

Table 1. The relation between public administrative policy and IT policy 1950 – 2010

	Public Administrative Policy		IT Policy	
	Visions and goals	**Means and measures**	**Objective for ICT**	**Typical measures**
1955 - 1975	The growth of the welfare state, strengthening rule of law and equality	Rationalize and efficiency. Strengthen the political role of the ministries.	Rationalization through automating of routine task	Large computers and computer centers. Centrally developed systems
1975-1990	Focus on a clear administrative policy, emphasize the division between politics and administration	Decentralization & delegation, developing regional and local administration. Introduction of MBOR	Decentralization of responsibility for IT-systems. Efficiency improvements	Support for case handling etc. by the use of local computer systems. Acquisition is a local responsibility
1990-2010	User orientation and freedom of choice. Make public services simpler & accessible.	Changes in budget regulation. Outsourcing increased competition. Improve public services	Growth of e-gov. Improve inter-action with citizens and private sector.	Integration of ICT in all work processes. ICT –architecture, standardization etc.

These developments underlined the need for a new type of IT-policy. Two recent white papers[1] clearly points in that direction: new initiatives, based on the need for greater harmonization of ICT solutions, have been taken and a set of common ICT architecture principles have been introduced [1],[12]. The development of public administrative and IT policies is summarized in table 1.

[1] St. mld. 17 (2006-2007): *An Information Society for All* , St.mld. 19 (2008-2009): *A Government for Democracy and Community*.

However, the general picture is that most major public administration reforms have been initiated in order to fulfil other political goals, and that ICTs have primarily been seen as a tool for accomplishing traditional tasks rather than as an agent of policy change. The current IKT-policy may thus be described in this way:

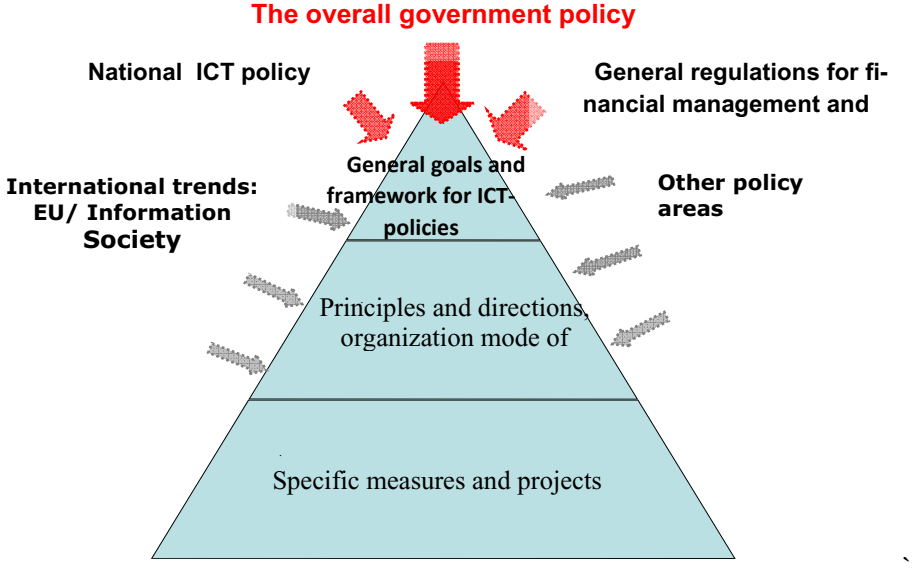

Fig. 1. The Norwegian IT policy framework

3 Theoretical Perspectives

Most comparative studies of IT governance in the public sector have analyzed differences and similarities at the national level. The assumption is that national approaches to IT governance can be described according to one distinct and "culture-specific" model (i.e. one nation, one model, see for instance [6-8]). In these studies, therefore, it is assumed that the interesting variations can be found across rather than within national political systems.

As already indicated, this article deviates from this approach. We hold that the IT governance is the product of ministry-specific management trajectories. However, the management trajectories may have been influenced by other factors. Consequently, all that is interesting is not national, significant variations can also be found on the intra-national level. True, the ministries IT governance springs from one particular and distinct political-administrative system. But within this overarching system, variations in IT governance may find fertile ground – there is no "one size fits all". In the next section we briefly trace the origin of variation: the development of administrative and IT policy.

3.1 IT Governance Models

It is these overall policy changes – past and current – that have spurred variations in IT governance: the changes have affected different ministries in various ways. In order to describe the nature of variation, we have constructed four IT-governance models. The models are (i) *the instrumental-structural model*, (ii) *the cultural-historical model*, (iii) *the network model* and (iv) *the market-oriented model.*

The instrumental-structural model promotes the view that the governance of public (and private) organizations can be understood as a top-down, predictable and controlled process. According to this model, what is being decided at the top of the political-administrative ladder will determine how organizations evolve and change. This means that top management make decisions about how organizations should be structured based on well-defined goals and policy instruments, and that these decisions are implemented in a predictable and relatively frictionless fashion [3]. Top management, when deciding goals or changing policies, can be influenced by factors outside their control (public pressure, for instance). Even so, reform processes will generally be controlled by those at the apex of the bureaucratic chain of command. The oversight model, outlined by [11], is similar to the instrumental-structural model in the sense that the modification of administrative behavior is achieved by adhering to instructions handed down from "above".

Table 2. Major features of the governance model

Governance models Features	The Instrumental-Structural Model	The Cultural-Historical Model	The Network Model	The Market-Oriented Model
Focus	Rational thinking	Maintain values and norms,	Reduce hierarchy, stimulate cooperation	Avoid monopoly, create markets
Structure/ Characteristics	Well-defined authority & responsibilities	Institutional, historical traditions	Interaction and collaboration	Decentralization
Decision-Making	Hierarchical, through authority	Guided by professional interests, consultation	Participatory, mutual influence, negotiations	Decentralized, create internal market.
Alignment	Centralized, top-down approach	Compatibility with existing values	Flexible adaptation	Ad-hoc, performance-driven
Formal communication	Hierarchical and centralised	"Business as usual"	Horizontal	Various patterns
Management type	By objectives and return (MBOR)	Path dependency; corporate society	Teams, TMQ, Internal quality management	Pay for performance, no specific
Control process	Obligatory return	Few	Few	Many

The cultural-historical model assumes that public bureaucracies have long-lasting institutional features that shape administrative behavior. These features are conceptualized as relatively stable norms, values and practices that create a distinct and specific organizational culture. These norms, values and practices are shared by all (or the great majority of) civil servants and the "new recruits" soon come to accept them as "natural" [5]. An important aspect of this governance style, particularly for top managers, is to represent and maintain "the best of what we stand for". This implies

that the cultural-historical style of governance is less based on hierarchy and control, and more on the ability to successfully mediate between the entrenched administrative traditions, on the one hand, and fashionable reform ideas that are held in high regard by "modernizers", on the other. The point is that reforms or changes will be adapted or brought in line (as much as possible) with the existing and entrenched institutional features.

The network model draws on [16] notion of participative government. This model is characterized by a flatter and less hierarchical organizational structure, and the style of governance is based on consultation, negotiations and involvement (for instance, in relation to third parties like private businesses, interest-groups or individual citizens). Internally, governance is not so much about issuing orders and instructions, but is performed by adopting a "softer" and more participatory approach (by way of forming teams or project-groups, for example). Moreover, the gradualist approach to reforms associated with the cultural-historical model is replaced by a greater emphasis on change and flexibility (often as a response to third party demands or pressure). This model corresponds, at least to some extent, with the mutuality perspective described by [11]. Here, administrative behavior is influenced by horizontal interaction and co-operation rather than command and control.

The marked-oriented model is based on devolution and decentralization of initiative and responsibilities – and an emphasis on greater individual incentives (particularly at the management level) for delivering above-average results. This style of governance emulates what is believed to be the essential features of the successful business company (or leader): inventive, risk-taking, mission-focused and performance-driven. Administrative behavior is controlled by exerting greater pressure on civil servants to "deliver the goods", typically by stimulating greater competition by the creation of internal market or through benchmarking (see [11], [17]). In this model, the critical management challenge is to define a framework for open, competitive and well-functioning public sector markets.

3.2 The Function of Technology in Governance Practices

None of the governance models takes into account the functions and roles that ICTs have and how they may influence IT governance. However, since we expect to find that ICTs fulfill different functions depending on the type and structure of the ministry, our assumption is that the way technology is utilized and perceived (by the ministries and their subordinate agencies) is a source of variation in IT governance practices.

This hypothesis is based on insights provided by a number of contributions to the IT literature. For instance, in their seminal article "*Desperately Seeking the 'IT' in IT Research—A Call to Theorizing the IT Artifact"* [15]] argued that ICT is not just a tool that we use: it is also the ensemble of equipment, techniques, applications and people that define the social context of use. In the corporate management literature, we find similar perspectives (see, e.g. [17]). This means that the technology itself is seen as an agent of change: it is one important factor that will influence how governance is organized and executed.

Below, we describe five different functions that ICTs may have within organizations – and that may be associated with (or underpin) the different models of IT governance.

ICT as a *tool*. This implies that we can select the appropriate technical equipment or system in order to carry out specific tasks. ICT, according to this view, is the engineered artifact, expected to do what its designers intended it to do. Tools are usually neither particularly complex nor very flexible. Thus, ICT is primarily understood as a technical matter, being separate from and controlled by human actors [14]. This may be exemplified by ordinary office automation support system or case handling systems, carrying out functions that are precisely specified.

ICT as *control and management*. Here, ICTs is used for reporting, monitoring and controlling purposes, i.e. the collection of data on performance or outcome, or for various surveillance purposes. This use of ICT is normally characterized by limited complexity, but there is a need for some flexibility and organizational integration.

ICT as support for *interaction and cooperation.* Strongly influenced by the development of the Internet, and particularly the World Wide Web, interaction and collaboration have become increasingly important. And not only within public institutions, but, perhaps more importantly, regarding the interaction between public agencies, citizens, businesses and the private sector as such. These effects of ICTs are less controllable than when they are used as tools, and this use of ICT requires more organizational flexibility.

ICT as an *information infrastructure*. This means that ICTs is seen as the basic technical and organization capabilities that are necessary to support application systems and solutions. Similar to physical infrastructures, an information infrastructure must be open, standardized, evolving over time and flexible in order to support the large variety of systems and services that run on top of the infrastructure [10]. Thus, ICT as an infrastructure implies a high degree of complexity as well as a need for extensive organizational integration.

ICT as part of *core (business) activities*. In the public sector, core activities and products are by and large *information services* which is offered to individual citizens or actors within the private sector. These activities and services include both technical and organizational elements, including training, staffing and support. They usually imply a significant level of complexity and flexibility, and organizational integration are crucial for their success [17].

We may summarize these five understandings of the role and function of ICTs in organizations according to two important features: i) degree of complexity and dynamics/flexibility, and ii) their need for integration.(* = weak,** = average, *** = strong).

Since we expect to find that ICTs fulfill different roles or functions across the ministries, our assumption is that the way technology is perceived and understood by the various ministries and their subordinate agencies is a source of variation in IT governance practices rather than a source of uniformity. And since we assume that the existing governance structures and practices differ across ministries, it seems likely that we will find dissimilar governance models even in those instances where ministries use and perceive the role of ICTs in similar ways. This means that we identify three main sources of variation in IT governance models:

i. The ministries' existing management approach and practices
ii. The degree of external influence and interaction with external actors
iii. The functions and roles that are attributed to the use of ICTs, reflecting their core business activities

Table 3. Features of the different ICT functions

Attribute / ICT Function	Complexity and dynamics	Need for organisational integration
Tool	*	*
Control and management	*	**
Interaction & cooperation	**	***
Infrastructure	***	**
ICT as part of core activity	***	***

4 Analysis and Discussions

Figure 1 above illustrates the overall policy framework to which each ministry has to adapt its IT governance policy. The framework defines few specific policy goals and instruments, and allows for significant variation when it comes to how ICT is governed. We find that that only a few ministries mention ICT explicitly in their budget

Table 4. Management Practices and External influence

Ministry	*Management Approach*
AD (Labour – Welfare)	*MBOR, Citizens focus*
BLD (Children, equity and social Inclusion)	*Partly MBOR, traditional management*
FAD (Government administration and reform)	*MBOR, Technology and Infrastructure focus*
FIN (Finance)	*MBOR, technology and infrastructure focus*
FKD (Fisheries and costal affairs	*Traditional resource management,*
HoD (Health and Care services)	*MBOR, infrastructure agencies*
JD (Justice and Police))	*Partly MBOR, technology focus*
KRD (Local government & regional dev)	*Traditional management, no ICT-focus*
KUD (Culture)	*Some MBOR. Technology focus:*
KD (Education and research)	*MBOR, technology and Infrastructure focus*
LMD (Agriculture and Food)	*Traditional resource management, ICT-focus*
MD (Environment)	*Resource management ICT and Infrastructure focus*
NHD (Trade and industry)	*Significant ICT focus, infrastructure agency*
OED (Petroleum and Energy)	*Resource man. ICT focus security and*
SD (Transport and Communication)	*Traditional management, some ICT –focus,*
UD (Foreign Affairs)	*Traditional Management, ICT strategy*

document. Even when we look at the assignment letters, the way ICT-related goals are operationalised (if at all) vary considerably. Less than half of the ministries specified measurement indicators for the use of ICT, and the indicators are for the most part rather vague. Based on the assessment on stated goals and outcome requirements, we can identify these dominant management approaches in the different ministries, as illustrated in table 4.

This table shows that a minority of the ministries explicit uses management by objectives and result in their IT governance, while only another minority make visible an IT focus in their management policies.

4.1 Plans, Strategies and Other Policy Instrument

We found that only seven ministries have defined a general ICT-plan or strategy that affected the whole sector. However, some of the ministries argued that a sector-encompassing strategy is not considered relevant, because the subordinate agencies have defined their own strategies which the ministries would follow up and monitor. It should also be noted that the usefulness of sector-encompassing ICT-plans is disputed.

Another (more soft) management approach is to establish forums or coordinating bodies, where the subordinate agencies can congregate and discuss issues of mutual interest, i.e. the harmonization and interaction of different ICT-systems. However, the formal status of such forums varies between sectors, i.e. whether or not the ministries themselves participate in the meeting and the forums ability to make binding decisions. Another interesting issue is the existence of agencies (or enterprises) that have specific responsibilities related to ICT developments or operations that support common ICT-function within the sectors (such as UNINETT in the educational sector, Norwegian Health Network, the Norwegian Mapping Authority/Norway Digital and the Brønnøysund Register Centre operating several registers related to business, trade and industries in Norway.

We see from table 4 that the majority of ministries that specify ICT-goals for their subordinate agencies also use measurements indicators. Similarly, those ministries that have a coordinating ICT-body also stimulate sector-wide cooperation and coordination. This illustrates important differences between the ministries regarding their IT governance styles.

In order to explain these differences, we have analyzed the ICT governance patterns in each ministry along with their influence by and interaction with external actors.

4.2 Are the IT Governance Approaches Consistent?

Bellow we will discuss our research question:

1. *What IT governance model is dominant within the different areas of ministerial responsibility?*

The instrumental-structural model use measurable objectives (indicators) and obligatory returns as management instruments, and control processes are often supported by the use of ICTs. The Ministry of Finance seems to fit well into this governance model,

since it is the initiator and driving force behind the use of Management by objectives and return, as do the Ministry of Reform, Ministry of Labour and Ministry of Health. The Ministry of Children and equity do also have some corresponding characteristics, although their IT governance approach includes elements from the cultural models as well.

Table 5. The relation between ICT management instruments, external influence and IT governance model

Ministry	ICT objective focus &means	External Influence	IT Governance Model
AD (Labour – Welfare)	Limited ICT focus, no specific goals or means	Some	Instrumental
BLD (Children, equity and social Inclusion)	No ICT focus, no specific goals or means	Limited, mainly with municipalities	Instrumental
FAD (Government adm. and reform	Well-defined ICT-goals, infrastructure focus, ICT agency & strategy	Significant	Instrumental /Network
FIN (Finance)	Well-defined ICT-goals, some infrastructure focus, ICT agency	Primarily with in the finance sector	Instrumental
FKD (Fisheries and costal affairs	Limited ICT focus, no specific goals or means	With private actors in sector	Cultural
HoD (Health and Care services)	ICT goals and strategy for interaction, also with private actor	Significant, with many actors	Instrumental/network
JD (Justice and Police)	Significant ICT and infrastructure focus, ICT goals and strategy	Some	Cultural/Network
KRD (Local government and reg. dev.)	Limited ICT focus, no specific goals or means	With reg. And local level	Cultural
KUD (Culture)	Significant ICT service and infrastructure focus, ICT agency	Significant internal interaction	Network
KD (Education and research)	ICT goals, Service and infrastructure focus, ICT agency	Significant (EU,OECD,..)	Network / Instrumental
LMD (Agriculture and Food)	Significant ICT and infrastructure focus, ICT strategy	Some	Cultural /Network
MD (Environment)	Significant ICT and infrastructure focus, ICT strategy and agency	External coop. dominating	Network
NHD (Trade and industry)	ICT goals. infrastructure and service focus, ICT agency	Significant interaction with industry	Network
OED (Petroleum and Energy)	Limited ICT focus, no specific goals or means,	Significant influence from industries	Network
SD (Transport and Communication)	Some ICT focus, an ICT strategy in the transport sector	Significant in some agencies	Cultural/Network
UD (Foreign Affairs)	Some ICT focus, no specific goals ICT strategy	With other ministries and abroad	Cultural

The cultural-historical model assumes that public organizations have historical traditions that create a distinct institutional form (both in terms of behavior, norms and values). We find that this governance model is typical for the Ministry of Fishing and Coastal Affairs and also the Ministry of Agriculture seems to belong here (dominated by the agronomist profession, and having close relations to external actors within the agriculture sector). The same is true for the Ministry of Justice, the Ministry of Foreign Affairs along with the ministries of Transportation and communication as well as

the Ministry of local government. The ministry of Justice and Police may also be associated with the instrumental model.

The network model assumes that interaction and collaboration with its environment is crucial, including building an open and flexible ICT infrastructure that can be used within the areas of ministerial responsibility. We find that the Ministry of Environment (MD) matches this model of governance. Other ministries that conform to this model are the Ministry of Education and Research (KD) as well as the Ministry of Culture (KUD), the Ministry of Trade and Industry (NHD) and the Ministry of Petroleum and Energy Policy (OED). These ministries have strong relations with the private sector, and are dominated by economist and civil servants with a technical or engineering background.

Regarding the market-oriented model, we find that none of the ministries have a governance approach that fits here, although we find that some ministries include some elements from this model. We can accordingly summarize these finding in table 5 below.

It is interesting to observe that none of the three models are dominating across the government. On the other hand, this picture is not static, but does only reflect the currents situation, where all ministries are involved in various reform processes. Assuming that the cultural-historical model is most similar to former management policies and practices, we would expect that either the instrumental-rational model or the network model become more typical in the future.

2. What is the typical function that ICTs fulfil within the different areas of ministerial responsibility?

We have identified the individual ministries' specification of ICT goals and means along with the general ICT focus, the existence of ICT strategies and/or ICT agencies etc. Furthermore, we have assessed the ministries view on the functions and role of ICT in their sector. In table 6, we summarize our findings in this way:

We see from table 6 that the tool function seems to be important in at least 7 ministries. The infrastructure function is important in at least 8 ministries while the same is true for ICT-based interaction and collaboration in 8 of the ministries. The control function is significant in 8 of the ministries and the service function is important in 7 ministries.

3. *What sort of correlation (if any) do we find between the dominant IT governance model and the typical ICT function?*

Our analysis indicates that the IT governance approach may be limited to three models: the instrumental-structural model, the cultural model and the network model. The market-oriented model may be more relevant for other countries. Table 7 summarize how the five ICT functions are relevant in relation to the governance models:

Table 6. Management practices and ICT functions in all ministries

Ministry	ICT objective focus, and means	3 dominating ICT function & roles	IT Governance Model
AD (Labour and welfare)	Limited ICT focus, no specific goals or means	Tool, Control, Interaction	Instrumental
BLD (Children, equity ..	No ICT focus, no specific goals or means	Tool, Interaction , Control	Instrumental
FAD (Government adm. and	Well-defined ICT goals, infrastr focus, ICT agency & strategy	Infrastructure, Interaction, Control	Instrumental /Network
FIN (Finance)	Well-defined ICT-goals, some infrastr. focus, ICT agency	Control, Infrastruct., Service	Instrumental
FKD (Fisheries and costal affairs	Limited ICT focus, no specific goals or means	Tool, Interaction, Control	Cultural
HoD (Health and Care services)	ICT goals, strategy for interaction, also with private actor	Interaction, Infrastr., Control	Instrumental/ network
JD (Justice and Police)	Significant ICT and infrastr. focus, ICT goals and strategy	Interaction, Tool, Control,	Cultural/Network
KRD (Local govern and reg. dev	Limited ICT focus, no specific goals or means	Tool, Control, (Interaction)	Cultural
KUD (Culture)	Significant ICT service and infrastr. focus, ICT agency	Service, Infrastruct., Interaction	Network
KD (Education and research)	ICT goals, Service and infrastr. focus, ICT agency	Service, Infrastructure, Control	Network /Instrumental
LMD (Agriculture and Food)	Significant ICT and infrastruct. focus, ICT strategy	Infrastructure, Interaction, Tool	Cultural /Network
MD (Environment)	Significant ICT and infrastr. focus, ICT strategy and agency	Service, Infrastr., Interaction	Network
NHD (Trade and industry)	ICT goals. infrastructure and service focus, ICT agency	Infrastructure, Service, Interaction	Network
OED (Petroleum and Energy)	Limited ICT focus, no specific goals or means,	Interaction, Control, Tool	Network
SD (transport and Communication)	Some ICT focus, an ICT strategy in the transport sector	Tool, Interaction, Control	Cultural/Network
UD (Foreign Affairs)	Some ICT focus, no specific goals ICT strategy	Tool, Control, Interaction	Cultural

Table 7. Management practices and ICT functions in all ministries

Governance models / ICT functions	The Instrumental-Structural Model	The Cultural-Historical Model	The Network Model
Tool	***AD***, ***BLD***	***FKD, FD***, ***SD, UD,*** JD, ***KRD***, LMD, UD	
Control	AD, ***FIN***, HOD, BLD, FAD	FD, JD, KRD, SD, UD	KD, OED,UD
Interaction	***HOD,*** BLD, Fad, AD	***JD, LMD*** , FKD, (KRD),	KUD, NHD,MD, ***OED***,
Infrastructure	***FAD,*** FiN, HoD	FD, LMD, SD	*MD*,***NHD,*** KD, KUD, OED
Service	FIN		***KD, KUD***, **MD**,NHD

*) The most important function is written in bold italic.

Based on a theoretical assumption about the relationship between models and functions, it seems plausible that that the attribute "limited complexity and dynamics" (the tool and the control functions) is associated with the cultural-historical model. This assumption is supported by our data: the tool function is most typical for cultural-historical models. Furthermore, we expect that the control and management function would be mostly associated with the instrumental-structural model, which is not supported empirically, as it also is related to the cultural-structural model. We would on the other hand hypothesize that interaction and cooperation as well as the infrastructure functions is typical for the network model, which is strongly supported. We also see the service function is more dominating in these ministries. We thus find that the attribute "complexity and dynamics" is associated with the network model, as, the infrastructure function as well as the interaction and cooperation functions may be significant within ministerial sectors that are influenced by this model of governance.

When we look closer at the characteristics of the different ministries, there are clearly connections between its core activities and the dominating ICT functions, i.e. the tool perspective relates to the reporting and control functions. The infrastructure function support resource and environment management oriented ministries. These findings tend to support our initial assumptions that, as resource management in itself is shared or common facilities

However, this picture is somewhat ambiguous, which can be attributed to other factors as their existing governance structure as well as external influence. The governance structure is probably not static, either.

5 Conclusions

Our findings show that we can identify three of the IT governance models within the Norwegian ministries, while the (pure) market-oriented model seems to be less important. We also find some correlation between the IT governance models and the ICT functions, where the tool and control function seems to be associated with the cultural-historical and the instrumental-structural models, while the infrastructure and interaction functions are mostly related to the network model. However, our results are preliminary and further analysis has to be carried out.

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Information Strategies for Open Government in Europe: EU Regions Opening Up the Data on Structural Funds

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Abstract. This empirical study explores the information-based strategies that EU Regions and Member States are implementing when publishing public data on the web. Cohesion Policy and its Structural Funds, which involve all EU Regions and Member States, are the ideal context to verify the presence of different approaches to the publication of government data. Therefore, 434 datasets on beneficiaries of EU Structural Funds are analysed with multivariate statistical techniques and classified into three clusters according to their characteristics. Two pro-active information strategies are identified, which are consistent with the theoretical framework based on the complementary principles of "stewardship" and "usefulness". The analysis of current practice also reveals that there is still much to be done in order to find the right balance between these two principles.

Keywords: Open Government, Transparency, Government Information Strategies, Structural Funds.

1 Introduction

The new European e-Government Action Plan 2011-2015 [13] dedicates specific actions to Open Government and identifies two main sources of potential benefits: transparency and data re-use. While the latter is focused on the creation of value by combining "raw data" from different sources and making “mash-ups” and new applications [5, 16, 2], the former is a positive effect of opening up data and information on government decision making, such as laws and regulations, policies and finance [4].

These topics are at the centre of the European Directive on the re-use of Public Sector Information (PSI), adopted at the end of 2003 and reviewed in 2009, which have introduced a common legislative framework regulating how public sector bodies should make their information available for re-use in order to remove barriers such as discriminatory practices and monopoly markets by harmonizing the regime for the re-use of PSI, broadly defined as any information held by public sector organization.

* The views expressed in this article are those of the author and, in particular, do not necessarily reflect those of the Ministry of Economic Development.

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According to the general principle of the Directive (Art. 3), *"Member States shall ensure that, where the re-use of documents held by public sector bodies is allowed, these documents shall be re-usable for commercial or non-commercial purposes in accordance with the conditions set out in Chapters III and IV. Where possible, documents shall be made available through electronic means".*

By now, all 27 EU Member States have implemented the PSI Directive into their national legal orders but considerable differences still persist in actual practices among public actors.

In particular, once government decides to make available its data on the web, the detail level of the information provided, the quality of data and the way it is provided are crucial elements that must be taken into account to ensure real transparency and re-use of the PSI.

The literature on public use of government information can offer valuable insights.

First, it is essential to determine how much the government will engage in value-added services itself and how much it will leave to private providers [9]. Government-produced reports, charts, and analyses can be very valuable [1] but *"it is essential to also publish the underlying data itself in a computer-friendly format that makes it easy for the vibrant community of civic technologists to make and share a broad range of tools for public engagement"* [16].

Secondly, since the community of information users is not homogeneous [4], more complete stakeholder analysis could lead to better understanding of users' needs and help identify which kinds of information content or formats generate different kinds of value for different communities of interest [9].

Dawes [8] proposes a framework based on two complementary information policy principles that need equal consideration: stewardship and usefulness. The first principle recognizes government information as a public good and focuses on assuring accuracy, validity, security, management and preservation of public information. In other words, it makes information "fit for use". The second principle focuses on increasing public value by enhancing public access to government information and making possible the re-use of information for new purposes. Dawes [8] also offers some examples by assessing the proposals that had been posted on Data.gov online dialog by April 21, 2010: "create or improve metadata", "improve data management", "adopt data standard and standard formats" are classified into the "stewardship proposals", while "provide easy-to-use basic features", "improve and enhance searching and display" are classified into the "usefulness proposals."

EU Structural Funds represents an ideal context for indentifying information-based strategies. On one hand, all Member States and EU regions are involved and share common rules and regulations, which makes data perfectly comparable. On the other hand, the regulations focus only on a minimum set of requirements for publishing data on the web, which leaves room for improvement in terms of detail, quality, access and visualization.

Therefore, this empirical study examines the information-based strategies that European governments are pursuing when publishing their data on the web. The paper is organized as follows. First, we introduce the EU Regional policy and the efforts that are being made to foster transparency in the use of Structural Funds. Next we describe the data we have collected on the lists of beneficiaries of the Funds, then we

present the results of an empirical analysis aimed at identifying the underlying information strategies. The last section is dedicated to the discussion of the characteristics of the three strategies revealed and to the final conclusions.

2 Regional Policy and Transparency

European Regional Policy (otherwise named European Cohesion Policy) "aims to promote harmonious development of the Union and its regions by reducing regional disparities" (Article 174 of the Treaty).

The policy "underpins the growth model of the Europe 2020 strategy including the need to respond to societal and employment challenges all Member States and regions face. [...] The multilevel governance system for the policy helps to make the EU more visible to its citizens" [12]

Regional policy is implemented mostly thanks to two Structural funds, namely the European Regional Development Fund (ERDF) and the European Social Fund (ESF). ERDF is aimed at leveling economic differences among regions and it finances, for example, initiatives for research and innovation, local development and employment, infrastructure, and protection and improvement of the environment. ESF was established to improve the quality and accessibility of jobs and employment opportunities within the European Union. The amount of Community resources dedicated to Regional Policy in 2007-13 is EUR 347 billion [11]; in addition to the Community financing, substantial national and regional budgets are mobilized.

Financial resources are concentrated on the lagging regions that fall under the Convergence objective, with 81.5% of the investment available. The declared rationale of the Convergence objective is to promote growth-enhancing conditions and factors. Outside the Convergence regions, the Regional Competitiveness and Employment objective (Competitiveness) aims at strengthening competitiveness and attractiveness, as well as employment, especially through innovation and the promotion of the knowledge society. The European Territorial Cooperation objective (Cooperation) strengthens cross-border co-operation through joint local and regional initiatives, trans-national co-operation and interregional co-operation and exchange of experience.

Structural Funds regulations for the 2007-13 programming period require the Managing Authorities (Member States and Regions managing an Operational Programme financed by Structural Funds) to publish the names of the beneficiaries, the name of the project co-financed with Structural Funds and the corresponding amount of public funding received. In fact, according to Article 69 of the Council Regulation No 1083/2006 of 11 July 2006 and repealing Regulation (No 1260/1999), "the Member States and the Managing Authority for the operational programme shall provide information on and publicize operations and co-financed programmes. The information shall be addressed to European Union citizens and beneficiaries with the aim of highlighting the role of the Community and ensuring that assistance from the Funds is transparent". In particular, Commission Regulation No 1828/2006 of 8 December 2006 (art. 7) states that "the managing authority shall be responsible for organizing the publication, electronically or otherwise, of the list of beneficiaries, the names of the operations and the amount of public funding allocated to the operations".

In November 2005 the European Commission launched a 'European Transparency Initiative' (ETI). A detailed Guidance Note of 23 April 2008 commits to the Commission the coordinating role of facilitating access to the data available on the websites of the managing authorities and proposes a common standard for the publication of data, so as to enable interested parties to carry out consistent analyses across the EU. A set of minimum information is proposed in an "indicative table for setting the list of beneficiaries of EU funding". This set includes: (a) The name of beneficiaries, (b) the name of the operation, (c) the amount of public funding committed to the operation, (d) the amount of public funding paid to the beneficiary at the end of the operation, (e) the year of final payment, (f) the date of the last update.

3 Data Collection

In October 2010, we conducted a web-based survey in order to explore the availability and quality of the lists of projects and beneficiaries of the European Regional Development Fund (ERDF) and the European Social Fund (ESF) published by the managing authorities across Europe. We have taken into account all 434 Programmes included in an official database provided by the DG Regional Policy in June 2009.

Table 1. Characteristics of the lists of beneficiaries of EU Structural Funds

Characteristic of the list of beneficiaries	Variable	Frequency (all 434 OPs)	Frequency (409 OPs with financial data)
Name of the project	project	409 (94%)	409 (100%)
Name of the beneficiary	Benef	409 (94%)	409 (100%)
Amounts committed to the project	tot_funds	409 (94%)	409 (100%)
Amounts effectively paid at the end of the project	paid_out	122 (28%)	122 (30%)
Amounts co-financed by EU Funds (ERDF, ESF)	ue_contr	192 (44%)	192 (47%)
Detailed description of the project	pr_descr	85 (20%)	85 (21%)
Status of the project (active, completed)	Status	72 (17%)	72 (18%)
Year of allocation	Year	259 (60%)	259 (63%)
Action of the Operational Programme	actions	67 (15%)	67 (16%)
Territory where the project impacts (at NUTS3 level or higher detail)	territory	52 (12%)	52 (13%)
Format of the dataset: PDF	Pdf	260 (60%)	260 (64%)
Format of the dataset: HTML	Html	99 (23%)	98 (24%)
Format of the dataset: Microsoft Excel or CSV	Xlscsv	136 (31%)	136 (33%)
Description of data and metadata	data_desc	58 (13%)	58 (14%)
Description of data in English	english	66 (15%)	66 (16%)
Map for data visualization	Map	61 (14%)	61 (15%)
Research mask	search	130 (30%)	128 (31%)
Number of clicks to access data (0= 3 or more, 1= less than 3)	Clicks	393 (91%)	372 (91%)

Datasets published on the web and containing the lists of beneficiaries and projects co-financed by Structural Funds were identified through a visit to the URIs indicated by the managing authorities and reported in the *Inforegio*[1] web site (managed by the DG Regional Policy of the European Commission) or in the web site of the European Social Fund[2] (managed by the DG Employment). We performed a search in the websites of regional operational programmes and of regional managing authorities when the link was broken or unavailable.

Table 1 shows the characteristics and features of the lists of beneficiaries of EU Structural Funds included in the survey, and their frequency. The characteristics that are not covered either by Structural Funds regulation or by the ETI were chosen after an extensive review of current literature and the latest policy reports on the matter [15, 7, 3] and the main institutional technical guidelines available on this topic [17, 6].

4 Results

The first step of our analysis is the application of a Multiple Correspondence Analysis (MCA) to the data collected. As a second step, we have performed a cluster analysis (CA) on the two dimensions considered in order to verify and test the presence of different groups corresponding to different information strategies.

4.1 Multiple Correspondence Analysis

Multiple Correspondence Analysis (MCA) is an extension of simple correspondence analysis to more than two categorical variables. The extraction of dimensions in MCA is similar to the identification of components in principal components analysis, or factors in factor analysis. MCA is more commonly used for exploratory, inductive research rather than hypothesis testing and deductive research. This is done by using the dimensions produced by the technique to generate scatter-plots with the scores of the column variables plotted in these dimensions. Variables with similar scores in these dimensions locate close together in these plots to reveal high degrees of association between them in the analyzed dimensions. These associations are also stronger the further the points are from the origin of the plots [14].

Table 2. Revealed dimensions from Multiple Correspondence Analysis

	Principal inertia	Percentage of total variation	Cumulative percentage of total variation
Dimension 1	0.0413496	60.22	60.22
Dimension 2	0.0112699	16.41	76.64
Dimension 3	0.0021024	3.06	79.7
Dimension 4	0.00094	1.37	81.07
Dimension 5	0.0000467	0.07	81.14
Total	0.0686607	100	

[1] http://ec.europa.eu/regional_policy/country/commu/beneficiaries/index_en.htm
[2] http://ec.europa.eu/employment_social/esf/discover/article_7093_en.htm

For our analysis, therefore, each characteristic of the list of beneficiaries was coded for both its 'yes' and 'no' presence. The MCA found 5 dimensions in the data, each of which accounted for between 60.2% and 0.07% of the total variation in the data (see Table 2). We will consider the first two dimensions, which individually accounted for the largest amount of variation in the data (76,6%).

4.2 Cluster Analysis

The second step of our analysis is to perform a Cluster Analysis (CA), which uses the first two dimensions revealed by the MCA as input variables. Two different methods of CA have been tested. First, an *iterative partitioning* method (*K*-means procedure) has been applied. Secondly, after having identified the main resulting clusters, three distinct *hierarchical agglomerative* methods have been applied (between groups linkage, within groups linkage, Ward's method), and three different ways to measure the distance between cases have been used (Euclidean, squared Euclidean, and cosine distance) to check the robustness of the results of the *K*-means procedure. Both the clustering algorithms have produced *three* main clusters.

In order to further test the statistical precision of our classification, we performed an estimation of three logit models, which estimate the strength of the association between the two factors used in the cluster analysis (input variables) and the resulting classification. As showed in Table 3, the estimation of the three logit models support the validity of the results of the cluster analysis (both in terms of significance of the single coefficients and the predictive ability of the models) and is fully consistent with the graphical analysis reported in Fig 1:

- Cluster 1 is characterized by positive values of Dimension 1 and negative values of Dimension 2.
- Cluster 2 is characterized by positive values of Dimension 1 and 2.
- Cluster 3 is only characterized by negative values of Dimension 1, while, as expected, the results for Dimension 2 are not statistically significant.

Table 3. Results of the three logit tests for cluster analysis

	Cluster 1 – User-centered (%)	Cluster 2 – Re-user-centered (%)	Cluster 3 – Regulation-centered (%)
Dimension 1	1.661488***	8.983535***	-6.939635***
Dimension 2	-3.430431***	10.69435***	-0.2407551
Pseudo-R2	0.7192	0.9525	0.7703
Correctly classified	96.09%	99.51%	90.71%

*** Significant at 1% level.

In table 4 is reported the individual contribution of the variables to the first two dimensions considered. The characteristics showing the highest level of contribution to the first dimension are: the presence of a research mask, information on the status of the project and the description of the data. The PDF format is the only variable negatively correlated with the first dimension. As for the second dimension, which could be

interpreted as a measure of the quality of the data provided, is characterized by the variables regarding the level of information detail (e.g. key financial data as the amount of money effectively paid to the beneficiary; information on the specific action of the Operational Programme, which is useful for example for policy evaluation purposes).

Table 4. Contribution of the characteristics of the lists of beneficiaries to the first two dimensions of the MCA (Pearson correlation)

Characteristic of the list of beneficiaries	Dimension 1	Dimension 2
Amounts effectively paid at the end of the project	0.2654***	0.5795***
Amounts co-financed by EU Funds (ERDF, ESF)	0.1781***	-0.5205***
Detailed description of the project	0.6019***	-0.1694***
Status of the project (active, completed)	0.6682***	0.2871***
Year of allocation	0.0843*	0.3288***
Action of the Operational Programme	0.4404***	0.4521***
Territory where the project impacts (at NUTS3 level)	0.5207***	0.0321
Format: PDF	-0.6521***	-0.2156***
Format: HTML	0.3104***	-0.7365***
Format: Microsoft Excel or CSV	0.585***	0.1027**
Description of the data and metadata	0.6635***	0.2993***
Description of the data in English	0.5875***	0.2282***
Map for data visualization	0.5236***	-0.4652***
Research mask	0.7133***	-0.5386***
Number of clicks to access data *(0= 3 or more, 1= less than 3)*	0.1525***	-0.3556***

*** Significant at 1% level; ** significant at 5% level; * significant at 10% level

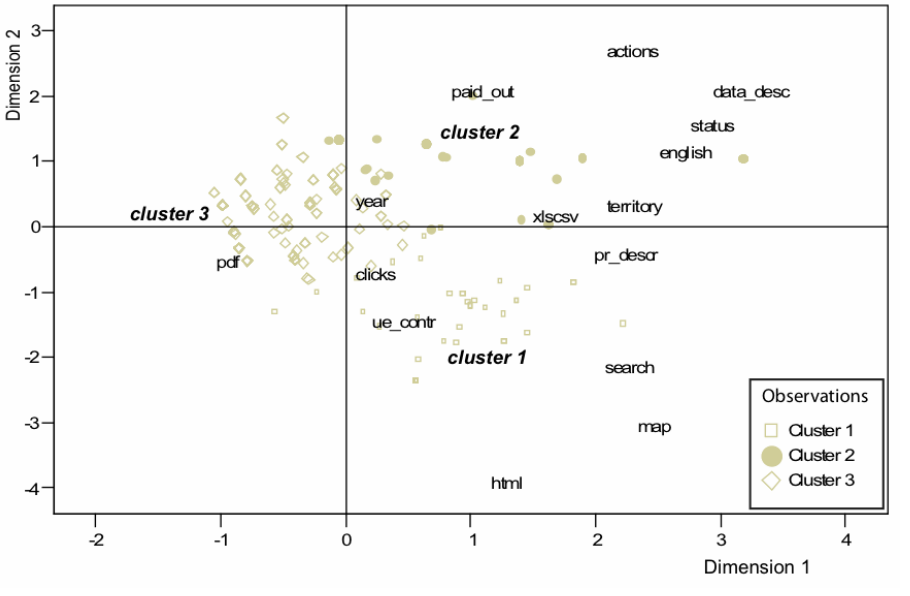

Fig. 1. Identifying three information strategies

Figure 1 shows the plot of the variables included in the MCA according to their scores in dimensions 1 and 2. As explained earlier, where variables are closely grouped together, they show high levels of association. The location of the variables is related to the individual contribution to the two dimensions considered. The figure also shows the single observations belonging to the three clusters identified through the CA.

The first cluster of variables is found at the bottom-right corner of the plot (*Cluster 1*). This group of variables shows the administrations' effort to make data understandable by non-technically oriented citizen, clearly represented, and accessible to users. This includes the presence of data visualization tools and on line forms that enhance searching and display. In particular, as table 5 shows, the most common characteristics of the lists of beneficiaries belonging to this cluster are the presence of HTML tables (99%), research masks (94%) and maps for geo-referenced data visualization (54%). On the contrary, while the data is always showed in HTML lists, typically as the result of a search action, only 46% of the lists are actually downloadable from the website in XLS or CSV formats, which could let the users further elaborate the data by themselves. For convenience, we label this cluster "User centered".

Table 5. Characteristics of the lists of beneficiaries of EU Structural Funds and the three information strategies indentified

Characteristic of the list of beneficiaries	Cluster 1 – User-centered (%)	Cluster 2 - Re-user-centered (%)	Cluster 3 – Regulation-centered (%)	Total of OPs with financial data (%)
Amounts effectively paid at the end of the project	2	60	30	30
Amounts co-financed by EU Funds (ERDF, ESF)	80	39	38	47
Detailed description of the project	45	39	8	21
Status of the project (active, completed)	12	60	7	18
Year of allocation	50	91	60	63
Action of the Operational Programme	23	35	9	16
Territory where the project impacts (at NUTS3 level)	1	61	2	13
Format: PDF	51	7	85	64
Format: HTML	99	3	6	24
Format: Microsoft Excel or CSV	46	93	11	33
Description of the data and metadata	13	57	2	14
Description of the data in English	17	49	6	16
Map for data visualization	54	20	1	15
Research mask	94	37	9	31
Number of clicks to access data *(0= 3 or more, 1= less than 3)*	99	95	87	91

Another cluster of variables appears at the top-right of the Fig. 1 (*Cluster 2*). The group is defined by many desirable characteristics aimed at assuring accuracy, validity, security, management, and preservation of information holdings, and therefore related to the principle of "stewardship".

Distinctive features of this group, as reported in table 5, are: the ability to download the data in a machine-readable format (93%) - which also enables effective data re-use - plus other characteristics related to data quality, such as the year of allocation of the funding (91%), the presence of the territory where the projects impact at NUTS 3 level (61%), the description of the data (57%), that makes data easier to access, understand and use. We call this cluster “Re-user centered”.

A third cluster (*Cluster 3*) is located at the left of the diagram. This group is associated with low values of Dimension 1 and is characterized by the absence of all the desirable features considered in the survey. In fact, low values of the first dimension can be associated to poor quality of the lists of beneficiaries of Structural Funds. The most common characteristic of this group is indeed the presence of the PDF format (85%). The use of PDF format makes the re-use of data dramatically difficult and is at odds with the stewardship principle that demands that government information should be acquired, used, and managed as a resource.

The managing authorities of the programmes belonging to this cluster seem to be more interested in formally meeting the requirements of the regulation than in pursuing real transparency. For this reason we can call this cluster “Regulation centered”.

As just reported, our analysis identifies a sort of "non strategy" (cluster 3, "Regulation centered") along with of two pro-active strategies corresponding to two different paths. A first path (cluster 1, "User centered") is consistent with the usefulness principle, while the other (cluster 2, "Re-user centered") is mainly focused on the stewardship principle.

Consequently, the theoretical framework proposed by Dawes [8] seems to be particularly useful to interpret this empirical results and shed some light on the different ways the EU public agencies are dealing with opening up their data on the web.

Moreover, the evidence that these two principles are connected to two statically different clusters suggests that EU agency have much to do in order to find the right balance between the stewardship and the usefulness approach. The two principles are in fact complementary and mutually reinforcing [8].

5 Conclusions and Policy Implications

In order to verify the presence of different information strategies that European public agencies are following when opening up their data, we conducted a web-based survey on the quality of the lists of beneficiaries of Structural Funds provided by the EU Regions and Member States responsible for the 434 Operating Programmes of the European Cohesion Policy. This policy represents an ideal context for such an assessment because, on one hand, it involves all EU Regions and Member States with common rules and regulations and, on the other hand, it limits the requirements for publishing the data on beneficiaries to a small set of minimum information. In other words, while the policy is implemented under the same rules across Europe, hundreds of public authorities responsible for managing Structural Funds are free to choose their information strategy when publishing their data on the web.

In October 2010 we collected data on fifteen variables corresponding to the presence/absence of a set of characteristics which includes not only the requirements of the current regulations plus the recommendations of the European Transparency Initiative, but also other features suggested by the literature and by technical official guidelines.

A multivariate analysis was applied to the data collected. The location of the variables in the MCA plot and the consequent cluster analysis reveal the presence of three information strategies, which are consistent with the most recent literature on this topic and, in particular, with the framework based on the two broad information principles "stewardship" and "usefulness". While a group that we called "Regulation centered" seems interested only in formally meeting the minimum requirements set by the regulations and therefore is publishing the data in PDF format with limited or no further detail, two alternative paths for pro-actively publishing government information on the web are revealed. The first path (cluster 1, "User centered") focuses on data visualization and searching and deals with the usefulness principle, and the second (cluster 2, "Re-user centered") leads to data quality and validity and is consistent with the stewardship principle.

In conclusion, the analysis confirms the robustness of the theoretical framework proposed by Dawes [8]. The desirable features of public datasets that were taken into account in this study tend to aggregate themselves into two groups which are consistent with the two broad principles "stewardship" and "usefulness".

Finding the right balance between these two principles is the key for ensuring data quality while fostering transparency, innovation and the creation of new added-value services. This analysis, which connect the two principles to two statistically different groups of public agencies, demonstrate that there is much to be done in order to finally find this balance.

On the one hand, EU regions following a “user centered” approach must consider not only the needs of the “average user” looking for a single data or cool elaborations, but also the requests of civil society organizations, “civic hacking” initiatives, data journalists, and individual citizens interested in re-using the raw data in order to improve the accountability of the policy, e.g. by facilitating inter-regional comparison, setting up advanced tools for data visualization, doing mash-ups with other sources of territorial information. The lists of projects displayed in hundreds of HTML pages, typically as the results of a search action on the region’s website, should be exportable in a single file for further elaboration. Besides, our analysis highlights that the authorities belonging to the “user centered” cluster tend to focus on the presentation aspects while the level of detail and the overall quality of the data provided is relatively low compared to the “stewardship” cluster and therefore should be improved.

On the other hand, the “re-user centered” organizations that make available the data only in XLS or CSV format should consider the differences within and among communities of users in terms of e-skills, and in particular with respect to the ability to analyze the data in a meaningful way (e.g. in a spreadsheet). Therefore, together with the raw data, data in a processed or aggregate form should be provided in order to make it accessible also by non-technically oriented citizen.

As for the “regulation centered” group of public authorities, an improvement of the regulation itself will force these administrations to do better. The desirable

characteristics of the lists of beneficiaries considered in this paper may help the European Commission and the other authorities involved in Regional Policy to set new and more stringent targets and requirements for the next funding period in terms of quality, openness and completeness. From a technical and organizational point of view, this will not necessarily imply the need for extra budget, major changes in information management or the update of existing software and infrastructures. Actions for raising the awareness among national and local authorities of the benefits that could derive from opening up existing data and information in a re-usable way are considered much more important.

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Market, Network, Hierarchy: Emerging Mechanisms of Governance in Business Process Management

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Abstract. Both financial pressure and customer and service-quality orientation force governments to "innovate their processes." With governmental processes affecting a large variety of stakeholders both inside and outside the government sector, involving these stakeholders in process innovation becomes an important means of increasing know-how, capacity, and ultimately ensure the legitimacy and acceptance of reform efforts. We contribute to the study of collaborative process innovation by applying a governance theory perspective, in order to understand the factors that impact on collaboration. Our quantitative study of 357 local governments reveals that, with an increasing maturity in process innovation, all types of collaboration (market, network, hierarchy) are increasing in importance. Moreover, we find that, under financial stress, governments tend to involve network partners (e.g. other local governments) in process innovation, while a lack of process management knowledge leads to market-oriented collaboration with consultants. We derive implications for management practice and discuss how the study enhances our understanding of process innovation and collaboration in the public sector.

Keywords: Public Sector, Business Process Management, Collaboration, Innovation Networks, Quantitative Study.

1 Introduction

Innovation networks and collaboration have become key themes in eGovernment research. With governments being under immense reform pressure, various approaches attempt to modernize, improve or restructure public administrations, be it practices in the context of New Public Management [1] or eGovernment [2]. Due to this high pressure, the diversity of demands, and new areas of responsibility, local governments rely increasingly on innovation networks. Various internal and external actors are involved in reform processes, such as software and consulting companies, local government associations [3], or individual citizens. Influential research in innovation management (for instance [4] and [5]) suggests that access to external knowledge, in order to enlarge an organization's own pool of capabilities, is a key to innovation success. External actors can contribute by providing distinct perspectives on the topic at issue, as well as domain-specific knowledge which does not exist in the public sector organization itself. With the importance of collaboration in eGovernment being widely acknowledged, [6-8], current eGovernment literature fails to

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provide a general framework that integrates distinct types of collaboration and, second, to understand to empirically investigate contextual factors that impact on collaboration schemata.

Process innovation is an essential element of eGovernment and public sector reform [9-14]. It seems to have established as common sense that municipalities need to innovate their business processes: cost-cutting, especially in times of the financial crisis, as well as citizen and service quality orientation, have led to calls for a program of process innovation in public organizations [12]. Most recently, for all European member states, the EU Service Directive requires the establishment of a single point of contact for all administrative services, providing yet another major impulse for public sector process innovation [15]. In this respect, Business Process Management (BPM) is an established contemporary concept of process innovation that builds on Business Process Reengineering, a more radical approach, and Total Quality Management, a more incremental approach to process innovation. BPM integrates the two perspectives into an approach to process innovation that makes use of both radical and incremental efforts. While BPM-driven process innovation has been heavily researched in the context of eGovernment, the current literature has yet failed to understand the role of collaboration and networks in process innovation [16-18].

In this paper, we contribute to the study of collaboration and process innovation in the public sector by (1) developing and applying a governance theory framework for differentiating and comparing distinct types of collaboration. (2) We investigate empirically, whether organizations that are more mature in their process innovation initiatives feature different collaboration schemata. We thus provide an overview of future challenges for public sector process innovation with regard to involving process stakeholders. (3) We study a range of contextual factors and their effect on collaborative process innovation. These factors include financial stress, organizational size, and the level of internal process management knowledge.

The remainder of the paper is structured as follows. Firstly, we build a theoretical foundation for studying collaborative process innovation, by utilizing governance theory and drawing on the BPM literature. We then set out our hypotheses and research design, a quantitative study of 357 local governments in Germany. The presentation of results is followed by a discussion of the implications for both theory and practice. The final part of the paper is concerned with limitations and potentially fruitful avenues for future research.

2 Theoretical Background

2.1 Business Process Management

BPM is a key concept for both E-Government research and practice. It is an approach for analyzing and improving business processes, integrating both incremental and revolutionary predecessors as Business Process Reengineering or Total Quality Management. Thus, BPM is not only about a one-off reorganization of both organization and IT, but more a permanent activity of monitoring business processes and comparing their achieved results with the desired ones. Public sector organizations employ BPM in order to streamline business processes. This is often closely connected to the introduction of new information and communication technology and, hence, has become a key concept in E-Government research [9-14].

Successful BPM requires specific assets and capabilities which are costly to obtain. Contemporary research on business process change emphasizes that expertise, skills, and capabilities, as well as information systems and other assets are needed if success is to be achieved [19]. Capabilities include, for example, business process modeling or process analysis. Organizations that wish to build up such capabilities have to train their employees or hire experts in these areas. Assets include BPM suites or workflow management systems. In this respect, organizations have to purchase solutions. Hence, the capabilities and assets needed for successful BPM are associated with considerable costs.

In modern public and private sector organizations, BPM capabilities are obtained with the support of a plethora of actors. Stakeholders from both inside and outside the organizational boundaries are involved in BPM projects [18]. Moreover, organizations that become more mature in BPM are said to collaborate with more actors [20].

2.2 Governance Theory

Governance Theory differentiates between three forms of governance, hierarchy, network (or cooperation), and market [21]. The characteristics of each, especially with regards to BPM, are described below.

Hierarchy. A classical Weberian bureaucracy operates according to the governance form hierarchy, with the primary means of communication being routines. The actors involved are bound through employer/employee relationships. These relationships create a quite stable and reliable work environment, affecting both commitment among partners and handling of conflict. However, this governance form has one major downside. Due to contractual constraints, the flexibility of the organization is rather limited. A hierarchical organization is restricted in its choice of partners, at least for short-term decisions. It takes time to set up or terminate commitments such as labor contracts. A BPM-related example corresponding to this form of organization is a firm that deploys its own employees for a BPM-related task.

Network. The network form, as identified by Powell, is claimed to be based on complementary strengths and common interests among independent partners. Probably, the most important characteristics of a network are the relationships between its members, which constitute both the primary means of communications and the mechanism for solving conflict. According to Powell, the latter is due to member concerns about their own intra-network reputation. Organizations working against the network, such as through betrayal, will probably simply be expelled from the network, as the other members share a common interest. This is also a good example of network flexibility. In general, all network actors have to agree on new partners. However, changes in the network occur more frequently than in hierarchical settings. In a BPM context, organizations could improve inter-organizational operational processes along their supply chain.

Market. Economic actions relying on market mechanisms are regulated mainly by prices. Additionally, contracts and property-rights regulations provide guidance. As long as the market structure does not suffer from monopolies or lock-ins, this form provides the greatest flexibility, since the company is not bound to its partners, as it would be in hierarchical or network forms. This means, on the other hand, that partners are not necessarily interested in the fate of the company, such that Powell attests

"low commitment" [21] among the partners. Even worse, the general atmosphere might be dominated by suspicion and control, with conflicts usually being resolved in court. Teece et al. also emphasize the risk of poor asset protection resulting from purely market-based arrangements [22]. In the sense of the present work, obtaining a BPM capability in the market can, for example, mean hiring external consultants who help the organization carry out complex BPM projects.

According to theory, the organization's choice between these three forms – the 'make-or-buy decision' [23] – depends on several aspects. Following Williamson's argumentation [24] and [25], Powell points out that "transactions that involve uncertainty about their outcome, that recur frequently and require substantial 'transaction-specific investments' – of money, time or energy that cannot be easily transferred – are more likely to take place within hierarchically organized firms" [21]. However, "exchanges that are straightforward, non-repetitive and require no transaction-specific investments will take place across a market interface" [21]. Furthermore, he comes to the conclusion that transactions performed within a hierarchy tend to be less efficient than market transactions, but market transactions tend to cause greater costs [21]. Thorelli adds the network-paradigm to the Williamson argument and explains its benefits. He claims that power, influence, and trust are cornerstones of the network paradigm [26]. Therefore, the downside of this concept is that managing and maintaining a network requires significant effort by all parties involved [26]. However the "effectiveness, efficiencies or risk-reduction gained in [network arrangements] is felt to exceed transaction costs of myriad spot transactions or the major resource commitments, difficulties of performance evaluation, etc. typically associated with all-out internalization" [26]. **Error! Reference source not found.** gives an overview of the major characteristics of the three forms of governance (see [21]).

Table 1. Stylized Comparison of Forms of Governance

Key Feature	*Market*	*Network*	*Hierarchy*
Normative Basis	Contract – Property Rights	Complementary Strengths	Employment Relationship
Means of Communication	Prices	Relational	Routines
Degree of Flexibility	High	Medium	Low
Tone or Climate	Precision and/or Suspicion	Open-ended, 'mutual benefits'	Formal, bureaucratic
Actor Choices	Independent	Interdependent	Dependent
Example Actor	Consultants	Value Chain Partner	Employees

3 Hypotheses

In practice, all governance forms are observable with regard to public sector BPM. Organizations can rely on their own staff to implement process-related reforms (hierarchy). They can cooperate with other partners as local government associations or customers (in terms of citizens and local companies), or "buy" BPM capabilities in a

market, e. g. from software or consulting companies. However, up to now, the choice of governance form (or governance mix) appears somewhat arbitrary. In this paper, we analyze the influence of several variables on the BPM governance form and formulate different hypothesis based on related theory (see Figure 1 for an overview of the hypotheses).

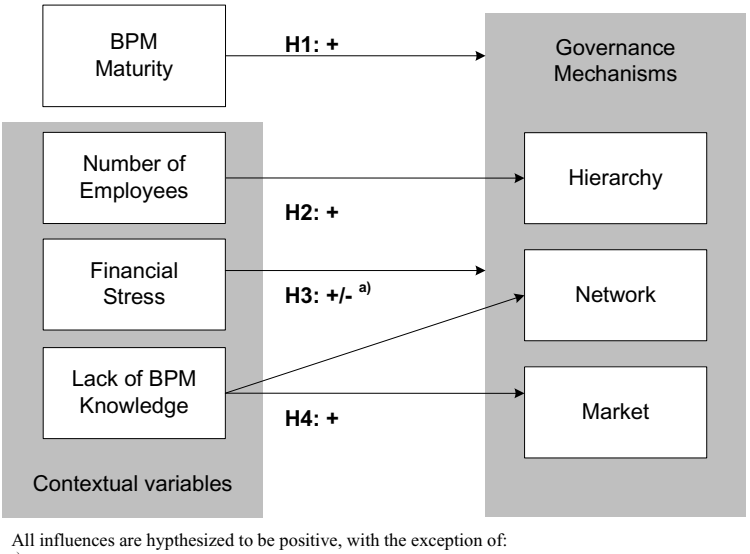
Firstly, BPM maturity refers to how mature an organization is with regards to BPM capabilities. It is regarded as exerting a considerable impact on the choice of collaboration. The BPM Maturity Model of Rosemann et al. [20] argues that maturing organizations include more and more actors from their respective hierarchy. Moreover, highly mature organizations are expected to manage processes collaboratively. Fisher coined the term "intelligent operating network" with respect to such situations [16]. Accordingly:

> *H1: The more mature an organization with regard to BPM capabilities, the more likely it is source its BPM capabilities using hierarchical, network, or market settings.*

Secondly, one could assume that a relationship between the number of employees in an administration influences the choice of governance form. Here, we argue that larger organizations have more potential to fulfill BPM-related tasks using hierarchical sourcing.

> *H2: The more employees a municipal administration has, the more likely is it to source its BPM capabilities using hierarchical governance.*

Thirdly, process improvement projects entail costs. This is especially true when the necessary resources are acquired through market relationships. Hence, organizations



All influences are hypthesized to be positive, with the exception of:
[a)] Financial stress with a negative impact on market-oriented governance

Fig. 1. Hypotheses

that perceive their financial situation as critical are more likely to rely on internal or network resources and less likely to source from the market.

H3: The higher the level of perceived financial stress, the more likely the organization is to source its BPM capabilities using hierarchical or network settings and the less likely the use of market governance.

Fourthly, BPM projects require substantial knowledge. This knowledge may be related to tools, modeling techniques, project management skills, etc. Hence, one could argue that organizations that do not internalize this knowledge have to rely on external partners. In this context, we hypothesize that organizations with greater knowledge scarcity tend to rely on BPM resources sourced via cooperation or the market.

H4: The greater the amount of BPM knowledge scarcity in a municipal administration, the more likely it is to source its BPM capabilities using network or market governance.

4 Research Methodology

Data Collection. We collected the data for this study in 2008 using an online questionnaire. We invited 8,000 government officials, each responsible for BPM in a single local administration to participate. Hence, we contacted around two thirds of all ~12,250 local governments in Germany. We hoped to collect a homogeneous sample of all organizations in the public sector (at a local level), which should ensure a certain robustness of the data. With 357 completed questionnaires, we achieved a response rate of roughly 4.5%. These organizations are distributed over all German large-area federal states (plus Berlin). We did not detect any participation bias.

Questionnaire. The questionnaire for the study was constructed with regard to both our presented hypotheses and the existing theory. However, for this specific study, only a part of all questions asked are relevant. Other questions focus, for example, on efforts to establish BI-solutions in public administrations. With regard to BPM Maturity, we relied on six common dimensions of BPM [19]. For the dependent variables, we asked for the perceived importance of relevant actors in both BPM agenda-setting and implementation [18] and [27]. Importance is, amongst others, such as frequency or strength, a criterion that is widely applied to measure links in social networks [28]. The constructs and the respective questions can be requested from the authors.

Data Analysis. After the data collection (online questionnaire), we employed SPSS 17.0.0 to analyze the structured data. In order to further understand the relationships between the constructs, we employed the partial least squares (PLS) path modeling algorithm [29-31]. We used the centroid weighting scheme, because it does not overestimate effects, as is the case with the factor weighting scheme [32]. The software package was SmartPLS [33]. The constructs were modeled using reflective indicators (a detailed discussion on formative versus reflective indicators can be found in Diamantopoulos [34]). Missing values were treated using the mean replacement algorithm [35]. This data analysis procedure enabled an evaluation of the above hypotheses.

5 Results

We present our study results in a three-stepped approach. Firstly, we show the validity of our constructs (outer model) in terms of internal consistency and inter- vs. intra-construct correlations. Secondly, we present the paths and their corresponding coefficients (outer model). Finally, although not a major focus of this study, we analyze the model with regard to the coefficient of determination.

Outer Model. The results derived using the above mentioned methodology are listed in Table 2. The internal consistency reliability (ICR) of all latent variables was measured with Cronbach's Alpha. In general, an ICR above .9 is considered as excellent, one between .7 and .9 as high, one between .5 and .7 as moderately high, and all others as low [36]. All reliabilities in our study are in the high or excellent range (note that BPM PreKnow and Number of employees were measured using single items) (Table 2).

Table 2. Measurement Model Estimation

	ICR	Mean	S-Dev	1	2	3	4	5	6	7
1 Hierarchy	.86	4.33	.59	.77						
2 Network	.93	2.24	.72	.19	.69					
3 Market	.84	2.83	.93	.14	.51	.82				
4 BPM Maturity	.86	3.03	.71	.31	.28	.09	.76			
5 Number of Employees	1.00	374	1257	-.02	-.06	.05	-.02	1.00		
6 Financial Stress	.91	3.21	.95	.09	.20	.09	-.03	.06	.89	
7 BPM Knowledge Lack	1.00	1.89	.80	-.04	.00	.17	-.31	-.04	.01	1.00

a) ICR: Internal consistency reliability (Cronbach's Alpha)

b) Diagonal elements are the square root of the shared variance between the constructs and their measures

c) Off-diagonal elements are correlations between constructs

Moreover, correlations between the constructs were lower than the square roots of the shared variance between the constructs and their measures in every case. According to Fornell and Larker [37], this indicates convergent and discriminant validity. We employed a bootstrapping method (500 iterations) using randomly selected subsamples to test the significance of our PLS model. Analyzing the item loadings, we observed that our latent variables are indeed measured by the corresponding items (Table 3).

Inner Model. In our proposed model, not all paths are proven to be significant using the bootstrapping method (Table 4). We observe high positive influences of Lack of BPM Knowledge on Market, of Perceived Financial Limits on Network, and of BPM maturity on all three governance types. These 5 paths are also shown to be significant. All other hypotheses were falsified by our analysis.

Table 3. Item Loadings

LV	Item	Loading
Hierarchy	AS_MAY	.7357 ***
	AS_DH	.8550 ***
	AS_EMP	.7543 ***
	I_MAY	.6982 ***
	I_DH	.8673 ***
	I_EMP	.7057 ***
Market	AS_CONS	.7939 ***
	AS_SOFT	.8585 ***
	I_CONS	.7906 ***
	I_SOFT	.8539 ***
BPM Maturity	MAT1_SA	.7295 ***
	MAT2_GOV	.7498 ***
	MAT3_MET	.6626 ***
	MAT4_IT	.7736 ***
	MAT5_PEO	.8532 ***
	MAT6_CUL	.7890 ***
Fin. Stress	PFL1	.9228 ***
	PFL2	.9037 ***
	PFL3	.9335 ***
	PFL4	.7729 ***

LV	Item	Loading
Network	AS_CM	.6302 ***
	AS_PP	.7184 ***
	AS_1TO	.7021 ***
	AS_2TO	.7459 ***
	AS_CIT	.6585 ***
	AS_COM	.6591 ***
	AS_LGA	.7108 ***
	AS_OLG	.5685 ***
	I_CM	.6402 ***
	I_PP	.7058 ***
	I_1TO	.7019 ***
	I_2TO	.7518 ***
	I_CIT	.7232 ***
	I_COM	.7278 ***
	I_LGA	.7414 ***
	I_OLG	.5899 ***

"Lack of BPM Knowledge" and "Number of Employees" were measured using single items.

Table 4. Path Coefficients

	Hierarchy	Network	Market
R^2	.1052	.1306	.0632
BPM Maturity	.3107 ***	.3078 ***	.1613 **
Number of Employees	-.0202	-.0633	.0556
Financial Stress	.0992	.2098 ***	.0902
Lack of BPM Knowledge	n.a.	.0902	.2205 ***

Coefficient of Determination. The coefficient of determination (R^2) is defined as the proportion of variance in the data explained by the statistical model (and not by random error terms or constructs not included). In our analysis, we did not focus on the coefficient of determination, but on the influence of BPM PreKnowledge, Perceived Financial Limits, Number of employees, and BPM maturity on the choice of BPM governance. Hence, the R^2 of our model is comparably slow. However, we can explain about 6.5 to 13% of the variance in the dependent variables (Table 4).

6 Discussion

Our study suggests that several factors influence the choice of governance mechanism for public sector BPM. Relating to our research question, we observe a high influence of BPM maturity as well as of other contextual variables (Fig. 2).

Firstly, organizations that are more mature are more likely to collaborate with any BPM actors. In this respect, the influence of BPM maturity on all market, network, and hierarchy is positive. Hence, our first hypothesis is confirmed.

Secondly, we assumed that a larger number of employees in local administration would lead to a greater reliance on BPM capabilities sourced through hierarchical governance settings. However, our study seems to falsify the related hypothesis H2: The choice of governance mechanism is not related to the size of the organization.

Our third hypothesis was that a higher level of financial stress would lead to greater collaboration in hierarchical and network settings and a lower reliance on market actors. However, our study reveals a different picture. Financial stress is unrelated to hierarchy and market settings. Apparently, the inclusion of such actors is not dependent on the financial situation of the respective organization. Yet, according to our study, a greater financial stress leads to greater collaboration with network actors. In this respect, we assume that organizations in similar settings (e. g. neighboring cities) collaborate both with each other and with other actors, e. g. government associations or citizens and local companies, once they face financial stress.

Fourthly, as hypothesized, a lack of BPM knowledge in municipal administration leads to a higher level of collaboration with market actors. However, the other part of H4 is falsified: BPM knowledge is not related to sourcing BPM capabilities in network governance.

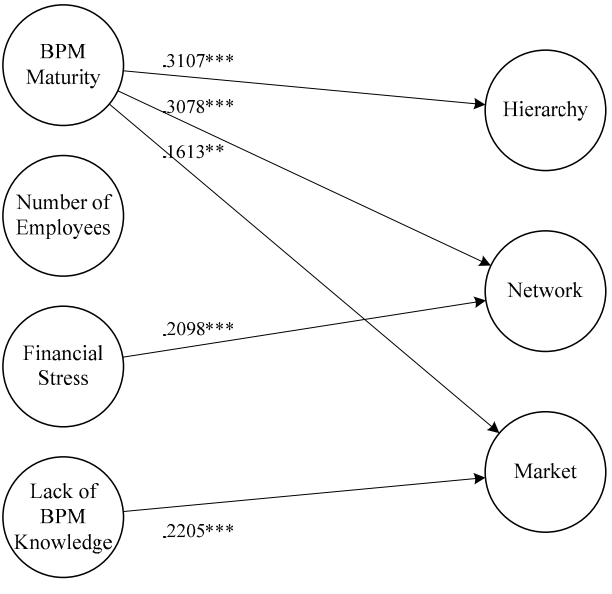


Fig. 2. Significant influences

The contemporary development of BPM capabilities in local administrations is a major influence on the collaboration type in terms of the choice of governance mechanisms. The more mature organizations become in their BPM capabilities, the more they are to collaborate with all actors, independent of market, network, or hierarchy sourcing. However, this is not the only influence. Contextual factors are important for the choice of governance form, too.

This study contributes the influence of BPM development on collaboration and governance mechanisms to theory on BPM capability development or BPM maturity. The continuous development of BPM capabilities in public sector organizations leads inevitably to a higher importance of all market, network, and hierarchy actors. Organizations that improve their capabilities to change and improve business processes will collaborate more intensively. However, contextual factors such as a lack of BPM knowledge or financial stress are also important. Firstly, local government organizations facing financial stress collaborate with such network actors as other local governments, local government associations, or customers in the form of local companies and citizens. Secondly, local governments that lack BPM-related knowledge are forced to obtain it through market mechanisms, i.e. buy the necessary knowledge from consulting companies.

Moreover, this study extends governance theory to the fields of BPM and public management. Firstly, it is important to note that successful BPM can be achieved with the aid of multiple actors using different governance mechanisms. However, the more mature organizations become in BPM, the more they collaborate. Secondly, future governance theory studies should include such contextual factors as financial stress or lacks of knowledge in order to investigate the choice of governance mechanisms.

For both practitioners and scholars, it is important to note that the role of process managers changes over time. In immature organizations, process managers can be described as “arm-chair-like lone cowboys”. However, once organizations start to mature, the role changes to that of an “orchestrator of different actors.” Process managers in future public organizations (assuming a positive development of capabilities), must be able to collaborate with actors from different governance mechanisms. Hence, their skill set will also have to change.

Furthermore, given that organizations facing financial stress evidently collaborate closely with network actors and typical local administrations face financial stress, information technology supporting this collaboration needs to be designed. Both theory and practice have to come up with solutions for methods and tools to support network collaboration. In this context, design science approaches appear to be fruitful.

The study suggests that local administrations as clients of consultancy companies (market governance) have to become more professional (client professionalization) and incorporate the knowledge generated in consulting projects more effectively. So far a lack of BPM knowledge leads to greater collaboration with market actors. However, this collaboration induces costs that can be avoided with the aid of an active knowledge transfer from consultancies to local governments. In this respect, the results of BPM consulting projects need to become more sustainable. However, not only consultancies are to blame for the prevailing lack of sustainability, but also local governments as clients. Government professionals are advised to improve their knowledge management in order to get the best out of consulting projects. Researchers can support this process with both the design of appropriate tools and an analysis of current shortcomings.

Our study is subject to limitations. Firstly, we only analyzed one country. While we believe that the results are fairly typical for Western countries, they may be different for other cultural settings (in particular Asia or Africa). Secondly, our study yields low coefficients of determination. Hence, other contextual factors not covered by our study could influence the choice of governance mechanism. Thirdly, the concept of BPM maturity is questioned in contemporary research. Other forms of describing the capability development could be valuable, too [38]. Fourthly, one could question whether public sector organizations understand the concept of BPM in the same way as scholarship. As we introduced the concept shortly in the questionnaire hope to overcome this limitation. However, slight misunderstandings are still possible.

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Computing and Information Technology Challenges for 21st Century Financial Market Regulators

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Abstract. This paper reports on a research effort designed to begin to systematically identify the most critical computing and information technology-related challenges facing financial market regulation activities. Computing and information technology adaptation in financial markets create a paradox. Information technology is needed for effective governing of financial markets, yet advances in information technology and the increasingly complex adaptations of that technology make it more difficult for regulators to have a clear picture of what is actually happening. Drawing on in-depth interviews with professionals from the financial market community, this paper outlines three primary challenges facing regulation efforts: 1) information sharing and integration, 2) mediating interrelationship among financial market constituents, 3) data-driven decision making. The paper concludes with recommendations for future research about the challenges and

Keywords: financial market, computing and information technology challenges, financial market regulators.

1 Introduction

This paper delineates critical Computing and Information Technology (CTI) related challenges facing financial market regulators in 21st century financial markets. A U.S. General Accounting Report (2009) pointed to the complexity of financial market due to new and complex financial products and large and interconnected financial institutions and conglomerates [22]. The complexification of financial markets has led to intensive adaptation of advanced CTIs to improve financial market oversight mechanisms. The institutionalization of information technology transformed and changed the character and structure of financial market reflecting in the transactions processing, competition, innovation, [4] and also oversight. Financial market regulators as well have become increasingly dependent on computing and information technology to track, monitor, and analyze the large number of transactions in modern financial markets. Activity in and around the markets is increasingly based on data-driven decisions which rely on the use of computing and information technology.

The impact of technology depends on how it is used, regulated, and/or guided [2]. A report from a two year investigation by the Financial Crisis Inquiry Commission confirms that information technology and trading systems themselves are not the

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cause of the financial crisis, but the way in which technology is currently used, may be. Computing and information technology has shown its resilience toward external exposure and demonstrates great potential to complement the weakness of oversight mechanisms in expanding markets. For instance, the terrorist attack of September 11, 2001 showed the reliability of the disaster recovery capability of ICT-based financial systems [3] and the uncovering of the $64 billion Ponzi scheme by Bernie Maddoff was made possible through the use of information technology [14]. On the other hand, the increasingly complex adaptations of that technology within the financial markets make it more difficult for regulators to create the necessary policies and practices necessary to monitor financial markets. This difficulty results in mismatches in the currency of market versus oversight and surveillance systems. Testimony given by Mary Schapiro, Chair of the Security Exchange Commission (SEC), on the flash crash of May 6, 2010, outline the challenges created by such a mismatch between technologies used in the process of market oversight and surveillance and the technologies and trading systems in financial market [19]. This situation obstructs regulators effort to develop clarity about what is actually happening. The risk of adopting new technologies is real, but often underestimated [24].

This paper reports on a research project designed to begin to systematically identify the most critical computing and information technology-related challenges facing financial market regulators. Drawing on in-depth interviews with financial market professionals, this paper outlines a preliminary mapping of the most critical information technology challenges facing 21st century financial market regulators. Subsequently, this paper outlines a preliminary research agenda for studying the impact of information technology challenges on 21st century financial market regulation. The rest of the paper is organized as follows. Section 2 briefly draws on the relevant literature to outline known CTI related challenges to financial market regulation and what is known about the impact of those challenges. Section 3 presents the research design and methods used, section 4 presents the results as well as the practical impact of the challenges for IT professionals. Section 5 outlines an agenda for future research. Finally, section 6 provides the conclusion.

2 Literature Review

2.1 The Role of Computing and Information Technology in Financial Market Governance

Hakken (2010) proposes four instrumental roles for CTIs in financial market [9]. The first role is CTIs as the enabler of rapid development of financial product innovations that exceed the threshold of transparent and perceptible structures of financial products [5, 23]. The structure of financial products becomes so complex that assessing the transparency and risks becomes less feasible [26]. The intensification of financial innovations was due to the role of CTIs in channeling and disseminating two essentials ingredients of financial products, namely: new sources of funds with low interest rates and surging demands from global investors [26].

The second role is to mediate globalized markets. CTIs afforded the creation of "un-boundaried market in capital" through the development of international

computing networks [9]. The globalization and boundary-less capital market resulted in escalating the unpredictability and uncertainty in the markets and challenges the "subjective boundary of financial regulators [9]".

The third role is complexification of risk assessment models. The current risk-assessment models are no longer adequate to assess risks associated with rapidly developed financial innovation [9]. Hakken argues that the problem is on the tendency to perceive the result of computer-based risk assessment models as the "end" and not as "means" to judiciously aid competent professionals to assess the risks [9]. Arguably, richer information, such as: insights and expert analysis should complement computer-based-risk assessment [25]. Finally, Hakken contends that CTIs contribute to making asset values more ambiguous and obscure [9].

2.2 The Primary Functions of CTIs

This section will discuss three primary functions of CTIs recognized as challenges to financial market regulators, namely: 1) information sharing and information integration, 2) interrelationship among financial market institutions, and 3) high level and complex computing to support for data-driven decision making.

1. Information Sharing and Information Asymmetry among Financial Market

A number of studies have shown the significant value that stems from inter-organizational information sharing in the private [11] and public sectors [7]. Interorganizational information sharing is regarded as one of the distinguishing core capabilities of modern ICTs [16].

Current literature outlines three possible benefits of information sharing among actors in financial markets, 1) diminish the potential of risk taking, 2) reduce information asymmetry, and 3) improve transparency [11]. Information sharing is important in improving risk management. Information sharing provides better benchmarks for risk assessment that will influence investors' risk behavior [10]. Information sharing is also important for financial market regulators to meet the primary objectives of ensuring the safety and soundness of the financial system and protecting stakeholders [21, 22].

Information sharing could also diminish information asymmetry among financial market actors. Information asymmetry emerges as a result of disconnected communication, internally or externally. A number of studies argue that information asymmetry will increase the likelihood of financial problem [8, 20]. Guillen and Suarez (2010) found that massive information asymmetry in the banking sector in the US and Europe result in decreased trust that lead to the recent financial crisis [8].

2. Interorganizational Networks

The advances of CTIs in the financial market had paradoxical impacts, creating global networking and challenging the governance and oversight mechanisms of financial markets. The potential benefits of information and communication technology to support the operation of network governance and collaboration has been highlighted in a number of studies [5, 6, 17]. The importance of network governance and collaboration is also acknowledged in the testimony of Mary Schapiro, in which she pointed out the significance of the coordination required to address inter-market manipulations and

abuses and called a robust effort to build consolidated audit and tracking systems in the interconnected markets [19].

The inter-dependency in the current financial market regulations systems challenges the adequacy of its management and governance and leads to three possible caveats. 1) Regulatory and jurisdictional overlaps among regulators, 2) Complicated risk assessment, and 3) likelihood of systemic risks. First, a number of studies point at the mismatch between the market and regulators particularly in the United States [8, 20]. Regulations in the US financial markets are divided among agencies that regulate different financial market segments. Government agencies and Self Regulatory Organizations (SROs) share regulatory responsibilities that often overlap [22]. The overlapping regulations create problems since the resulting gaps in the US regulatory system can be manipulated by financial market actors. For instance, In the Senate Hearing on March 2009, Ben Bernanke stated that the crisis was also related to the fact that "AIG (The American International Group, Inc) [is able to] exploited a huge gap in the regulatory system" [8].

Second, networked governance increases the difficulties of predicting and assessing market risks [13, 25]. Extensive global networks of sellers and buyers of financial products and cross-borders interdependency make it virtually impossible to tracks the associated risks [13]. The rapid development of financial innovation and interconnected markets can lead to gaps in technologies as well used for market oversight and surveillance against the technologies and systems used in the financial market [19].

Finally, interconnectivity increases the likelihood of systemic risks [13]. The development of ICTs results in stronger global financial linkages that lead to increases in the likelihood of creating systemic risks [13, 20]. Initial tremors in a local market could easily reverberate globally [13].

3. Information Processing and Data Driven Decision Making

CTI development affords a high level computing and data processing which affects financial market regulators in two ways. First, regulators increasingly rely on quantitative measurement performed by "Quants[1]" for oversight and decision making. Second, risk assessment becomes more complicated due to risky products. These two issues are interrelated, in the sense that both point at the complications for market oversight mechanisms and decision making for the regulators.

Complicated oversight mechanisms arguably lead to increased reliance on quantitative indicators for risk assessment and market surveillance. The limitation of increased reliance on quantitative indicators for risk assessment is the inaccuracy of models used to reflect the actual risk of a financial product or in a market. The behavior of the market is shaped by various influences, some of which are unquantifiable, these might not be fully captured in the structured data [15]. The computational efforts using structured data are still inadequate to capture the inherent risks in recent financial innovation and might potentially augment the cost of asymmetric information [1].

[1] "Quants" are mathematical gurus, who build mathematical models to exemplify the financial risks in the financial product innovation [18].

3 Research Design and Methodology

3.1 Research Design

This research employs semi-structured interviews and focus group discussion. This approach enabled researchers to gain in-depth understanding and experiences of knowledgeable individuals expertly involved in financial market. Five organizations and approximately 25 individuals participated in individual face to face or phone interviews and focus groups. The larger set of interviewees minimize the problematic data bias pertain to qualitative research. The bias was also reduced by the fact that the interviewees are selected from different functions and different industries in financial market.

3.2 Interview Profile

The team of researchers interviewed 25 participants encompassing various components of financial markets. Specifically, 7 participants from investment banking, 4 participants from broker-dealer units of nation-wide insurance company, one interviewee came from market analyst and research, two interviewees were from the financial guarantee industry, and 11 were from self-regulatory organizations. The interviewees described their positions as related to general counsel, compliance function, legal department, or information technology.

3.3 Interview Procedure

Each interview lasted an average of between 45 minutes for interviews and 1 hour 20 minutes for group discussion. The interviews/group discussions were conducted separately, four by a face-to-face meeting and four by phone interview. A notification by phone and email was sent to each interviewee before each interview. During the interview, the participants were presented with one major question; What are the most critical challenges facing by financial market actors in the 21st century? After each challenge was identified, interviewees were asked to clarify and elaborate each challenge and to reflect the challenge to their organization. Subsequently, the interviewees were asked to rank the challenges according to their perceived level of importance to their organization. Although the numbers of interviewee were not large, the interviews were sufficiently in-depth thus generate a significant amount of data.

4 Result

Common themes across the challenges were identified from interview transcripts (*See table 1*). Three primary CTIs related challenges were identified. The following sub-sections discuss the challenges within each theme. Quotes from the interviews and focus groups are provided to support the theme development.

4.1 Information Sharing and Integration

The focus group discussions and interviews indicate majority agreement on the significance of information sharing issues. This analysis identified five inter-related challenges within the context of information sharing and integration (*See table 1*).

1. Disparate Legacy System

The interviewees noted that the banking industry has undergone a substantial numbers of mergers and acquisitions resulting in a number of disparate legacy systems. One interviewee from a Broker-Dealer pointed out that integrating legacy systems is a major hurdle for organizations. These efforts brought together many different firms along with their legacy systems resulting in a variety of systems that don't "talk to each other" and various "gold copies"; copies of data captured at different level and organization. This results in restrictions on information sharing and undermines efforts to eliminate inter-market manipulations.

Table 1. Impact of 21st Century Challenges for IT

Theme	Challenges	Potential CIO/IT function Impact
Information Sharing and Integration	• Disparate legacy system • Cost of compliance • Strict Information sharing policy • Keeping up with the changes in regulations	• Reconciliation of the data and system • Ensuring data quality (reliability, relevancy, & timeliness) • Interpreting changes in regulations • Balancing regulatory change, investment plan, cost of compliance, and IT budget.
Interorganizational network	• Interdependency and overlaps of financial market regulators • Managing conflict of interest	• ICTs for network governance. • ICTs for networked risk assessment. • ICTs for collaboration, coordination, and relationship-building.
Information processing and Data driven decision making	• Information processing • Data monitoring	• Data relevancy for risk assessment. • Complementing structured data analysis with non-structured analysis. • a reformed quants

2. Keeping up with changes in regulations, financial privacy, and cost of compliance

Keeping up the changes in regulations and compliance as well as new and changing privacy requirements represent the second set of major challenges. An interviewee from an investment bank notes the sheer numbers of policy changes they have to comply with – "at anytime the SROs have 2 dozens proposals to change rules". The legacy systems, onerous rules and regulations lead to difficulties in using IT to deal with compliance responsibilities. This set of conditions is a major hurdle especially for small institutions. Keeping up with the changes of regulations can be very costly and need to be budgeted well in advance.

3. Integrating business and technology units

The need to integrate business and technology units to support intra-organizational information sharing is another issue. The data indicates the classic case of disintegration between IT and business units. The IT people and business unit people need to, but do not, talk to each other and nor do they have a common language to faciliate information sharing. One of the interviewees emphasized "technology is

there, most IT skills are there, business knowledge and experience are real challenges". A certain level of IT fluency is important. Interviewees spoke to the need for understand the role, application, and architecture of technology aoutlining s well as challenges around data quality and integrity, knowledge of the architecture of systems and work flow.

4.2 Interorganizational Network

The majority of the interviewees asserted the importance of addressing interconnectivity and interdependency among financial regulation systems. The regulation of the United States financial markets is divided among agencies that regulate the different financial market segments and often overlap. Companies engaging in multiple financial markets find themselves regulated by different institutions with different approaches to regulation.

The interviewees from investment banking pointed out the duplication and overlap of regulations that result in a large number of inefficiencies and lack of coordination among the regulators. For instance, according to the interviewees, NYSE, FINRA, and SEC send very similar inquiries which require separate efforts to respond. These overlaps in regulations lead to redundancy in efforts to ensure compliance with regulations thus inducing higher costs for compliance.

Interviewees from insurance and broker-dealers, noted that interdependency sometimes creates competition within regulations/regulators. The regulators compete with each other to be the first to protect consumers, identify fraud creating inconsistencies, and appeal to the public. This competitiveness among regulatory agencies poses a problem for financial firms as they work to comply with various regulations. The financial firms often have to marry various strict rules imposed by different agencies. The overlaps in financial regulations create confusions for firms to choose which one to focus on and to follow. As an example, the interviewee from investment bank mention that "eight option exchanges have different rules, [so] which do you use as the right one in monitoring systems".

The interviewees from self-regulatory organization (SROs) also point at the same issue. The SROs highlight "reputational risk" as one of their primary risk. The reputational risks relate to the risk of being relevant to the market and risk of losing power over the market. As asserted by one of the interviewee, "I think one of the greatest challenges right now is remaining relevant, there is a lot of works going on as the result of regulatory reform…that could jeopardize the organization as the whole…is the business gonna move from cash security to swap such that SRO's B gain a lot more power and SRO's A roles are minimize". Negotiation of power and power dependencies are considered as characteristics of networked governance.

The interviewees from SROs also expressed concern about the impact of these interdependencies on the risk assessment. They especially noted concerns about future efforts of regulators to evaluate risks. Informed risk analysis is important, but in the case of networked systems, regulators, the interviewees agreed, also need to understand the interdependencies and dealing with multiple regulatory schemes. As interviewees from the SROs put it, "[it is] hard to know how firms are morphing their behaviors in areas we don't have access to…".

4.3 Information Processing and Data Driven Decision Making

One interviewee from the financial guarantee industry described the problem associated with integrated data and information sharing as "no one on the other end would know what to do with that information". Implied in this statement are the challenges of processing and interpreting the data and information. Interviewees from the investment bank, insurance companies, and broker-dealer all emphasized the increasing volume of data. They noted an exponential growth of trading information and data as result of current high-tech trading systems. This concern was found to be more imminent for financial regulators as compared to other actors of financial market.

For financial regulators, information processing involves collecting data and figuring out how to interpret it. Having large amounts of intricate financial market information leads to several possible issues for information processing. The first issue relates to the increase complexity in efforts to analyze the behavior of markets. Over the years, the regulation has changed from prescriptive to less prescriptive and become more contextual. The regulations they noted, have become too broad, too general, and offer alternatives. As result, the information collected by regulators is more complex and creates problems when analyzing market behavior and in particular when trying to understand cause and effect relationships. It is more difficult now they noted, for analysts to connect the aggressive behavior of some firms to the current economic crisis. .

The second issue relates to the difficulties of identifying the relevancy of data or information. One interviewee indicated that expanded filing requirements yields different types of information which lead analysts to question the relevancy of data. The example given by the interviewee is corporate bonds in which there is no way to differentiate among the bonds. As a result, there is different information and different granularity of data that complicates the processing of information.

The third issue noted by interviewees from self-regulatory agencies is that the limitation created by reliance on quantitative indicators or "quants" for risk assessment. "Quants" are mathematical gurus who build mathematical models to exemplify the financial risks in the financial product innovation or/and command excellent ability to perform quantitative analysis [18]. They assert that the problem with "quants" is that "they cannot marry the practical with the theoretical". For instance, quants are concerned only with measuring quantitatively the high yield of bond market and raise concern about it. However, according to the interviewees, the quants do not connect the dots to consider about what to do with the information. This issue also points at the requirements to have integrated skills for IT professionals/graduates. Financial or information technology skill alone is not adequate to deal with the future challenges of financial market.

5 Discussion

As discussed above, analysis of the interviews and focus group discussions identified three primary CTI related challenges for 21st century financial market regulators: 1) information sharing and integration, 2) mediating interrelationship among financial market constituents, and 3) data-driven decision making. The challenges also serve as the framework for the recommendations for future research presented below.

5.1 Information Sharing and Information Asymmetry

This research identified the need to foster information sharing across financial market constituents. Well-designed and executed information sharing is necessary for improving risk assessment and risk management. There is the need to have closer working relationship, discussion, and communication among financial regulators, IT professionals, and financial firms. One of the interviewees described the communication between regulators and firms that used to exist and currently missing.

> *"regulator of the [this organization] used to come in like in 2000, they use to meet [with me] annually and then they would ask about credit default swaps and wrapping this and wrapping that…I was impressed they were asking some reasonable questions and then nothing ever happen with that sort of like their academic division…[interview result]"*

Disconnected communication, both internally inside organizations and externally among financial market actors could result in information asymmetry. In support to the Houston's argument [11], information sharing could diminish the information asymmetry and increase transparency among actors of financial market. Research is needed to address this situation.

Future research could address current limitations in integrating and making effective use of existing information and limitations in creating integrated communication among financial market constituents. A comprehensive understanding of the information sharing structure of the financial actors (in particular financial regulators) is needed to identify factors that can obstruct information sharing and therefore hinder effective prudential regulation, consumer protection and, in general, reduction of the systemic risks. Venue for future research could also assess the needed capabilities to foster close working relationship and communication among financial market constituents. Among others, possible sample questions that new research could explore are:

1. What kinds of information sharing mechanisms are presently used among the financial regulatory agencies?
2. What are the challenges of integrated communication and information sharing among financial market regulators/actors?
3. What kinds of capabilities are needed to have effective cross-boundary information and data sharing among financial market regulators/actors?
4. What kinds of critical success factors are required to better account for variations in the capabilities of actors in the networked financial market?

5.2 Interorganizational Network

Networks of actors that trust each other and share information are the foundation for more advanced systems of information sharing and information integration. However, governance by networks comes with problems and challenges. This research found the importance of addressing challenges of interconnectivity and interdependency particularly among financial market regulators. The interdependency could create negative impacts for financial market in the sense of 1) increase redundancy and information overlaps, 2) create competitiveness among regulators, and 3) complicate risk assessment process.

This research found several avenues for future research in relation to the interdependency among financial actors. First, the concern of regulators in evaluating risk in the network system. In accord to Hakken's finding [9], the interdependencies restrict the ability to analyze across regulators. Business is regulated by different regulators thus performing complete risk assessment require bridging the regulatory boundary. This complex network of relationships accentuates the need to evaluate the effective mechanism of collaborative network of public-private partnership to keep up with the rapid changes in financial innovations and regulations.

Second, interdependency might lead to competition among regulators that could create mismatch between market and regulators. Globalized financial network raise challenges to the "subjective boundary of financial regulators [9]". Complex relationships between many semi-autonomous organizations in the financial market result in competition, cross jurisdictions, and power negotiations and exploitation. Network analysis is needed to model and analyze the interactions among financial market regulators in the dynamic settings.

Third, financial market actors are connected to each other in complex social structures, locally and globally. This condition accentuates the necessity to have a deep exploration of the role of social networks to assess and representing the complexity of organizational social processes among financial market actors. Additionally, future research needs to investigate the influence of social interconnection among financial market actors in facilitating and/or inhibiting effective regulatory and supervisory systems. Thus, possible sample questions within this venue are:

1. What theories of social networks and social herding can inform research into the mechanism of interrelationship of financial market regulators/actors?
2. Does the current regulatory information sharing relationship structure pose challenges for ensuring the sound and safety of the financial system?
3. How can we model and represent the complexity of organizational and social processes that are useful for developing system for effective risks assessment and oversight mechanism in the networked financial market?

5.3 Information Processing and Data Driven Decision Making

This research found two major concerns related to information processing and computing, namely: massive volume of data and overreliance on quantitative measurement. Cutting edge computer technology affords processing of large amount of structured data through computing model. However, this research indicates that analyzing structured data is insufficient to capture the actual risk inherent in the financial market. Structured data may not be adequate to provide close approximation to the real-world scenario.

This research found that data and information interpretation for risks analysis and prediction of market behavior not only requires sophisticated analysis of structured data but also complementary of richer information. Several research proposed alternative approaches aim to provide close approximation to the real-world behavior by complementing the quantitative indicators with non-quantitative indicators [12, 15, 20]. Nonetheless, future research is needed to assess the effectiveness of analyzing unstructured data, such as narrative reports and social media, as complementary of structured data analysis.

On the other hand, in many cases the information needed by actors in financial markets, particularly regulators, are available but not accessible in a meaningful way.

A massive amount of data is sometime available, but extracting meaningful information from the data requires large effort that might not be economically or technically feasible. One issue that the interviewees pointed at is the need to have mix of skills and knowledge. For instance, business unit sometime does not have adequate skill about information technology for them to understand the challenges faced by IT units. This issue relates to the adequacy of the dimensions of capability of current college graduates and also professionals working in the financial market. College graduates might have a high ability but codified in their respective fields that restrict them to do an analysis in holistic and comprehensive way.

6 Conclusion

The analysis identified a set of practical implications for IT professionals and avenues for future research based on the critical CTIs related challenges identified in this preliminary research effort. Four major practical implications for IT professionals emerged from the analysis of the identified challenges. These practical implications are: 1) the need to have information and data management or strategies, 2) the important of budgeting and planning of IT expenditures, 3) the growing significance of networked governance, and 4) the increasing requirement for better monitoring and surveillance to ensure compliance.

This research was undertaken to begin to systematically identify and build new understanding of the primary CTIs challenges for financial market professionals. Three primary themes of CTIs related challenges identified in this paper are: 1) ability to facilitate information sharing and integration, 2) mediate interrelationship among financial market constituents, and 3) data-driven decision making. Four practical implications as well as four possible avenues for research related to the three primary themes of challenges emerged and are presented here as well. Considered together they create an approach for framing the research and practice challenges facing the 21st century financial market community.

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eGovernment Trends in the Web 2.0 Era and the Open Innovation Perspective: An Exploratory Field Study

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Abstract. Integrating Web 2.0 technologies in e-government opens up new opportunities for improving the quality of online public services and developing new ones, and can potentially contribute in achieving e-government strategic objectives. This paper presents and analyzes the result of an exploratory field study conducted recently with a group of e-government experts in France. Our objective is to identify e-government development trends, and to assess the transformation potential associated with Web 2.0 and Open Innovation (OI). We have adopted an enriched Delphi method, and used a GSS (Group Support System) to facilitate brainstorming and idea generation. Preliminary results are analyzed from two perspectives: Their contribution to e-government 2.0 and to open government, and their differences and complementarities with a recent governmental report on the future of public e-services in France. This work is a first step in a comprehensive research whose purpose is the study of public organizations' transformation and the emergence of the government 2.0 concept. It is a contribution to a better understanding of e-government future.

Keywords: Future directions in e-government, e-government 2.0, open innovation, open government, Web 2.0, field study.

1 Introduction

All around the world, significant advances are made in e-government. According to the UN e-Government Survey 2010 [1], citizens are benefiting from more advanced e-service delivery, better access to information, more efficient government management and improved interactions with governments. However, enormous challenges are still facing the development of e-government. Practitioners and researchers report many inherently complex situations requiring multidisciplinary perspective analysis and investigations, and the future of e-government is a recurrent question [2, 3, 4 and 5].

If we look at the EC benchmark's five-stage maturity model [6], it suggests that *targetization* is the next step in e-government development. The current objective is to provide online services that are customized to users' profiles and requirements, and to personalize the relation they have with public institutions. The emergence of Web 2.0 and the rise of social networks have indeed opened up new perspectives that challenge public institutions. These institutions are particularly attentive to the possibilities of taking advantages of these tools in the context of e-government. This trend towards

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web 2.0 usage in e-government is particularly visible in a recent report issued to the French government by a group of "Digital Experts" [8]. One of the main directions identified in this report for developing e-government is to improve interactions between government and users. The underlying idea is to involve users in the improvement of public services by allowing for example the user to assess governmental services online and to publish the results. The term *e-government 2.0* points to the specific applications of social networks and Web 2.0 in the sphere of public services [7]. Many benefits are expected, such as a better match between public services and citizens' expectations, greater adoption of online services by citizens, or better control of costs and delays in the implementation of new services.

It is however the introduction of the *Open Innovation* (OI) concept [9, 10] in the governmental context which represents the most innovative and promising opportunity, both in terms of potential achievements and in terms of future research avenues to explore [11]. The concept of OI highlights the growing role of external sources of innovation, as opposed to relying only on internal resources within organizations [12]. It gives companies the ability to optimize their innovation process and to take advantage of new business opportunities. Transposed to the e-government context, OI could become a powerful way for public institutions to stimulate creativity, improve in-depth efficiency and quality of delivered services, and to build a new relationship with companies and citizens. The aforementioned Riester report [8] included some proposals for developing OI in public administrations, such as the creation of "Practice Labs" where users can participate more actively in the management, creation, development and evaluation of new public services; or the creation of a platform for service innovation ("State Lab") which allows third parties to develop innovative services using public data. OI is nevertheless a challenge for companies and for governments as well. It requires a profound change of attitude with respect to information- and knowledge-sharing and dissemination, the questioning of governance modes, the mastering of new tools and technologies, etc.

Little academic work has focused explicitly on these issues so far, and the research presented in this paper is a contribution to fill this gap. The research questions may be formulated as follows: How Web 2.0 and OI can be used to change the current model of e-government towards a more social, open and participatory model? What are the most interesting and relevant topics and issues to be explored in order to get there?

In this exploratory study based on an enriched Delphi method, twenty French experts in e-government, from professional and academic spheres, participated in a half-day Expert Focus Group [13]. The objective was to reflect collectively on the development of e-government 2.0 and open government. This included understanding possibilities for applying Web 2.0 technologies and OI concept to e-government in France, identifying problems that may occur, and pointing to research topics related to the design, development and evaluation of new types of online services.

The rest of this paper is structured as follows: Section 2 present related works and describe briefly what Web 2.0 and OI are, and how they are actually perceived in an e-government context. Section 3 describes the research method that has been used, and how the Expert Focus Group has been conducted. Results are summarized and discussed in section 4. Section 5 contains concluding remarks and will sketch the limits of this work as well as its future perspectives.

2 Related Works

New usages of information and knowledge-sharing have emerged with the advent of Web 2.0 technologies, giving rise to the Enterprise 2.0 concept [14, 15]. Enterprise 2.0 refers to "*the use of Web 2.0, emergent social software platforms within companies, or between companies and their partners or customers*" as defined initially by Andrew McAfee [16]. Used initially in the private arena, Web 2.0 technologies (e.g. blogs, wikis, RSS[1] , social networking platforms, folksonomy, podcasting, mashups, virtual worlds, etc.) are increasingly disseminated within the professional sphere, regardless of the type of organization or field of activities. These technologies - also called Social Media [17] - are user- (social) centered, user-friendly, intuitive and flexible. They are participatory and personalized with a dynamic content, and are generated by users themselves. Web 2.0 technologies are very useful for self-expression and mass participation, social networking, knowledge capitalization and co-creation, and skills and talents identification. They are a good opportunity for organizations to improve in the sharing of best practices, to boost social interactions and to encourage bottom-up and open innovation [10].

Coined by Chesbrough in 2003, the concept of OI is based on the premise that companies need to open up their innovation processes, combining both internal and external technologies to create business value [9]. Because companies can no longer rely exclusively on their own ideas and resources for fueling innovation, organizations should work with their customers, business partners and even their competitors according to specific organizational arrangements such as in- and out-licensing, selling and buying of Intellectual Property (IP), cross-licensing or spin-off ventures, in addition to traditional marketing. Opening up the innovation process requires the implementation of relational strategies in order to explore and exploit the business ecosystem in which companies operate. In [9], Chesbrough distinguishes inbound from outbound OI processes. Inbound innovation refers to an outside-in process through which the company will acquire resources in its environment to bring innovation to its current market. Instead, outbound innovation refers to an inside-out process through which the company will generate additional revenues and profits from selling in-house research outputs to other firms. OI can be described as a continuum between high and low degree of openness [18].

OI models can be developed both in the private and the public sector. Inbound and outbound innovation can be used by public agencies in order to develop new services for consumers and citizens, but also for the needs of public agencies themselves. While many public agencies develop specific applications for their own needs, they are also likely to use providers' turnkey applications to support their operations. Inbound innovation is therefore akin to a fairly common approach in the public sector. In contrast, outbound innovation is still very rare but is growing rapidly, as suggested by various initiatives related to e-government and/or Open Government [19]. On this point, the example of the District of Columbia (Washington, USA), is quite significant in term of outbound innovation. Since 2009, an Apps[2] contest called *Apps For Democracy* makes it possible for independent developers, geeks, public and

[1] Really Simple Syndication.
[2] Applications Contest.

private research centers to compete in order to create innovative online services that solve practical problems expressed by citizens through a social network. The purpose may be for example to identify the different cycling routes in the district, or to check the availability of a book in a public library. Public agencies within the District of Columbia provided developers with public data in order for them to build their applications. This ability to make high-value public data available to the public encourages participation and collaboration.

On emerging issues of e-government 2.0 and Open Government, research output is still quite limited. The views of U.S. President B. Obama in favor of open and collaborative government generated some scientific work: In [20] for example, the author offers an in-depth historical analysis of presidential directives' implications. In the same vein, the annual meeting of the Gov2.0 Summit has been bringing together since 2009 figures from the U.S. administration and some researchers to discuss experiments, problems and questions concerning e-Government 2.0 and Open Government implementation. Several governments around the world have conducted similar studies, notably in Australia [21]. Some recent academic publications tackle explicitly Open Government and the problems it raises: specific applications of the concept in the field of process management [11], the adoption of e-government 2.0 by citizens [22], or factors that promote openness, collaboration and participation [23].

3 Research Method

To conduct our exploratory study, we used a Delphi approach, enriched by the use of the thinkLets-based modeling proposed by Briggs et al. [24]. ThinkLets are packaged thinking activities (facilitation techniques) that create predictable, repeatable patterns of collaboration among people working toward a goal. They are used to streamline collaboration during brainstorming sessions, rapid decision-making, evaluation of strategic objectives, team building, creativity… [25]. Delphi studies are regularly used in information systems' studies when a consensus needs to be achieved among domain experts on a topic where ideas generation is required [26].

While Delphi studies are normally survey-based [27], we had the opportunity to use Group Support Systems (GSS) and a well-structured facilitation process. GSS is a suite of software tools designed to support collective problem solving, including the generation of ideas, reducing, organizing, and evaluating idea sets [28]. These tools facilitate the emergence and sharing of information among participants, and assist the facilitators in the control of the reflection process so that to converge to relevant proposals. Each team member in a GSS session uses a computer to submit ideas and votes to the group, to make selections, to organize ideas, or to write draft texts. Using GSS, all team members can contribute simultaneously, and may generate and evaluate ideas anonymously, while participating in well-structured deliberation processes [24]. The use of a GSS allowed us to collect in a bottom up fashion, extensive and well-organized group collaboration results. It also served for the development of a synthesis report summarizing the results of the process, which is presented and discussed with all participants.

3.1 The Sample

In December 2010, a number of organizations were invited to a research seminar at the authors' institution to discuss issues related to the use of Web 2.0 technologies and OI concept in the context of e-government, using electronic brainstorming. The participants were selected based on a diverse set of characteristics, including organizational type, area of activities, their profile, education, work experience, job, etc. Demographics of the study participants are provided in Table 1.

Table 1. Participants' demographic data

Variable	Value
Participants	: 20
Organizations represented	: 16
Largest Organization	: > 50,000
Smallest Organization	: <5
Organization Types	: 8 public-sector organizations, 6 private-sector firms and 2 associations
Area of activities	: Ministry, Central Purchasing, Local government, service firm, research center, telecom company, University, Association, etc.
Youngest Participant	: 30-35
Oldest Participant	: 56-59
Average Age	: 46
Male Participants	: 17
Female Participants	: 3
Occupational profile	: 15 professionals and 5 academics
Education Level	: MSc/MBA or PhD
Education Type	: Public or business Administration, political science, computer science, law, geography, etc.
Most Years of Work Experience	: 15–20 years
Least Years of Work Experience	: <4 years
Average Years of Work Experience	: 10 years
Jobs	: Top management, Innovation, R&D, Research and Forecasting, IT department, Project management, higher education, etc.

3.2 Issues and Themes Discussed

Regarding the themes to be brainstormed, we relied on the results of the *eGovernment RTD 2020* project [2]. The purpose of this collective work, carried out at European level, was to define future research topics in the e-government area. One of its main outcomes is a series of 13 research topics analyzed and classified by importance according to the perception of the expert group. For example, the two topics identified by the RTD 2020 project as the most important are: *Data privacy & personal identity*, and *Trust in e-government*.

After analyzing the RTD project's 13 proposed topics, we have summarized four key issues for the evolution of e-government:

- **Performance and governance:** This theme concerns the government operations and addresses issues such as effectiveness and efficiency, return on investment, value creation, public-private collaboration, etc. The brainstorming session on this theme was facilitated by a researcher[3] in Strategic Management.
- **Investment and infrastructure:** This theme focuses on the technical, organizational and legal tools to be implemented to enable the development of services. It covers issues such as technical infrastructure development, authentication protocols, exchange formats, etc. The brainstorming session on this theme was facilitated by a researcher in Information Systems Engineering.
- **Information quality:** This theme relates to public information and its various dimensions such as its dissemination, confidentiality, traceability, security, but also personal digital identity, data privacy and protection, legal framework, etc. The brainstorming session on this theme was facilitated by a researcher in MIS.
- **Roles and relationships:** This theme deals with citizens' and companies' participation in content building and innovation in terms of services, stakeholders' accountability, copyright, etc. The brainstorming session on this theme was facilitated by a researcher in marketing and social networks.

3.3 The Brainstorming Process

The brainstorming process consisted of several activities in which the participants were asked to engage during a 180 minute period. A summarized agenda and research process follows:

- 60-minute introductions were necessary to (i) explain the expected outcomes of the brainstorming session by introducing the principles of Web 2.0 and OI; (ii) put into perspective some elements of the aforementioned Riester report [8]; (iii) present the thinkLets-based modeling method and explain the facilitated process for the brainstorming session through the GSS interface; and (iv) introduce and briefly explain the session's four themes of discussion (c.f. 3.2).
- Participants were then asked to anonymously generate proposals, ideas and suggestions around the four predefined themes of discussion (c.f. 3.2). They could submit as many proposals as they wished for each topic, according to their inspiration and expertise. A proposal is formulated around an objective, considered relevant when it is *Specific* (well defined), *Measurable* (with key success factors), *Acceptable* (attached to concrete actions), *Realizable* (feasible in the context) and can be defined in *Time* (SMART characteristics). During this process, each participant was able also to read and be inspired by the other participants' contributions. This is generally a source of emulation.
- Participants were then assigned to four subgroups and asked to reduce, clarify and organize collectively generated proposals around one of the four themes. Each subgroup was assisted in this task by a facilitator[3]. The goal is to converge on similar statements, remove non-related ones, and reword those insufficiently clear.

[3] Chosen among the researchers who conducted the study according to his/her research area.

- Participants rejoined as a whole group, and each subgroup facilitator presented and explained to the group which proposals were selected for their respective theme.
- Participants were then asked to individually and anonymously rate the relevance of each proposal on a 10-point Likert-type scale, with '10' representing a very relevant statement and '1' a least relevant statement relating to both e-government 2.0 and open government.
- The voting scores were then presented to all participants in a raw format to stimulate a discussion of the results (proposal by proposal), and to allow the reformulation of proposals when necessary, to clarify ratings' standard deviations and so to create a collective consensus.
- Participants were finally asked to rate the consolidated proposals once again.

4 Results and Discussion

At the first stage of brainstorming, a total of 153 proposals were produced across the four themes. In accordance with the brainstorming process, they were reduced to a maximum of 10 proposals for each theme. The results presented in the following subsections have been treated twice. First, during the brainstorming process in the clarification, reduction, organization, evaluation and consensus stages; and second, after the brainstorming session, whereupon all proposals were verified and reformulated where necessary. In this last step, the focus was on two criteria: That there be no confusion of issues in the classification of proposals, and that the proposals are relevant to the field of e-government and OI.

After the brainstorming session, the final 29 selected proposals and their interpretations were sent out to all participants for final validation. Final results are presented in tables 2, 3, 4 and 5. For each theme, we indicate the average (Avg) voting score and the standard deviations (Std) of participants' responses for each proposal. These tables rank the proposals in order of increasing averages. The Cronbach alpha was calculated to assess the consistency of voting scores.

Table 2. Consolidated proposals for the 1st theme: Performance and governance

Proposal	Avg	Std
1.1 Federate digital identity to facilitate access to all services	7.94	2.11
1.2 Develop and organize access to public data	7.81	1.91
1.3 Develop and stimulate the creation of public/private/user/academic communities	7.50	2.66
1.4 Improve communication between public and private actors to better formalize the needs and to co-construct the solution	7.50	2.94
1.5 Develop flexible and scalable resources, on demand, taking into account the specificities of the public sector	7.38	2.50
1.6 Develop a shared and transparent evaluation process to measure ROI	6.69	2.33
1.7 Develop a European collegial governance structure	6.19	2.45

4.1 Theme 1: Performance and Governance

For this theme, the expert group generated 55 initial proposals, out of which 7 have been elicited and are briefly presented below. The Cronbach alpha equals 0.87 (> 0.7), indicating a certain homogeneity in the panel's responses relative to the understanding of these proposals.

4.2 Theme 2: Investment and Infrastructure

For this theme, the expert group generated 27 initial proposals, out of which 10 have been elicited and consolidated and are briefly presented below. The Cronbach alpha equals 0.91 (> 0.7), indicating a high homogeneity of responses relative to the understanding of these proposals by the panel members.

Table 3. Consolidated proposals for the 2nd theme: Investment and infrastructure

Proposal	Avg	Std
2.1 Adapt public website ergonomics to accommodate user profile (age, occupation, education level, etc.) and preferences	7.5	2.71
2.2 Impose the use of an (already existing) single digital certificate format to ensure interoperability, relying mainly on a public consultation	7.44	2.00
2.3 Move from unique or specific web portals for each public agency to fully customizable portals using widgets	7.31	2.96
2.4 Provide digital spaces for consultation and exchange in order to develop standards for the interoperability of public documents, to be imposed by the government in the future	7.00	2.66
2.5 Adapt public computer systems to allow web 2.0 architectures and usage	7.06	2.41
2.6 Identify and document public APIs[4], evaluate them and make them available in a shared repository	6.81	2.74
2.7 Before launching a new public call for tenders for a new software development project, systematically use the possibilities of Web 2.0 to check if such software development has not already been made in another jurisdiction, or if similar or identical software applications are not already available on the market	6.81	2.71
2.8 Promote the digital co-construction of government- local community services using Web 2.0 technologies and through an open and free service catalog	6.75	3.00
2.9 Develop and promote tools and spaces where users can beta-test new public online services before they are made available to the public	6.75	3.13
2.10 Change the legal framework to promote the development of public services by third parties	6.44	2.83

[4] Application Programming Interface.

4.3 Theme 3: Quality of Information

For this topic, 38 initial proposals were generated, out of which 7 have been elicited and consolidated. The Cronbach alpha equals 0.62 (< 0.7), indicating a relatively low homogeneity in the understanding of these proposals by the panel members. This probably expresses a certain lack of consensus on the meaning of the term "quality" itself and on the role of governments in defining and in assessing it.

Table 4. Consolidated proposals for the 3rd theme: Quality of Information

Proposal	Avg	Std
3.1 Clearly distinguish between two different situations: one where anonymity will prevail, and the other where it is essential for the user to have a reliable digital identity to access more personalized services	7.81	1.91
3.2 Make policy makers aware of the necessity of communicating about new Web 2.0 tools which are available to users, taking into account different behaviors	7.56	2.16
3.3 Identify legal shortcomings and make legislative proposals	7.44	2.00
3.4 Encourage user contributions to the quality of information, and describe these contributions	7.38	2.55
3.5 Improve the general knowledge of legal texts to better identify the rights and duties of each player	7.19	1.76
3.6 Propose an experimental protocol (technical and legal) to open public data while ensuring its quality	6.94	2.32
3.7 Explore the opportunity of establishing an official e-government certification to guarantee information quality	6.81	3.37

4.4 Theme 4: Roles and Relationships

For this theme, the expert group generated 33 initial proposals, out of 5 which have been elicited and consolidated and are briefly presented below. The Cronbach alpha equals 0.94 (> 0.7), indicating a high homogeneity in responses relative to the understanding of these proposals by the panel members.

Table 5. Consolidated proposals for 4th theme: Roles and relationships

Proposal	Avg	Std
4.1 Give users the means to evaluate/assess and judge the quality of e-government services	7.94	2.57
4.2 Develop support and geographic/community mediation services for users experiencing difficulties	7.75	2.41
4.3 Promote the convergence of practices by adapting to media, new technologies and to public/business usage	7.69	2.44
4.4 Promote e-government as furthering social cohesion and service development (collaboration with non-profits, R&D with companies, etc.)	7.63	2.31
4.5 Establish a single point of contact, a harmonized HCI, and a single information file with tracking and traceability for each citizen	7.56	2.99

4.5 Discussion

We have analyzed the results according to two points of views: The first is the direct contribution of proposals in answering the research questions (c.f. section 1), and the second is to examine the 29 proposals in light of the aforementioned Riester report delivered to the French government by the "Digital Experts" group [8].

For the first point of view, although all proposals concern the development of e-government, not all of them are directly related to Web 2.0 and to OI. The proportion is however very significant, almost 50% (for sake of space, these 14 proposals are listed below[5]). This suggests that there is a high level of awareness in the expert panel concerning their impact on e-government, and this impact is perceived as an important opportunity for developing the quality, the extent and ultimately the nature of online public services.

For the second point of view, the 29 proposals confirm, complement and extend the Riester report's recommendations. In this official report published in February 2010, 25 initiatives were proposed (grouped into 3 categories and 7 subcategories), and 9 key success factors were suggested for sustaining a successful strategy of digital services. By cross-analyzing the expert panel proposals with report's recommendations, we have classified our proposals into three categories:

- The first category consists of 10 proposals which are similar and/or complementary to those made in the Riester report. They are initiatives and actions to be developed (for sake of space, these proposals are listed below[6]).
- The second category consists of 10 proposals which describe necessary factors for the development of government 2.0 and open government. While the success factors mentioned in the Riester report are general order recommendations, the proposals of our panel are much more precise and deal with specific problems. They are an interesting complement to success factors mentioned in the Riester report. They concern the following issues: *Availability of public data to third parties* (proposal 1.2), *interoperability* (proposals 2.2, 2.4, 2.5, 2.6), *juridical aspects related to web 2.0 usage* (proposals 2.10, 3.5), *better communication and dialogue between public organizations* (proposals 1.4, 3.2), *adequate technical infrastructures* (proposal 1.5).
- The third category is a collection of 9 proposals which cannot be correlated with the Riester report. They concern the resolutions of specific problems and the development of new services: *Development of communities of practice* (proposal 1.3), *websites personalization* (proposal 2.1), *better public governance and higher level of transparency* (proposals 1.6, 1.7, 2.7), *optimization of identity management usages* (proposal 3.1), *enhancing the juridical environment* (proposal 3.3), *universal accessibility to all citizens and digital divide* (proposals 4.2, 4.4).

[5] Proposals n° 1.3, 1.4, 2.8, 2.10, 3.4, 3.6, 4.1, 4.2 are related to open innovation; and proposals n° 1.2, 1.3, 2.5, 2.6, 2.9, 3.2 are related to web 2.0.

[6] Proposals which are complementary to those in the Riester report: proposals n° 1.1, 2.3, 2.8, 2.9, 3.4, 3.6, 3.7, 4.1, 4.3, 4.5.

5 Conclusion and Perspectives

Questions concerning the future of e-government are recurrent in researchers and practitioners communities. In this exploratory field study, we have analyzed the views of a panel of experts with regard to the opportunity of integrating open innovation concept and benefiting from Web 2.0 technologies to develop e-government. With the help of a GSS-type software tool, the experts were able to identify challenges and opportunities in a very short time (150 minutes), and out of 153 initial proposals, 29 were selected, discussed and scored.

The preliminary results' analysis provides clear answers to our initial research questions. Almost 50% of the collected proposals are directly related to e-government 2.0 and to open innovation in e-government. Many of them are initiatives which will clearly help in changing the current model of e-government towards a more social, open and participatory model. Although some proposals are similar to those initially made in a similar prospective report recently mandated by the French government, our study highlighted new success factors and came up with many complementary suggestions for the development of new public services. Important success factors – unmentioned in the report – deal with issues such as open data availability, enhancing the juridical environment, or the interoperability of documents and standardization of electronic certificates. New service proposals embrace aspects such as reducing the digital divide, correlating e-government development with better transparency and better governance, or optimizing identity management.

This study represents the first stage of an ongoing research endeavor, and should be developed further – in particular through one or more detailed confirmatory studies to validate the results and to determine more precisely the nature and scope of concrete actions to be undertaken. However, due to the exploratory nature of this study, a limit must be considered: At this stage, this study does not lead to any final findings but rather to thoughts and insights. From this perspective, future work will combine qualitative and quantitative approaches. Several meetings are actually planned with the panel members and other experts in order to refine the proposals. Results of this study will be used for constructing a questionnaire, which will be administered to a large and significant sample of experts.

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A Scenario-Based Approach towards Open Collaboration for Policy Modelling

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Abstract. In the context of current increasing variety, interconnectivity and alteration, many methods and tools for planning and decision-making such as time series analysis and trend extrapolation do not longer work out. Along the demands for good governance and open government, policy-makers need concise, reliable and up-to-date information to manage society's problems and affairs in an efficient and effective way. Likewise, stakeholders affected by a particular policy demand transparency, accountability and trustworthiness in political decision-making. Along the increasing digitisation of the Information Society, citizens are more and more requesting direct involvement in policy-making. The implementation of good governance principles as already defined a decade ago by OECD or the European Commission become predominant in societal evolution. In this contribution, a novel approach to policy development through collaborative scenario building via online means and formal modelling and simulation of policy is introduced. The approach adds value to current policy discussions by facilitating the understanding and assessment of specific policy issues, letting stakeholders express their views and concerns on a policy via collaborative scenarios and e-participation tools, and providing means to better understand consequences of policy choices.

Keywords: Scenario building, Policy development, Open collaboration, Stakeholder involvement.

1 The ICT Demand for Governance and Policy Modelling

Today's global challenges are interconnected, dynamic and complex in nature thereby having strong impact on the wellbeing of societies and economies. Dealing with complexity has become a key success factor for good governance in the 21st century. To ensure sustainable wellbeing of societies and economies, policy makers must be able to cope with unwanted side effects from environmental changes and social dynamics.

Besides, disenchantment with politics and political parties characterise the current crisis of Europe's representative democracy (see latest turnout results at the European election[1], the voter turnout has kept falling about 2.37% from 2004 to 2009).

[1] See Results of the 2009 European Elections,
http://www.elections2009-results.eu/en/turnout_en.html
(last access 2011/06/11)

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Democracy has failed to secure greater political accountability. Vertical accountability, i.e. the obligation of political decision-makers to explain and to account their decisions towards their voters, comes to the fore[2]. In the course of these developments, governments all over the world place special emphasis on the concepts of Open Government and Good Governance.

The EC identified modelling, simulation and visualisation as path-breaking ICTs for Governance and Policy Modelling to trigger and shape significant changes in the way future societies will function[3]. However, results from the state of play analysis of the CROSSROAD project evidence that existing tools are far from being widespread; and the related research fields are still fragmented[4].

The OCOPOMO[5] project is one out of seven projects funded by the European Commission (EC) in the 7th Framework Programme in the field of ICT for governance and policy modelling. OCOPOMO integrates collaborative scenario building with agent-based modelling and simulation in order to empower and engage different types of societal groups and communities, to enable them to utilise e-participation platforms and to allow governments to incorporate stakeholders' inputs in policy developments of two pilot cases. OCOPOMO encompasses three complementary research fields, which have traditionally been quite separated: (i) OCOPOMO relates to scenario building that allows stakeholders to conduct simple "what-if" and "if-then" exercises to inform modelling and simulation via narrative texts that stakeholders are usually familiar with. (ii) OCOPOMO refers to e-participation to allow for open collaboration and online stakeholder involvement in order to facilitate compliance with the concept of Open Government and the principles for Good Governance. (iii) The combination of scenario building and stakeholder involvement through online means serves the common goal of improving public decision-making to handle complexity, to make policy-making and governance more effective and more intelligent, and to accelerate the learning path embedded in the policy cycle. With it, OCOPOMO contributes to the realisation of Open Government and the Good Governance principles.

In this paper, we present the OCOPOMO approach to address policy modelling through collaborative scenario building via online means thereby informing the model, on which the simulation will run. Section 2 introduces the concept of Open Government and the Good Governance principles of the EC, which ground the selection of scenario building for OCOPOMO explained in section 3 and lay the foundation for the OCOPOMO collaborative scenario approach outlined in section 4. It also founds the evidence base for developing the use case related policy models

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[2] Impact Assessment of European Commission Policies: Achievements And Prospects, EEAC Working Group Governance, online http://www.eeac-net.org/download/EEAC%20WG%20Gov_IA%20statement_final_18-5-06.pdf (last access 2011/06/11).

[3] FP7 ICT Work Programme 2009-2010. European Commission, online http://ec.europa.eu/information_society/newsroom/cf/itemdetail.cfm?item_id=4535 (last access 2011/06/11).

[4] See Deliverable 1.2 – State of the Art Analysis of CROSSROAD, Crossroad consortium, online: http://crossroad.epu.ntua.gr/files/2010/04/CROSSROAD-D1.2-State-of-the-Art-Analysis-v1.00.pdf (last access 2011/06/11)

[5] OCOPOMO - Open Collaboration in Policy Development, see www.ocopomo.eu

introduced with a use case example in section 5. Section 6 concludes with some remarks on future work. A more detailed introduction to the project, its objectives and the overall approach is available in [26], [27] and at the project website[1].

2 Open Government and Good Governance

Open government aims to help governments to be more accessible and more responsive to their demands and needs. Open government is an essential ingredient for democratic governance, social stability and economic development. The principles of good governance stand for the basis upon which to build open government.

The concept of Good Governance describes „*the principles, approaches and guidelines for good governance and public administration to promote interaction and formation of political will with regard to societal and technological changes*" [6].

The European Commission (EC) set up the following five principles for Good Governance[6] (see also [11] and [20]):

- *Openness:* Ensure transparent process of decision-making and implementation.
- *Participation:* Degree to which affected parties are involved in the policy-making life-cycle[7].
- *Coherence:* Consideration of collateral effects on stakeholders caused by the policy.
- *Effectiveness:* Efficient delivery of quality outcomes. Policies have to be effective and established at the right time grounded on clear goals.
- *Accountability:* Roles and responsibilities should be clearly formulated and communicated.

Open Government aims to overcome the long-lasting culture of politics of secrecy where decisions were made without democracy and refers to public's right to know (cf. [16], [1]). A key principle of Open Government is Freedom of information (FOI) legislation that guarantees access to data held by the State. Many countries around the world have established FOI acts with the intention of establishing a system of transparency, public participation and collaboration [2]. The OECD argues three principles of Open Government [17]:

- *Accountability*: it is possible to identify and hold public officials to account for their actions;
- *Transparency*: reliable, relevant and timely information about the activities of government is available to the public;
- *Openness*: governments listen to citizens and businesses and take their suggestions into account when designing and implementing public policies.

Information and Communication Technology (ICT) has aided to disclose and disseminate information [21] and to contribute to implement Open Government.

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[6] European Governance – A White Paper. EC, COM(2001) 428 final, `http://eur-lex.europa.eu/LexUriServ/site/en/com/2001/com2001_0428en01.pdf` (accessed 23/03/2011)

[7] Policy-lifecycles (Agenda Setting, Policy formulation, Decision-Making, Policy Implementation, and Policy Evaluation) are e.g. described in [12] and [15].

The recent developments in innovative ICT solutions bear good potentials to implement the concept of Open Government and the principles for Good Governance. In the next sections, we present a concept and approach for such a solution, which focuses on simplifying regulatory impact assessment and which will be implemented in the OCOPOMO project.

3 Collaborative Scenario Building for Regulatory Impact Assessment

As already explained above, today's policy-making is challenged by dealing with increasing complexity. The citizens demand the implementation of the Good Governance principles to ensure Open Government. In the course of these developments, regulatory impact assessment (RIA) using foresight exercises such as scenario building received a significant boost in the development of policies and strategies (cf. [3], [7], and [8]).

3.1 Theoretical Background to Scenario Building for RIA

Most existing methods and tools for strategic planning and decision-making, which were successful in former more or less stable times such as time series analysis [23] or trend extrapolation [14], do no longer work out in the context of current increasing variety, interconnectivity and alteration as they are barely able to cope with dynamics and complexities. Only a few of them (i.e. Delphis and Scenarios) are robust despite an uncertain long-term future and successful despite a difficult socio-economic environment (cf. [23], p.73). Both, Delphis and scenarios are among a few methods applicable to very complex problem scopes with extra long-term projections into the future, and, hence, are applicable for governance and policy modelling. However, the iterative process of the Delphi technique is slow and very time consuming ([14], p.36). Thus, scenarios have been identified in the course of analysis in OCOPOMO as most suitable to establish an analytical background for policy decisions in the project.

Scenario building can be classified as a method for foresight. It is, therefore, a "*systematic, participatory, future intelligence gathering and medium-to-long-term vision building process aimed at present-day decisions and mobilising joint actions*" [8]. Scenario building is currently a very popular approach[8] as it is inherently flexible in terms of design and construction (cf. [7], [8], and [3]). Scenarios help stimulate different internally consistent alternatives of a specific situation and its settings concerning a specific policy issue [5]. With it, scenario building provides the opportunity to gather information and learn about the circumstances of a complex policy issue. Focus of scenarios in foresight exercises is on the identification and description of impact factors as well as on cause and effect interdependencies [23]. Kahn and Weiner explain that scenarios describe hypothetical possible (future) events, which might occur within an environment [13].

Besides, scenario building hardly grounds on literature review. It focuses on stakeholder involvement, instead. Scenarios are often built by groups of experts or stakeholders in workshops [1]. Hence, scenarios support the communication among the

[8] Several technology roadmapping projects funded by the EC (e.g. eGovRTD2020, PHS2020, ROADiBROM) used scenarios for envisioning the future.

participants thereby bringing down the level of conflict and facilitating cooperation. The participatory process can help build consensus as the different policy alternatives, and the consequences of those alternatives, are shared and discussed by all.

In this context, RIA founded by scenario building can contribute to achieve the Good Governance principles, if it is embedded in a well-designed process, which stimulates reflection and learning among all participants [10]. The next section, therefore, reflects stakeholder involvement through scenario building, which lays the foundation for the open collaboration in policy modelling aimed at in OCOPOMO.

3.2 Theoretical Background to Stakeholder Involvement for RIA

The OCOPOMO approach relies on modelling and simulation to express possible strategies and to investigate their potential consequences. Modelling is the process of abstraction that includes the analysis of the policy issue[9]. The model, on which the simulation will run in the end, should rely on evidence-based information. Evidence-based information can be gathered by applying several data collection methods and analyses such as literature review, interviews, workshops and scenarios. Moss states that "*eliciting the evidence requires the participation of stakeholders*" [18]. Further Richardsen and Andersen [21] stress the importance of group model building, and Kim [14] pointed out the meaning of developing shared mental models. Surveys with stakeholders, such as interviews or group discussions, are traditional approaches to gather the necessary information, which helps modelling how and why individuals and groups react under certain conditions. So, major benefit can be achieved through simulations that help understand the behaviour of complex systems over time. Table 1 gives an overview of popular techniques to gather information thereby outlining its strengths and weaknesses.

Table 1. Strengths and weaknesses of popular techniques for collecting data

Literature review	Interviews	Workshops / group discussions
→ Very useful to gather general information on the policy issue → Useful only with reservations when it comes to behavioural modelling especially social behaviour using e.g. statistics → Is not appropriate for stakeholder involvement.	→ Allow spontaneous adoptions and intervention through the interviewer in contrast to written surveys [7] → Necessitates transcribing of the data received in verbal form, which can be very time & effort consuming [7] → Subject to sentimental biases and influences	→ Allow embedding opinions into a social context [6] → The overall picture of a discussion can be slightly skewed through e.g. contrary opinions or dominant participants or only socially accepted answers [7] → Subject of a discussion process → The apparent efficiency of group discussions is qualified by increased efforts necessary for its organization and analysis [6]

[9] See Deliverable 1.2 of CROSSROAD – details in footnote nr. 4.

Interviews and workshops/group discussions can rather exploit their full potential in face-to-face meetings than in online consultations. Group discussions can be better adapted for online consultation than interviews can in particular as there are more advanced tools available that support online group discussion (e.g. discussion forums) than available for online interviewing.

From scenario exercises carried out in several technology roadmapping projects (e.g. eGovRTD2020 and CROSSROAD), we realised that participants feel comfortable with scenario building as it is easy for them to learn how to build scenarios. Scenarios are narratives understood in the language of participating stakeholders [4]. Therefore, people intuitively know how to build scenarios and feel familiar with the method as it allows them to use natural language. Besides, the method promotes the cognitive ability and sagacity of participants, and their ability to act. Scenarios may start from an actual problem, which is perceived as disappointing by a large part of the population and which must urgently be solved. The fact that superior resp. global policy issues (where people normally feel unconscious and powerless) are addressed with the aid of scenarios provides attraction to participants. Additionally there are several (sometimes controversial) scientific and/or political approaches to solve the problem. Breaking down influence factors makes participants see reason that one has the ability to start retail and cause long-term changes [23] although not everything - and also not at once - can be changed. This motivates people in particular to participate in building scenarios. Furthermore, the role of this structure of story-lines is to constrain the discussions and development of scenarios for wider discussion in a constructive manner.

For OCOPOMO the involvement of stakeholders through scenario building is, thus, crucial for a number of reasons:

- → scenarios are developed in a transparent and inter-subjective manner
- → scenarios are used as common reference points for policy modelling
- → all relevant information and data can be included in the scenarios in an unbiased manner
- → assumptions on developments expressed through the scenarios are shared
- → although agreement with the views of all relevant stakeholders is not necessary, reading the scenarios developed by others help to understand their viewpoints and therefore supports acceptability

Section 4 outlines the collaborative scenario building approach of OCOPOMO.

4 Collaborative Scenario Building in OCOPOMO

In OCOPOMO, we adopt the understanding of Piaget and Senge, who argue a scenario as a textual description (i.e., narrative, structured text) of a perceived view or understanding of a topic under discussion. A scenario may cover an existing world status or mental model of stakeholders (cf. Piaget and Senge cited in [14] on p. 30 and p.32). Alternative scenarios may exist or are developed to describe different aspects and /or alternatives stakeholders have in mind. Different stakeholder groups may develop different sets of scenarios independently (i.e., reflecting e.g. different mental models in scenario sets of different groups). Some of the scenarios may also be

conflicting among different stakeholder groups. Scenarios may be extended and therewith advance an existing scenario (nesting scenarios). Hence, scenarios as narrative texts enable stakeholders to express their views and concerns on potential policy decisions. For OCOPOMO, scenario building helps to identify conditions and circumstances of the policy under investigation in order to allow better handling of complexity and related uncertainty.

In OCOPOMO two different kinds of scenarios will be developed:

1. Evidence-based stakeholder-generated scenarios
2. Model-generated scenarios

The stakeholder-generated scenarios will subsequently inform simulation models to run alternative policy choices, i.e. to show potential real effects of alternative conditions and courses of action.

The results of the simulation run will generate scenarios to help better understand potential interferences or conflicts of positions of stakeholders, which help them to reflect their positions.

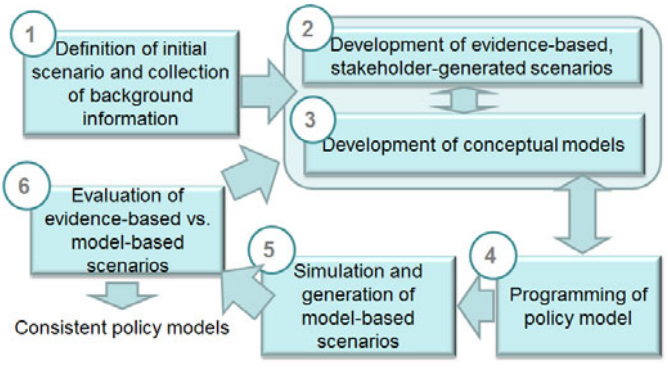

Fig. 1. Sketch of the OCOPOMO overall method including evidence-based user-generated and simulation-generated scenarios

Collaborative scenario building in OCOPOMO will be carried out in phases 1 and 2 (see Fig. 1). While in phase 1, an initial scenario is developed by the policy initiators with respective facilitators to start the discussion, scenarios in phase 2 are developed by stakeholders. Both, face-to-face scenario building workshops and a virtual common workspace for online scenario development are used. The face-to-face scenario building workshops are mainly used in phase 1 and at the beginning of the process in phase 2 to detail the policy issue and the objectives related to the policy issue with initiators of the policy process. The OCOPOMO project encompasses three use cases; hence, the initiators of the policy process are the Campania Region in Italy, the Kosice Self-Governing Region in Slovakia, and the Greater London Authority in UK. Each use case is tackling a specific policy issue (i.e., renewable energy in Kosice Self-governing Region; competence centres for knowledge transfer in Campania Region; and housing facilities in London). Face-to-face scenario building workshops already took place in order to formulate initial scenarios for all three use cases by the

initiators of the policy process. The initiators (policy owners) were supported by facilitators (i.e. policy analysts, policy consultants from the project team). This step is supported by the use of a common workspace.

As Fig. 1 indicates, the overall policy development of OCOPOMO continues in phase 3 with the development of consistent conceptual models of each policy case, the generation of formal policy models in phase 4, the simulation of the formal policy models and generation of model-based scenario texts (based on multi-agent simulation), and the evaluation of model-based vs. evidence-based scenarios. OCOPOMO foresees an iterative policy development process, as the simulation results may unveil insights into dependencies, discrepancies and inconsistencies in the narrative scenarios generated by the stakeholders, which have to be resolved in interaction with stakeholders and, hence, may lead to revisions of scenario descriptions in phase 2 until consistency is reached. How the relevant information is extracted from the scenarios and feeds modelling and simulation is shown in an example in section 5. For more details on the overall OCOPOMO policy development process, the reader is referred to [26] and [27].

In OCOPOMO, the initial scenarios of phase 1 will be published at the collaboration space thereby opening the scenario for viewing and manipulating by relevant stakeholders (see Fig. 2). The initial scenarios serve as starting point to involve different stakeholder groups via online means to collaboratively build scenarios. An invitation will be sent to the stakeholders informing them that they can express their views on the policy case via either further elaborating the initial scenario or by generating new (alternative) scenarios. When a scenario will be closed by the facilitator after a while, then affected users will receive information about this action. The same holds true for reopening a scenario after a policy modelling iteration (entering into phase 6). Scenario extensions and updates include the opportunity to rate the scenario and/or parts of it, as well as to discuss on the scenario. Online collaborative scenario building is supported by an adequate scenario generation tool, which shall help producing a narrative that provides the fundamental basis for policy model design.

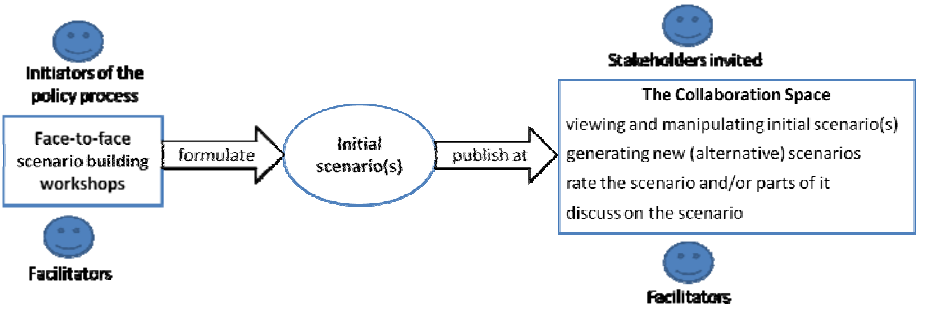

Fig. 2. Simplified depiction of the OCOPOMO evidence-based user-generated scenario building process

OCOPOMO aims to generate scenarios in order to represent different views of stakeholders in a sensible way, taking into account the goal of the modelling process and its structure, the available information and the computer facilities and available software. Ensuring traceability through the step-wise transformation of narrative scenario texts via the consistent conceptual descriptions (e.g. rule-dependency graphs, actor network diagrams, ontology, etc.) into formal statements (actor and facts descriptions, rule-descriptions) in e.g. java code is an important contribution to achieve open government and to implement the good governance principles (i.e., improving in particular openness, transparency, participation and coherence in policy modelling). In the next section, we exemplify a scenario and the extraction of relevant information for the policy simulation.

5 Scenario Example from OCOPOMO Use Case

Stakeholder groups will collaboratively develop scenarios for a strategic area of high interest for the three OCOPOMO use cases. Below, a scenario developed for the Kosice Self-Governing Region use case is presented. The policy to be developed regards investments in renewable energy to reduce dependency on energy import from other countries (especially gas from Ukraine) and reduction of energy consumption of households.

The scenario example reads as follows:

I am living with my wife and two children in a three room flat below the top of the house. The house, in which my flat is in, is not well insulated and, hence, has high consumption of energy for both electricity and heating. Since energy prices are increasing and the energy consumption in my house is very high, I am reflecting alternatives both to decrease consumption such as renovation and to switch the source of energy (if possible). Currently, I am recognising that energy consumption is too high and more and more becomes too expensive for me and my family. Hence, I want to reduce costs of energy consumption. For me who am living in a flat, the association of flat owners is responsible for energy issues, i.e. they have to perform energy audits by law. Citizens need to provide certificates on how efficient energy use is in the house (energy certificates and energy audits). I have to discuss with my family and neighbours. Together we can consult the association of flat owners for a plan to trigger renovation. The association of flat owners, then, calculates the impact of the renovation, the increased energy price and the reduced energy consumption for the future maintenance costs. Urban householders are obliged to create an association; rural houses are not. An association hires service company/building manager (on fee) who is a responsible for dealing with heat and electricity providers. An association may refuse to cooperate with a service company and make arrangements with heat provider on its own. An association itself can be member of a higher association. An association of associations is a board of directors, which e.g. talks with regional or even national governments.

Analysing and structuring the information from the scenario aims at identifying the main aspects relevant for a policy simulation, i.e. stakeholders (i.e. agents), model

objects, actions, relations and rules. The classes are derived from scenarios using an adopted version of the concept to integrate open collaboration in technology roadmapping developed by the authors, which is introduced in [1]. The subsequent example of analysis presented in Table 2 and Table 3 is by no means exhaustive – it is meant to exemplify the approach in a simple way within the scope of this paper.

From this analysis, conceptual models and formal policy models can be developed. Subsequently, simulation runs produce model-based scenarios, which represent audit trails of the individual rules fired along the simulation. This kind of scenarios is also exposed to the stakeholders in order to a) detect inconsistencies in stakeholder-generated scenarios vs. model-generated scenarios, which lead to revisions of the policy model; and b) understand potential implications of certain policy options, which help to make better informed decisions and reflect stakeholder concerns in decision-making of a policy (see the overall policy development process in Fig. 1).

Table 2. Data derived from scenario including class of agents, class of objects and characteristics

Class of Stakeholders	Class of objects	Characteristics
→ Households - *Flat owner* - *Flat mates* - *Neighbour* → Association of flat owners → Service company → Government - *Regional* - *National*	→ House (Flats) → Heating system → Energy audits → Message - *Demand* - Provide energy certificate - Perform energy audit	→ House - *Established in* - *Renovated in* - *Insulation* - *Electricity consumption* - *Heating consumption*

Table 3. Data derived from scenario including actions, rules and relations

Actions:	Rules:	Relations:
→ Flat owner - recognising - reflecting alternatives - decreasing consumption - switching source of energy - reducing costs - discussing with - consulting - creating an association → Association of flat owners - trigger renovation - calculating impact - hiring service company - perform energy audits	→ IF energy prices are high AND energy consumption is very high THEN flat owners reflect alternatives to decrease consumption AND/OR to switch the source of energy. → IF renovation is needed AND support is asked for THEN energy audit AND certificate are needed	→ being responsible for → living in → sharing flat with → providing certificates to → belonging to

6 Conclusions and Outlook

This paper presented an approach to collaborative scenario building, which is applied in OCOPOMO and which supports the realisation of open government and the good governance principles, as it fosters openness, participation, transparency and cohesion. The contribution explained in brief the overall process in which scenario building will be carried out. Involving stakeholders through scenario building in policy development has become a high priority to engage wider stakeholder groups in online and offline consultations (i.e. Open Government). In order to engage stakeholders in the policy modelling process (i.e. regulatory impact assessment through agent-based modelling), we have presented a concept for open collaborative scenario building via online means to evidence-based modelling and simulation. We have investigated different methods to collect data and have assessed them in how far they are useful to be deployed in a comprehensive concept for policy modelling as depicted in Fig. 1.

From a scientific point of view, collaborative scenario building can help validating and evidencing the policy model and simulation results. In this context, the integration of open collaboration among key stakeholders (such as policy analysts, policy operators, wider interest groups of specific policy domains, etc.) ought to be facilitated by using online means. Supporting the participation of external experts and designated stakeholders, as well as the collaboration between the analysts internal to the project helps improving quality of results.

For this purpose, a respective toolbox for collaborative scenario building and policy modelling will be developed in OCOPOMO (see [26] and www.ocopomo.eu). This toolbox aims at helping to understand, model, simulate and validate the next generation of public policy formulation (see Fig. 1).

Besides the toolbox development, the process of transforming scenarios into formal models will be investigated and detailed in order to close the gap between scenarios and the simulation model (i.e. supporting the transformation process and integrating stakeholder-generated scenario development with formal policy modelling using agent-based simulation).

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Open Government Data: A Stage Model

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Abstract. Public sector information constitutes a valuable primary material for added-value services and products, which however remains unexploited. Recently, Open Government Data (OGD) initiatives emerged worldwide aiming to make public data freely available to everyone, without limiting restrictions. Despite its potential however there is currently a lack of roadmaps, guidelines and benchmarking frameworks to drive and measure OGD progress. This is particularly true as proposed stage models for measuring eGovernment progress focus on services and do not sufficiently consider data. In this paper, we capitalize on literature on eGovernment stage models and OGD initiatives to propose a stage model for OGD. The proposed model has two main dimensions, namely organizational & technological complexity and added value for data consumers. We anticipate the proposed model will open up a scientific discussion on OGD stage models and will be used by practitioners for constructing roadmaps and for benchmarking just like the European Union stage model is currently used for measuring public service online sophistication.

Keywords: Stage model, open data, eGovernment, data integration.

1 Introduction

Public sector produces, collects, maintains and disseminates a wealth of information. Governments all over the world realize that "*within the exercise of its public tasks, the public sector collects, processes and disseminates huge quantities of information*" [1]. Examples include maps and satellite images, legislation and case-law, statistics and company, population and patent registers [2]. In Europe, "*public bodies are by far the largest producers of information*" [3].

The availability of this information (government data onwards) in easily accessible digital format makes it possible to re-use it and combine it with other digital content to create new added-value services and products. Examples include navigation services, real-time traffic information, weather forecasts e.g. sent directly to mobile phones and credit rating services [2]. It is widely recognized that such data-based, added value services and products increase government transparency, improve public administration's function, contribute to economic growth and provide social value to citizens [4] [5]. They generate new businesses and jobs and give consumers more choice and more value for money [2].

The value of the government data market in the European Union (EU) is estimated having a mean value around 27 billion Euros [5]. More than a decade ago the

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European Commission recognised the potential of exploiting this information to boost economic activity and job creation [3] [6] [7]. At the political level, the European Parliament and the Council have launched a Directive on the re-use of government data [1]. Therefore, government data constitutes a valuable asset for both society and economy and as a result governments have a mandate to enable and facilitate data consumption and exploitation by both citizens and businesses.

Nevertheless, problems on government data re-use such as lack of information on available data [2] or the need to bring some order to the mass of data produced [8] still exist. A recent evaluation of the European Directive underpins a number of barriers towards the full exploitation of government data [2]. Things seems better in USA where re-use is strongly encouraged [2] however even there the potential of government data has not been fully exploited.

This situation seems to change in the last couple of years, where a large number of governments worldwide started to massively make data available on the Web. This *Open Government Data* (OGD) movement follows the Open Data philosophy suggesting making data freely available to everyone, without limiting restrictions. One of the main tenets of OGD is that government provides data and then private parties built added value products and services that provide interactive access for the public [9]. A recent study however has shown that current OGD initiatives employ different approaches for providing data and exhibit important limitations such as data duplication [10].

It is therefore evident there is a lack of roadmap guidelines to set clear objectives for next steps and benchmarks and measure progress. This is particularly true, as the various stage models developed during the last decade for measuring the progress of eGovernment development do not seem appropriate for OGD. Indeed, these models often consider online information provision as the lowest stage in eGovernment development while the higher stages aim at enabling online transaction and providing sophisticated online services through governments transformation [11], [12], [13] and [14]. Apparently, the existing eGovernment stage models are not capable of describing the increasing OGD movement.

The objective of the paper is to supplement the existing eGovernment stage models by introducing an *OGD stage model* aiming at *(a)* providing a roadmap for open government data re-use and *(b)* enabling evaluation of relevant initiatives' sophistication. To this end, we review existing eGovernment models in order to identify how they deal with government data provision and also OGD literature in order to identify characteristics and limitations of current initiatives.

The remaining of this paper is organized as follows. In section 2 we outline important issues that should be taken into consideration in government data provision. Section 3 presents the review of eGovernment stage models as well of OGD models. In section 4 the OGD stage model is presented. Finally, in section 5 conclusions are drawn and future work is presented.

2 Considerations for Government Data Re-use on the Web

As already mentioned, the Open Government Data (OGD) movement aims to unlock public information to enable re-using it and combining it with other digital content to create new added-value services and products. However, there are a number of important

challenges for realizing this aim. These include legal issues, such as those relevant to data privacy and protection, cultural issues, e.g. related to politicians and public servants, and socio-technical issues related to organizational and technological challenges. In this paper, we concentrate on the latter issues particularly those related to enable re-using government data including combining it with other open data on the Web.

Government data is produced, collected, stored and disseminated by public agencies. Each agency manages data according to its mandate. The issues related to re-use of government data would be much easier resolved from an organizational perspective, if public agencies (a) were totally independent from each other and (b) were managing different data from those managed by other agencies. However, in the public sector none of these two conditions is true.

On the contrary, agencies formulate hierarchical structures that contain a number of administrative levels. Thus, agencies have in their responsibility and sometimes control other agencies, i.e. those belonging to a lower administration level. In addition, the public sector is organized in functional areas, such as education, health etc. This decentralized organizational structure of the public sector suggests that in certain cases public agencies in different administration levels and different functional areas produce, maintain and possibly disseminate similar data i.e. data about similar real-world objects or problems. This situation results in a number of challenges regarding data quality. In particular, it is possible that the disseminated data is incomplete, controversial and/or obsolete.

At the same time, the Web is moving from a model of connected documents to a model based on the connections between real-world objects and data describing these objects [15]. In this context, a number of Web sites and platforms opened up recently their data. Examples include Facebook's Graph API[1], Twitter's RESTful API[2], the semantically enabled Google's Rich Snippets[3] and also the Linking Open Data project[4], which realized the provision of Linked Data from a number of Web sources such as Wikipedia. Linked Data aims to extend the Web with a data commons by creating typed links between data from different sources [16].

Government data is part of this ongoing evolution of the Web and thus it should be combined and integrated with other open data on the Web in order to allow for added value services. To this end, both governments and private sector are expected to develop the necessary technological infrastructure and establish the appropriate organizational processes. Governments could be involved and play an important role in this process because they own the data and thus can understand it better than third parties.

3 Related Work

In this section we review eGovernment stage models as well as Open Government Data (OGD) models. We analyze all proposed dimensions and stages but particularly

[1] http://developers.facebook.com/docs/reference/api/

[2] http://dev.twitter.com/doc

[3] http://googlewebmastercentral.blogspot.com/2009/05/introducing-rich-snippets.html

[4] http://www.w3.org/wiki/SweoIG/TaskForces/CommunityProjects/LinkingOpenData

concentrate on organizational & technological complexity and data integration considerations due to the analysis presented in the previous section.

3.1 eGovernment Stage Models

During the last decade, a number of models and schemes have been suggested by international organizations, consulting firms and researchers in order to provide a roadmap for eGovernment development and to enable evaluation of relevant initiatives. The European Union [17] proposed a five-stage maturity model in order to enable benchmark and rate "governments' service delivery processes". The stages included in the model, which are described based on maturity and sophistication, are the following: information, one-way interaction, two-way interaction, transaction and finally targetisation. Layne and Lee [11] in order to describe different stages of eGovernment development introduced a "stage of growth model for fully functional eGovernment". This model comprises four stages, namely cataloguing, transaction, vertical integration and horizontal integration. These stages are explained in terms of organizational and technological complexity as well as different levels of integration. Deloitte Research [18] described the stages that a government will pass as electronic service delivery evolves. The aim of this model was to identify the key issues governments need to resolve to make this moving successful. The proposed model includes six stages, namely information publishing/dissemination, official two-way transactions, multi-purpose portals, portal personalization, clustering of common services, full integration and enterprise transformation. Deloitte Research described the model using two axes: the eminence of web-based applications and the degree of enterprise transformation. eGovernment transformation was described by West [19] using four stages, namely the bill board stage, the partial service delivery stage, the portal stage, including fully executable and integrated service delivery, and interactive democracy including public outreach and accountability enhancing features. West's aim was to provide a tool to researchers to determine an agency's progress based on how far along they are at incorporating various web site features. To this end, he studied more than 1800 government websites in the United States and carried out a survey involving chief information officers in different state and federal agencies. Based on Layne and Lee's model, Andersen and Henriksen [20] proposed a progressive growth model for eGovernment. Here, the key dimensions are the degree of activity-centric websites and processing of end-users information and service requests. The first phase of the model is cultivation, which shelters horizontal and vertical integration within government, limited use of front-end systems for customer services and adoption and use of Intranet within government. The next phase is extension that involves extensive use of intranet and adoption of personalized Web user interface for customer processes. Phase three is maturity where the organization matures and abandons the use of the intranet, have transparent processes, and offers personalized Web interface for processing of customer requests. The last phase is revolution characterized by data mobility across organizations, application mobility across vendors, and ownership to data transferred to customers. In this phase, the employees' actions can be traced through the Internet and there is information available online about progress in, for example, case handling. The Center for Democracy & Technology [21] suggested a model to divide the process of eGovernment implementation into three independent phases. These phases do not need one phase be completed before another can begin. The first one is publish, i.e.

using ICT to expand access to government information, the second is interact, i.e. broadening civic participation in government, and the last one is transact, i.e. making government services available online.

Table 1. Review of eGovernment stage models

	Dimensions	Stages
Andersen and Henriksen [20]	Degree of activity-centric websites and processing of the end-users information and service requests	Cultivation, extension, maturity and revolution.
Center for Democracy & Technology [21]	n/a	Publish, interact and transact.
Deloitte Research [18]	Eminence of web-based applications and the degree of enterprise transformation	Information publishing, two-way transactions, multi-purpose portals, portal personalization, clustering of common services, full integration and enterprise transformation.
European Union [17]	Maturity and sophistication	Information, one-way interaction, two-way interaction, transaction and targetisation.
Layne and Lee [11]	Organization – technological complexity and different levels of integration	Cataloguing, transaction, vertical integration and horizontal integration.
Lee [14]	Citizen/service and operation/technology	Presenting, assimilating, reforming, morphing and eGovernance
Siau and Long [13]	Time/complexity/integration and benefits/costs	Web presence, interaction, transaction, transformation and eDemocracy.
West [19]	n/a	Bill board, partial service delivery, portal stage (with fully executable and integrated service delivery) and interactive democracy.

In addition, work has been also carried out aiming to compare and synthesize eGovernment models. For example, Siau and Long [13] developed a five-stage model to synthesize eGovernment stage models of that time so that to create a common frame of reference for researchers and practitioners in the area. This model is described in terms of time, complexity and integration as well as benefits and costs. More specifically, according to this model time spending, system complexity, integration, benefits and costs all increase with the advancement of eGovernment. The model proposed consists of five stages, namely web presence, interaction, transaction, transformation and eDemocracy. Finally, Lee [14] also compared existing eGovernment development models in order to identify a common frame of reference across different stage model. This framework comprises two dimensions, namely citizen/service perspective and operation/technology perspective and five stages, namely presenting, assimilating, reforming, morphing and eGovernance.

Table 1 summarizes the review of the existing eGovernment stage models. As regards the dimensions utilized for describing the model the majority of the works include dimensions related to socio-technical issues such as technological complexity, organizational complexity, enterprise transformation etc. As regards the description of data provision the majority of these models consider it as the first stage in eGovernment development.

3.2 Open Government Data Models

Recently, Kalampokis et al. [10] proposed a classification scheme for Open Government Data (OGD) and identified four generic classes that could describe all relevant initiatives. To this end, the authors analyzed 24 recently launched OGD initiatives around the globe and studied relevant practical models such as the five-star model of Tim Berners-Lee [22] and W3C's three step model [23]. This study revealed some interesting characteristics of OGD initiatives with regards to the employed technological approaches as well some limitations that current initiatives present.

In particular, current OGD initiatives use the following main technological approaches for publishing their data:

- Making data available of the Web as downloadable files in well-known formats such as PDF, Excel, CSV, KML, XML, JSON etc
- Making data available of the Web as Linked Data through RESTful APIs and/or SPARQL search interfaces.

The majority of the existing initiatives fall into the first technological approach while only three to the second, namely Data.gov.uk, Data.gov and "Catálogo de Datos de Asturias".

In addition, the study concluded in some limitations that many current OGD initiatives present mainly because of the followed organizational approach. In particular, in 18 out of the 24 initiatives the OGD portal re-publishes data sets that a public agency has already published in a different place on the Web. This approach results in data duplication and in problems related to maintainability and accuracy of the provided data. Some initiatives try to overcome this issue utilizing an indirect approach for providing data (i.e. they publish references to the actual data sets published by the different agencies in a decentralized way) however this approach impedes data integration.

4 The Stage Model

The proposed stage model comprises four stages as depicted in Fig. 1. The aim of the model is two-fold: first to provide a roadmap for open government data re-use and second to enable evaluation of relevant initiatives' sophistication. In Fig. 1, the vertical axis presents the technological and organization complexity that is involved in the provision of the data while the horizontal axis presents the capability of developing added value services based on the provided data. In this section, we describe the four stages of the proposed model.

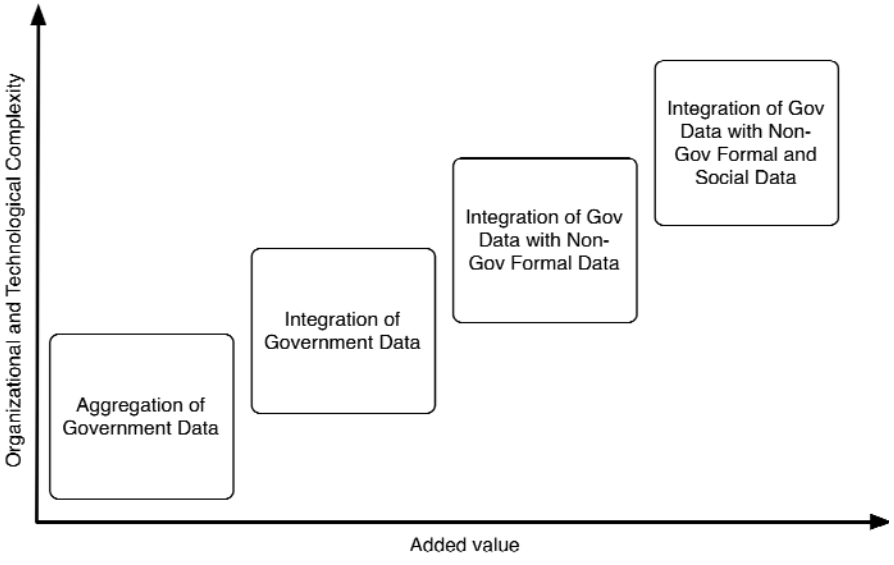

Fig. 1. The Open Government Data Stage Model

4.1 Stage 1: Aggregation of Government Data

This stage includes opening up data, publishing data online for others to re-use and, possibly, aggregating data provided by different sources. The main concern of public agencies in this stage is to easily and quickly make their data available online. Different agencies can publish their data employing different technological solutions and following different implementation details. This stage may also include data aggregation in a single website like the recently launched OGD portals. We use the term aggregation here to indicate that data is simply gathered and provided together from a single point of access.

In this stage, public agencies have to overcome a number of organizational, cultural and legislative barriers. In the case of European Union, the ultimate goal of the Directive on public sector information re-use is for all member States to overcome these barriers and hence provide their data online for anyone to re-use.

From an organizational perspective, open data at this stage can be provided in one of the following ways:

- The public agency publishes the data sets on its website or on the website of a higher-level agency.
- The public agency forwards the data set to an OGD portal that publishes the data.
- The public agency publishes the data sets and the OGD portal provides links to the actual data sets along with metadata.

From a technological perspective, the following approaches are possible according to the analysis presented in sub-section 3.2:

- Publish downloadable files in well-known formats such as CSV, XML, KML etc.
- Publish data using the linked data paradigm but without caring about linking to other data sets.

The main benefit of this first stage is that the public gains access to a wealth of valuable data. This data can be used for the development of new added value services. However, at this stage, governments do not consider a number of limitations that could impede data use and re-use. Actually, data is available as provided by agencies and thus it is not possible to automatically search across data provided by different agencies or combine them in order to create value-added services and products. According to the analysis presented in Section 2, these limitations are related to data duplication and data freshness, data formats that facilitate re-use, complete metadata, linking to other data sets etc.

As a result, at this stage data consumers need to be involved in a time and effort consuming process in order to overcome these limitations and use the provided data. This process could include the identification of all sources that provide data related to a specific real-world problem, assess the accuracy of the data, fuse the identified data sets, transform the data to the appropriate format, identify other data sets that could add value to the solution and integrate them with the initial ones.

Based on [10], in which a significant number of OGD initiatives were analyzed, we deem that the majority of the existing OGD initiatives fall into this stage. An indicative example of government data provision in this stage can be given by Data.gov.uk where data on criminal statistics is provided both in the Ministry of Justice website[5] and the central access point[6] where in the latter an outdated version of the data exists.

4.2 Stage 2: Integration of Government Data

This stage includes government data integration across public administration. The analysis of Section 2 presented a number of government data provision challenges that emerge from the decentralized structure of public administration. These challenges emerge when different agencies in different administrative levels and functional areas provide data about the same real-world problem since this data can be incomplete, controversial or obsolete.

The most important benefit of this stage is the provision of a unified view of government data that comes from different sources. In addition, it is expected that integrated government data will be complete and concise: complete suggests no specific object is forgotten; concise suggests no object is represented twice and data is without contradiction.

Government data integration is a very challenging task that includes significant technological and organizational issues. As regards the technological issues, governments should provide their data in specific formats that enable and facilitate integration on the Web. At the moment, Linked Data seems to be the most promising approach towards this direction. Thereafter, governments should decide on the architectural approach to follow (e.g. central repositories or federated queries). Other

[5] http://www.justice.gov.uk/publications/criminalannual.htm
[6] http://data.gov.uk/data set/criminal-statistics-england-and-wales

technological issues involved in this process are data schemas standardization, identifiers standardization, etc. With regards to the organizational issues, governments should establish business processes that prevent data re-publishing from different agencies, ensure in-time publishing and enhance data accuracy. Decentralized data provision could be a solution towards this direction i.e. every public agency to disseminate only the data that has the mandate to manage.

This type of integration will enable data consumers to execute more complex queries on top of the integrated data. A simple question that could be easily answered at this stage would be "Which governmental points of interest are located on a specific area?"

Although the final goal of this stage is to provide integrated government data across every public agency, it is more possible partial integration to take place in the beginning. These initial efforts can be developed around real-world objects or specific real-world problem related queries. We can deem that this is the case in Data.gov.uk where partial integrated data is provided around specific real-world object such as schools, bus stops, members of parliament, geo-locations etc. In these initiatives linked data technologies are employed and also links have been established between data sets provided by different public agencies such as Ordnance Survey, the Ministry of Education and the London Gazette.

4.3 Stage 3: Integration of Gov Data with Non-Gov Formal Data

Government data can be characterized as formal as it is published by a highly trustworthy source. Data consumers assume that data published by governments is always accurate and reliable. However, many non-governmental sources also provide formal data on the Web in structured formats that allow for re-use. In this category we could encompass DBpedia[7], which is the linked data version of Wikipedia, and Data.nytimes[8], which is the New York Times' linked open data set. Although the former is a social platform, users' participation ensures that the provided information is objective, accurate and unbiased. This sort of sources provides data about real-world things such as organizations, people and locations as well as subject descriptors such as "greenhouse gas emissions".

The integration of government data with this non-government formal data defines the next stage of the proposed model. This type of integration will enable the provision of richer information to data consumers and will allow for more complex queries answering. A simple use case that will be enabled by this stage could include the identification of news posts that refer to public agencies or politicians connected to high expenditures in the governmental budget reports.

The implementation of this stage increases both organizational and technological complexity that should be overcome by governments and third parties. As regards the former, possible conceptual integration points between government and non-government formal data should be identified. These integration points will define use cases that could add value to data consumers. Thereafter, relevant government data sets and sources of non-government formal data should be identified and the required

[7] http://dbpedia.org
[8] http://data.nytimes.com

technological and organizational connections that will enable data integration should be established. Taking into account that Linked Data is the most advanced technological approach in government data provision, the technological requirements of this stage would be the establishment and maintenance of links between government and non-government data sets. In addition, richer metadata should be included in order to describe these links and these data sources.

4.4 Stage 4: Integration of Gov Data with Non-Gov Formal and Social Data

The final stage of the proposed model covers the integration of government data with not only non-government formal data but also social data on the Web. We define social data as data that is created and voluntarily shared by citizens through social media platforms such as Twitter and Facebook. This sort of data is differentiated from government data and non-government formal data because it mainly communicates personal opinions, beliefs and preferences.

This type of integration will allow for new innovative services in which government data will provide a context of interpretation for social data. In particular, it will enable governments to consider citizens' opinion expressed through social media in governmental decision-making processes; it will further allow citizens to deliberate in social media about public administration related real-world things such as laws and public agencies in a more explicit manner.

For example, at this stage governments and citizens will be able to answer questions such as "What is the opinion of citizens affected by a specific law about this law?" In addition, governments will be able to understand public sentiment on specific decisions by analyzing integrated government and social data and thus take corrective actions that would alleviate the foreseen reactions.

Social data is streamed in large quantities every second, mainly through social networking platforms such as Twitter and Facebook. Taking into account the fact that social data is highly dynamic and unstructured, we understand that this type of integration introduces additional technological and organizational requirements. It should be also noted that we do not expect permanent links to be established between government and social data in this type of integration. Nevertheless, the appropriate mechanisms to allow and facilitate this type of integration should be established.

The additional complexity related to this stage could be better described by a real-world case. A very popular attribute of social data that enables personalization is the location from which a message is published online. This attribute could be the "joint point" for different government and social data sets. However, the format and granularity of data describing locations can vary between different data sets. For example, although Twitter adds the longitude and latitude of a point to tweets posted by mobile applications, Ordnance Survey in the UK does not provide a service for mapping a specific point to an administrative area in order a linking between these to representations of a geo-spatial object to be enabled.

5 Conclusions and Future Work

The public sector produces, collects, processes and disseminates a large amount of data. These can be re-used and integrated to create new value-added services and

products with potentially significant impact in global economy. Recently, Open Government Data (OGD) initiatives emerged worldwide aiming to unlock public sector data, aggregate them and make them available through one-stop access points. These initiatives however are lacking a roadmap to provide guidance and an evaluation framework to assess progress.

In this paper we present a stage model for OGD. The model capitalizes on stage models proposed to measure the development of eGovernment. Unlike these models however where focus is on service provision the proposed model's focus is on data integration. The model consists of two main dimensions, namely organizational & technological complexity and added value for data consumers. The model includes four stages, namely aggregation of government data, integration of government data, integration of government data with non-government formal data and integration of government data with non-government formal and social data.

The proposed model can be used by researchers to further study OGD roadmaps and evaluation frameworks. It can be also used by practitioners as both a roadmap and a framework to evaluate progress.

Future work in the area is envisaged in a number of directions. First, current OGD initiatives will be thoroughly studied to identify important data sets for each stage of the model to be identified. This will enable better understanding the current state of play in the area and to set future targets. These important data sets could be also applied in the same sense that the European Union defined "20 basic public services" to measure eGovernment's sophistication. Second, each stage will be thoroughly studied in terms of organizational barriers and technological solutions. Here, we envisage building one or more reference IT architectures and prototype implementations for each stage.

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Enrolling Local Strategic Actors in Public Portal Development

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Abstract. This paper focuses on the seemingly routine but essential aspects of network formation by actors in an E-government context. A qualitative case study is used to explore portal development in public healthcare. The theoretical framework applied is Actor-Network Theory (ANT). The research question is: What factors contribute to the enrolment of strategic local actors in technology development in E-government? The results of the study show that the basic functionalities are of strategic importance for the enrolment of local actors in the portal development and its use. These functionalities act as *enrolment devices*. In complex environments, critical success factors for network formation require local support based on present usefulness of the functionalities and on long-term project organization that safeguards their future development.

Keywords: Portal, development, healthcare, Actor Network Theory, enrolment.

1 Introduction

The development of E-government systems is a complex and challenging endeavour since it involves many actors and many logics. From both a practical as well as a research perspective, successful network formation in E-government development by actors is therefore of particular interest [2, 12, 14, 23, 30]. This paper uses a qualitative case study of national healthcare portal [11] development to investigate the reasons for the success or failure of network formation in the complex political context of E-government. The paper's focus is the development of a national Swedish public healthcare portal in which various local county councils are involved in the development of the portal. Thus, this is a process case study of technology development in an E-government context [33].

The context of the case study is a Western country where there is significant public funding of healthcare and where there is very high Internet usage by the general public. Although the main actors are the semi-autonomous government entities (the county councils), national government authorities and other organizations are also involved. The success or failure of the portal is judged based on its use by healthcare users and by the support it receives from the county councils.

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A theoretical framework is required in order to examine the development of a national healthcare portal in the context of E-government where there are many actors and many logics. Stakeholder analysis [29] is one possible framework for such a study since it considers the diversity of actors and their interests. However, the focus of our study is not the appearance of different interests *per se*. Instead, our focus is the specific actions and opinions of actors in the portal development that precedes enrolment [4] by a certain group of strategic local actors (the county councils). Therefore, an alternative framework for this study, and the one we have chosen, is Actor-Network Theory (ANT). According to an influential article [14], ANT is an excellent framework for understanding the politics of E-government project trajectories. Our paper thus contributes to E-government research with specific reference to those studies that use ANT [14, 26, 30, 33, and others]. The research question is: *What factors contribute to the enrolment of strategic local actors in technology development in E-government?*

2 Previous Studies

There are a few E-government studies that use ANT as well as some related studies of technology development in healthcare that use ANT. One study uses the concept of symmetry in ANT to examine the use of technology in the context of national border controls [31]. This study concludes that since people (the social aspects) and goods (the technological aspects) have several very similar problems in this context, symmetrical analysis is appropriate. Another study suggests that an ANT analysis of processes in the public sector is an excellent way to understand project trajectories and network formation and to distinguish between global actors and local actors [14]. These authors recognize the emergent power of actors as a central tenet in such processes, determining their success or failure. In a similar vein, in its focus on global and local actors, another study finds the latters' interests are much weaker than the formers' interests [23]. The subject of another study is the organizational outcome of an online analytic processing tool in a municipal environment [16]. This study focuses on the successive enrolment of diverse groups of actors within the organization as well as on the modifications of their perceptions of the system. Another study presents an ANT analysis of actors and objectives when citizens use a Decision Support System in pension reform as a part of an attempt to influence their behaviour [26]. To a limited extent, two studies propose the use of ANT in an E-government case context [1, 12]. Lastly, one study looks at contextual dynamics in health information systems in public healthcare with a focus on the dynamics of the elements of content and context [6]. This study tests a particular methodological approach by focusing, structuring and presenting the case study based on process events.

With one exception [31], these studies focus on broad development processes and the network formation of actors in E-government. However, none of these studies examines the particularities of the enrolment of one (strategic) group of actors other than the key dominating actors in the initial stage of a translation process [13]. Our aim is to use ANT as an approach to investigate factors that contribute to the enrolment of strategic local actors in a process of technology development in E-government. Thus, similar to the approach taken by the authors who explore an event-based network [6], our study tests a specific research approach in its exploration of the role of local strategic actors in network development.

3 Theoretical Framework

The theoretical framework for this study builds on ANT, the sociology of translation and the concepts of *problematisation, interessement* and *enrolment* [4]. While ANT is a continuously developing theory that emerged in seminal texts [4], there have also been relatively recent contributors [5] and [8]. This paper uses this framework by applying certain concepts to a process in a specific field of praxis (the process by which an E-government system develops). Next we present a brief account of these concepts.

The classic ANT study, involving scallops, fishermen and researchers in St. Brieuc Bay, France, presents a simple but telling account that introduces important concepts [4]. The study describes how certain actors (the researchers) attempted to enrol or align other actors (scallops and fishermen) in a process with the objective of ensuring the survival of the scallop industry. To that end, the researchers recommended the use a towline to grow the scallops. The towline is the *enrolment device* in this process in which *problematisation* is the first phase. The researchers identify themselves as indispensable resources for the solution to the problem they defined; the scallops' and the fishermen's roles are defined more generally. Thus, the initiators (the key actors) identify themselves, in terms of ANT, as an *obligatory passage point*. All actors have to pass that point in order to reach a solution.

In the second phase, *interessement*, initiators try to convince other actors that the previously defined ideas match their own interests. The concept of *interessement* etymologically is related to the notion of being in between (inter-esse), that is, of being interposed. According to [4], actors may be defined in other, more competitive ways. However, by building devices for use by the actors and their allies, initiators shape their identities. This phase consists of trials of strength whose outcome determines the solidity of the previously defined solution. Incentives are also created for actors to enlist their support. 'Interessement is the group of actions by which an entity attempts to impose and stabilize the identity of other actors […]. Different devices are used to implement these actions' [4, pp. 207–208]. Put simply, the *enrolment devices* may be different artefacts, such as the towlines in the scallops study. They may also be IT systems.

The third phase is *enrolment*. In this phase, alliances of actors form around the proposed solution. In some studies [19, 4] actors achieve enrolment when they persuade other actors to act in accordance with their own intentions. The author of the scallops study, in which enrolment was unsuccessful (the trapping device of the towline failed) concludes: 'Interessement achieves enrolment if it is successful. To describe enrolment is thus to describe the group of multilateral negotiations, trials of strength and tricks that accompany the interessements and enable them to succeed' [4, p. 211].

We apply the concepts of *problematisation, interessement* and *enrolment* in this study of portal development in healthcare. Since we made our case study between November 2008 and February 2009, consideration of the new technology planned for introduction in 2010 is not applicable in this paper.

4 Method

This is an interpretive single case study [18] based on the theoretical framework of ANT. Our motivation for the choice of this approach was our intention of filling the gap created by the lack of empirically rich process studies in E-government research [33]. Therefore we needed to collect a rich body of qualitative empirical data.

Interviews were our first research strategy. We began with a search for actors who were associated with the creation of a network for portal development in healthcare. In order to identify the larger network of such actors, in March 2007 we interviewed the manager of a Swedish public development organization–*Sjukvårdsrådgivningen SVR AB* (Health Advice Online Ltd.). Thereafter we interviewed actors whom other actors had identified as important for our research. We conducted 18 face-to-face, semi-structured interviews (60-90 minutes each). Eight of these interviews were with representatives of Health Advice Online Ltd. that managed the portal development. We also conducted interviews with officials at the Swedish Association of Local Authorities and Regions (SALAR) who represent the county councils, the SALAR commissioning agency entitled the National Centre for Coordinating e-Health, six representatives from two of the largest county councils (Stockholm and Västra Götaland) and a Carelink representative. Carelink is the second public development organization involved in the portal development. These interviews dealt with the activities, actors, intentions and technologies that were relevant to the development of a national healthcare portal.

We also conducted a second set of interviews. From November 2008 to February 2009 we held semi-structured telephone interviews (30-60 minutes each) with 20 of the 21 county council project leaders who had been recently appointed (January 2007 to December 2008). For technical reasons, we were unable to interview the 21st county council project leader. These leaders had the task of coordinating the regional activities required for the connection to the national healthcare portal. In our opinion, owing to their positions and their broad healthcare and technology experience, these leaders were well situated to present valid commentary on the development process. In these interviews we focused on the *interessement* phase and the activities related to the *enrolment* of the county councils. We asked about the current and future technological functionality of the new portal, local activities, and meetings in the development process and about interviewees' views of the process. We were especially interested in hearing the project leaders' comments on the pros and cons of the new portal and the critical success factors by which they evaluated it.

According to plans, the launch of the portal was scheduled for the autumn of 2010. As our study was made prior to the launch, there were no healthcare users to interview on their reaction to the portal.

Our second research strategy was the examination of relevant documents that dealt with the gradually evolving ideas about the purpose and use of the portal. We had access to public policy process reports on healthcare and IT, policy documents describing the functional requirements of the proposed portal, as well as strategy documents and evaluations produced by SALAR.

Our third research strategy dealt with the study of the relevant technology. We examined the technologies ("devices") that the actors described as featuring in the portal development. We used documents and interviews as data sources for examining

these technologies. We also analysed this data in order to create a theoretically informed overview of the *problematisation* phase that focuses on identification of the problem and its solution (see Section 5.1) and of the *interessement* phase that focuses on activities and opinions that preceded the enrolment of the county councils (see Section 5.2). Our main goal was to summarize and interpret the county councils' reasons for their enrolment in the development of the healthcare portal (see Section 6).

5 Case Description

5.1 The Problematisation Phase

To understand the *problematisation* phase, it is important to understand that most healthcare in Sweden is publicly financed. National authorities regulate Swedish healthcare by setting principles and guidelines although the 21 local county councils are responsible for managing and providing the actual care. Independent political bodies govern these councils that have the right of taxation. In this section we explain the *problematisation* phase of the national healthcare portal development. This is the phase when prominent actors assume their roles, a problem is identified and a solution is proposed.

In the 1990s some activities in Sweden at the national government level concerned IT infrastructure in healthcare [21], but no legislation was passed related to the issue. The interest among the county councils in the issue varied greatly. In 1998 a national public healthcare portal (Infomedica.se) with information about illnesses, treatments and patient rights was launched by one regional agency and two national agencies– SALAR and Apoteket (the Swedish national pharmaceuticals retailer). Following that launch, various prominent national actors created a national IT strategy for healthcare that was introduced to the public in March 2006. One of its aims was the development of a national healthcare portal for the provision of information and services to healthcare users [22].

SALAR's new national commissioning agency for healthcare managed the follow-up activities. The development organization, Health Advice Online Ltd., announced that the portal must provide the following [15]: (1) Textual information about 'children', 'pregnancy', 'sex' and 'illnesses', with both national and regional texts, including choices and a waiting-time guarantee; treatments, available at the national and regional levels; drugs available at the national and regional levels; and user rights concerning the waiting-time guarantee, choices and patient committees; (2) Facilities that offer online health tests and self-help therapy; (3) An advanced facility for searching for regional healthcare providers; (4) A national facility for comparing waiting times for county councils' healthcare centres with direct connections for information about illnesses/treatments and waiting times; (5) A forum for asking questions; (6) Individual interactive e-services for making/changing appointments, renewing prescriptions, requesting copies of electronic patient records, contacting healthcare personnel, and requesting tests and test results. All these functions had to be protected by passwords.

In June 2007 the SALAR commissioning agency assigned Health Advice Online Ltd. the task of developing a national healthcare portal in a "version 0.5" and a complete 1.0 version [7]. The formulation "version 0.5" referred to a functionality called *Mina Vårdkontakter* (My Health Contacts) for individual e-services that was introduced previously by the Stockholm County Council. During the spring of 2008 nearly all the 21 county councils employed project leaders to work on the activities necessary for linking their websites to the national portal. In July 2008, after the bidding process for the contract concluded, an external company was selected to perform the technical development work for the new portal.

5.2 The Interessement Phase

At this point, the *interessement* phase of portal development could begin. During this phase national actors worked directly with the development project. Previously, in 2007, external consultants had reviewed the project organization and content based on a request from the SALAR commissioning agency [27]. These consultants concluded that the project organization should be tightened and its scope should be more clearly defined. The importance of the county councils for the success of the portal was also emphasized. In 2008 the SALAR commissioning agency ordered an analysis. The purpose of this analysis was to calculate the monetary value of the portal to both the healthcare users and the healthcare providers. This information was provided to SALAR and the county councils [17]. Meetings were held in 2008 between the county council project leaders and Health Advice Online Ltd.

Next we describe the county councils' actions and their success criteria in the development of the portal.

Participation in meetings. In 2008 all project leaders in the county councils, with the exception of one newcomer, met with Health Advice Online Ltd. Most leaders commented that the exchanges on the county councils' experiences were the most useful aspects of these meetings. These exchanges were especially valuable to those leaders who had less experience and fewer resources than others. The meetings also dealt with the communication of information about organizational issues related to the national portal. Many interviewees complained about the emphasis on such issues that were such a large item on the meetings' agendas. They also complained about the turbulence created by the problems associated with the project organization *per se*. Project Leader No. 8 remarked: "It has been a turbulent organization of project work from the side of the Health Advice Online Ltd., and the project leaders have been changed several times. Even though I work in the county council I have never seen such a degree of constant reorganization."

Development of new information. Beginning in the spring of 2007 there were meetings between Health Advice Online Ltd. and the people working with information issues at the county councils. In addition to the national information about patient rights as well as illnesses and treatments (Requirement specification No. 1, listed in Section 5.1), the county councils were allowed to add their own information in accordance with a set of special rules. Many of the county councils had begun work with these texts in 2008 or had plans to do so in 2009. Although one-third of the county councils had similar plans, they were uncertain if this work would be

finished in 2009 or 2010. The Stockholm County Council had no such plans although it already offered a large body of patient-centred information.

Development of a database of healthcare providers. Two parts of the portal functionality depended on the existence of a database with information about the healthcare providers (Requirement specification No. 3, listed in Section 5.1) and about those providers who offered user e-services in the form of My Health Contacts (Requirement specification No. 6, listed in Section 5.1). The county councils had worked for several years to complete this database. Most county councils reported that they had already completed the database or would do so in 2009. However, the plans for this work by four county councils were rather vague. The Stockholm County Council reported that their database structure was more advanced than the required structure.

Introduction of My Health Contacts. My Health Contacts is a functionality for personal e-services originally created by the Stockholm County Council. In the spring of 2007 the SALAR commissioning agency identified this functionality as part of the portal project that would provide a common facility for all county councils. Most of the county councils said that they had already introduced this functionality, or would do so in 2009. Several county councils were still considering adopting the functionality but had not yet decided what action to take. A few county councils hesitated because they already had a functionality providing personal e-services that was nearly the equivalent of My Health Contacts.

Introduction of a Chlamydia testing facility. As part of the national portal project, an additional functionality was added in 2007-2008. This functionality allowed users to order Chlamydia tests online and to see the results of their tests online. The addition of this new functionality was consistent with the trend in Swedish healthcare to increase the number of medical tests offered. One-third of the county councils' project leaders said they planned to adopt this functionality. Another one-third of the project leaders said no decision had yet been made on the introduction of the functionality. In addition, a few project leaders reported that they already used a different functionality for offering such tests.

Critical success factors for enrolment. According to one third of the interviewees, the success of the portal depends on the quality of information that the regional healthcare providers enter into the system. The perceived usefulness of the functionalities was seen as equally important. Project Leader No. 3 stated: "You have to work to show that this [the portal] is actually useful for the patients and healthcare in a very tangible manner." Another project leader identified My Health Contacts and the ability to search for healthcare providers as success factors. A few interviewees mentioned that economic and organizational aspects of the national project were important for the success in their own regional activities (see Section "Participation in meetings" above).

6 Discussion

Our account of the portal development reveals that a large network of actors enrolled in the *idea* of creating a national healthcare portal. This network included actors on

both the national and local levels. The most important national actors were the SALAR commissioning agency, the Ministry of Health and Social Affairs, Health Advice Online Ltd. and the external company charged with the developmental work. Together, these actors constituted a global (in our case, national) actor network for creating the space and assembling the resources needed for the innovative work required [14]. This network of national actors, with their portal plan, created an *obligatory passage point* that the local strategic actors, who would do the actual work of introducing the portal, had to pass through.

In Swedish healthcare, the county councils are part of the local network 'necessary to the successful production of any working device' [20, p. 22]. The explanation lies in the fact that projects in the Swedish public sector are often outside the direct control of the national actors. It has been observed that global actors may have "power over" local actors but may lack the "power to" coerce or influence these local actors [14]. Section 5.2 of this paper describes how the Swedish national actors encouraged the local actors to enrol in the idea of the portal. For example, meetings related to the portal were held with regional representatives, but the county councils maintained their independence as far as the adoption of the proposed IT strategy. Thus the general conclusion about the limitations on the power of global actor networks [14] is relevant in our case study.

Based on a closer analysis of the county councils' activities and the interviewees' views (see Section 5.2) it is possible to reach other general conclusions. Although the development of an E-government system may take several years, our case shows that local actors, such as these county councils, can be persuaded to enrol in and support such projects in their initial phases. Many county councils did initiate regional work with a basic healthcare portal functionality, which was scheduled for completion in 2009, and did participate in meetings at the national level. This observation is important since county councils often act independently on economic, organizational and technological issues. Yet, as the result of various persuasive activities initiated at the national level, some county councils became active supporters of the portal, not only in principle but also in practice.

Our case also shows that both national actors and the local actors viewed the basic technological functionality as strategically important, not only for the portal development, but also for the larger process of generally improving healthcare services. The e-services of My Health Contacts and Chlamydia testing that some county councils adopted exemplified the benefits of the new functionality.

We conclude that it is important to prepare semi-independent local actors technically for enrolment in an IT portal such as the healthcare portal of this study. This preparation means acquainting them with the larger development process as well as with the current and potential technological usefulness of the portal. Using the vocabulary of ANT, the portal functionality presented specific technological *enrolment devices* that influenced local actors (in our case, the county councils) to commit to the goals of other actors (in our case, SALAR and the Ministry of Health and Social Affairs, among others),

Furthermore, the issue of usefulness has a dimension related to the future potential of the healthcare portal. The portal version 1.0 consists of an infrastructure with a simple but useful functionality that has some interaction with local healthcare systems. The real value of the portal may very well be that it supports activities such

as direct appointment scheduling and patient access to electronic health records. Therefore, to safeguard the new portal as a platform for future development ("version 2.0"), it is necessary that the organizational aspects of continued joint development be pursued, or administered, at the national level.

In sum, a simple functionality that offers perceived and expected usefulness is an important device for the enrolment of actors in E-government contexts. In IS research the concept of (perceived) usefulness [28] is often used in *ex post facto* evaluations that justify technology use [24]. In the context of E-government in general, and in healthcare exemplified by portal development in particular, the concept of usefulness has a specific strategic flavour. The concept of usefulness can be a multifaceted motivator, if not *the* motivator, for the enrolment of local actors. This is so, even if one must pose the following question: usefulness – for whom and for what purpose?

In any discussion of the concept of usefulness it is important to consider the multiple logics represented as well as the important persuasive activities in the *interessement* phase that have the potential to convince local strategic actors ("power to") in the absence of global actors' influence/control ("power over") [14]. The perceived and expected usefulness is, of course, closely related to the notion of existing, emerging and future users and the use possibilities. Thus documents that outline technology strategies do not feature usefulness strategies [32]. Instead, they feature important narrative *enrolment devices* in basic technology development processes. In our case, the national actors suggested that the related issue of benefit management must increasingly be taken into account before, during and after the portal development [9]. Our conclusion is therefore that usefulness in its various forms seems to be both political and politically important in E-government contexts. Future research should examine the nuances in meanings of usefulness, and the significance of this concept for enrolment.

The intent of our ANT-based analysis of the politics of network formation in an E-government context, with its focus on local actors and their enrolment in a technological functionality, is to achieve quality of results and to avoid reporting extensive empirical detail. This intention is a response to the criticism of ANT that charges that ANT described rather than explains [30]. Our study, although it uses ANT as a theoretical framework, tries to explain rather than to present a long and detailed description of network formation in an E-government context. Therefore we performed an empirically based analysis at a general as well as a specific level in order to fairly represent the actions and opinions of the actors. We have illustrated the potential of various approaches when treating the different stages in the process of translation as well as a certain group of actors [4]. In examining certain phases closely, such as the *interessement* phase, there is also a problem concerning the stylistic aspects of descriptions. In many qualitative E-government process studies [33], the majority of examples have more a textbook character than the research articles do [3, 10].

7 Conclusion

This paper contributes to E-government studies with particular reference to those studies that use ANT. In its focus on the strategic aspects of one specific group of actors in network formation the paper also contributes to ANT more generally by

testing a particular approach in data capture and analysis. We suggest the following implications of this research. 1) Basic functionalities that seem simple may have strategic importance for enrolling semi- independent actors in portal development. These functionalities act as *enrolment devices* because of their ability to communicate the usefulness of a function. 2) Due to the complexity of the environment and the extent of the development process, stable project organization in the long-term that safeguards future work is necessary. 3) Enrolment is a top-down process in which global (i.e. national in our case) actors try to lead local actors. However, the local actors exhibit a certain independence that results in a self-organizing attitude. An implication for practice is therefore the symbolic as well as concrete value of technology to show usefulness in elongated development processes.

We recognize that a limitation of our research is that it was conducted during the actual development of the portal instead of *ex post facto*. Therefore our paper does not offer a final evaluation of the portal since our research was conducted during the "work in progress." Nevertheless, this timing of the research was in some respects a strength since we were able to capture opinions about current events instead of *ex post facto* rationalizations. A second limitation is that our results are derived from a single case, necessarily calling into question the generalizability of our findings. However, because our study is based on a relatively large sample–interview data from 20 county councils–it has validity as a comparative case study.

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Inter-organizational Cooperation in Swiss eGovernment

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Abstract. In Switzerland inter-organizational cooperation is a cornerstone of the national e-government strategy. Based on existing frameworks, the authors examine different stakeholder's perspectives towards cooperative e-government within the Swiss federal system. The discussion of pronounced barriers and enablers is based on various sets of data: A document analysis and interviews with the program office on the national level, data from surveys among e-government officers across federal levels and a case study conducted at the concrete operative level. The analysis aims at reflecting the relevance of different aspects of cooperation for the development of e-government, contributes to validating existing analytical approaches and provides suggestions for further research.

Keywords: inter-organizational cooperation, Switzerland, federalism.

1 Introduction

Cooperation enables innovation and is considered to be a big challenge for business development [1]. It is also an important parameter for the public sector: through standardizing technology, processes or data and generally through sharing information costs, *efficiency* in *production* and *distribution* can be optimized and the *quality* in the *service delivery* can be enhanced [2], [3]. Governments are increasingly using collaborative strategies and projects to face complex problems, which cannot be addressed effectively through traditional bureaucracies [4], [5].

E-government maturity models consider different stages, usually indentifying two initial stages referred to as "interaction" and "transaction", followed by a third stage generally referred to as "integration". While the first two stages are primarily associated with technology, the third stage involves a *culture leap* and *organizational change* [6]. In this stage, inter-organizational cooperation is a key element of public management reform efforts [7]. *Cooperative government* can be seen as a higher stage of development in e-government; it assumes a certain grade of *organization maturity*, in which coordination is established and inter-organizational services can be provided efficiently and effectively [8].

Applied to governments in a federal system, the term "inter-organizational cooperation" incorporates *horizontal cooperation* between agencies of the same federal level as well as between departments and divisions of the same organization.

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Secondly, it incorporates forms of *vertical cooperation*, which involve different federal levels of the political-administrative system and thirdly, it incorporates *cooperation outwards with non-governmental organizations and industries*. Regardless of the constellation of partners, we can assume that different *project types* (e.g. different size, grade of complexity or organizational change) will influence how inter-organizational cooperation in e-government is achieved. Collm et al. [9] distinguish between six different dimensions in which organizations can establish either cooperation or collaboration, namely goals, tasks, responsibility, resources, leadership and decision-making. According to their concept, collaboration constitutes a more complex form of cooperation in the sense that the named dimensions are conceived as being shared. In the following, we focus on inter-organizational cooperation and collaboration, referring to both forms as cooperation. The present paper emerged from an applied research-project, which aimed at identifying challenges of cooperation among organizations from different federal levels.

2 Discussion of Selected Analytical Frameworks on Cooperation

Research has approached the topic of cooperation since as far back as the sixties [10], [11], [5]. Still, there are few validated results about the determinants of effective governance in inter-organizational settings [4]. The same holds true for the available literature in the field of e-government. Most of the discussions take place at the conceptual-theoretical level; the validation-process is often on a qualitative level, mainly on the basis of case studies. Research in the field deals with the challenges for inter-organizational cooperation and/or formulates strategies on how to deal with identified key barriers, and often focuses on issues related to cross-agency information sharing in the context of service delivery. Generally, there is a consent that inter-organizational cooperation is demanding: it often combines competition, questions of autonomy, and interdependence [10], [5] and relates to issues associated with the notion of *trust* [15], [14]. Accordingly, managing in inter-organizational arrangements is considered to be different from management within organizations [13]. Enabling leadership is of special importance, since there is *no central authority*. In this context, the necessity of assuring *top-management support* in the involved organizations is broached by different authors (e.g. [11], [15], [4], [16], [8], [3]). Rather than controlling, the focus needs to be on *co-ordinating*, whereby autonomy of the partners should be retained [16].

In order to illustrate the specific affordances with regard to leading inter-organizational e-government projects, we can draw on Thomson and Perry who identify five *key dimensions of collaboration* from an actor's point of view focussing on concrete *activities* and *processes*:

1. *The process of collaborative governing*: Agencies must understand how to make decisions jointly about the rules that will govern their relationship. It is important to create structures for reaching goals through shared power arrangements;
2. *The process of collaborative administration*: Agencies need administrative structures that move from governance to action. Key elements here are e.g. the presence of clear roles and responsibilities, the presence of concrete achievable goals and good communication;

3. *The process of reconciling individual and collective interests*: Collaboration creates a tension between self-interests and collective interests. This dimension is especially problematic because these settings typically form around intractable problems that partners cannot solve on their own;
4. *The process of forging mutually beneficial relationships*: Without mutual benefits, information sharing will not lead to collaboration. Agencies that collaborate must experience mutually beneficial interdependencies based on either differing or on shared interests;
5. *The process of building social capital norms*: In collaboration, partners often demonstrate a willingness to interact collaboratively only if other partners demonstrate the same willingness ("tit-for-tat" reciprocity") [17].

These affordances as formulated from a leadership perspective are also integral to existing frameworks for analysing cooperative e-government. Thereby, authors stress different dimensions that can generally be categorized along the classical holistic framework for e-government (e.g. [12]), which incorporates a political, a legal, an organizational and a technical dimension (for an extensive literature review see [15]). Klievink/Janssen for instance focus on the need for a coordinated e-government service delivery, and propose an analytical framework of coordination. They stress that coordination between different agencies creates dependencies at various levels, including channels for contacting government agencies, business processes, information (systems) and infrastructural dependencies within and among governmental organizations [3]. Their framework distinguishes three layers. First, a *network layer*, that includes political and governance elements. "Actors, structures, (conflict of) interests and outcomes" are understood as being part of a political process that relates to the notion of power and involves the ability to cope with diverse power positions. Governance elements include specifying various roles in the network and setting up agreements in order to ensure accountability. Secondly, an *intra-organizational layer*, which includes the allocation of roles and responsibilities as well as the alignment of the different processes. Finally, there is a *technical layer* that focuses on standards and interoperability as key aspects (fig. 1).

Coordination	**Network and Governance**	Power and trust Agreements and contracts Accountability
	Organization and processes	Responsibilities Division of roles Aligning processes
	Information (technology)	Standards Interoperability Data

Fig. 1. Analytical Framework of Coordination [3]

Persson/Axelsson/Melin apply inter-organizational concepts from the industrial/business network approach to an e-government case in order to better understand the e-service development challenges in one-stop government [18]. The focus is on the *interaction* between organizations, the quality of their relationships and correlated challenges. First, they propose *characterizing* relationships between

organizations with regard to *continuity*, i.e. the relative stability of the relationship, *complexity* with regard to the number of contact channels, actors involved etc., *symmetry*, e.g. resources or goals and *formality*, i.e. the existence and relevance of contracts. Related challenges concern differing organizational cultures and goals and stakeholders' perceptions of the relationship itself. In that they put a stronger focus on the preconditions for cooperation. Furthermore, they point out different qualities of cooperative relationships, namely inter-organizational relationships where connected *activities* need be coordinated (links), relationships in which related actors *mutually acquire meaning* in their reciprocal acts and interpretation (bonds), and relationships that comprise *pooled resources* such as personnel, equipment, know-how and financial resources (ties). The challenges associated with these dimensions of relationships (cf. fig. 2) are similar to the ones proposed by Klievink/Janssen, addressing technical issues (dependencies and ownership of IT-systems), organizational aspects (administering separated processes and interdependencies between activities), political aspects (hierarchical levels of involved actors, division of tasks, i.e. power positions) and legal aspects (differing assignments and roles of agencies). By applying a business approach to e-government, Persson/Axelsson/Melin explicitly put a focus on an *economic level* of cooperation, discussing the problem of potentially asymmetrical incentives for joint e-government projects, which may affect the allocation of resources. This aspect is also more prominently discussed by Gil-Garcia et al. who suggest integrating the topic of securing financial resources as one of several core strategies to deal with barriers to information integration [16]. Persson/Axelsson/Melin further address the difficulty that *knowledge* is usually an outcome of as well as one of the resources that needs to be managed in the project.

DIMENSIONS OF RELATIONSHIPS	CORRELATED CHALLENGES
Links: Link refers to the connections that exist in the activities between organizations; the links between activities reflect the need for co-ordination which affects how and when various activities are carried out	**Technical**
	Administrative
	Activity
	Commercial
Bonds: Bonds arise in relationships as two related actors mutually acquire meaning in their reciprocal acts and interpretation	**Actor**
	Economic
	Legal
Ties: A relationship between two organizations affects the way in which the organizations use their personnel, equipment, know-how, and financial resources, etc.	**Resource**

Fig. 2. Dimensions of relationships and correlated e-government challenges [18]

This latter aspect is also stressed by Pardo/Gil-Garcia/Burke who identify six *determinants of governance structure* in cross-boundary information sharing initiatives. In their categorization, determinants related to knowledge issues are salient, including knowledge of participating organizations, knowledge of environments and knowledge of information needs. In accordance to other approaches in the field, further determinants are executive involvement, enabling legislation and the diversity of participating organizations and their goals [4].

3 Inter-organizational Cooperation in Swiss E-Government

The Swiss Federal Council considers inter-organizational cooperation as a key-success-factor for e-government and has anchored its importance in the national e-government strategy. The basic assumption is that business and the population expect their affairs to be dealt with in a flexible and efficient way, beyond organizational limits and federal hierarchies. In order to ensure that this occurs, existing administrative processes must be optimised across organizations at different levels and the various administrative authorities must cooperate [19]. In the Swiss federal political system, *subsidiarity* is a guiding principle, which assumes that matters should be handled by the lowest competent authority. In the context of e-government this may pose problems, since financial power for e-government matters is often stronger at higher levels – an asymmetry that can hinder collaboration.

In order to describe the Swiss situation and the maturity grade of inter-organizational cooperation at different federal levels, we rely on a discussion of different sets of data: For the national perspective, we conducted a qualitative analysis of publicly available strategic documents and open interviews with members of the national e-government program office. Furthermore, we analyse published data from national surveys on e-government [23], which allow for discussing accentuated challenges from different perspectives. Finally, we briefly present a concrete case, in order to integrate salient aspects from an operative point of view.

3.1 Development of E-Government in Switzerland

In a first national strategy (2002) the Swiss federal executive conceived e-government as an *information society* phenomenon aimed at modernizing the state and supporting political participation [20]. In this first phase, the Swiss political authorities neither stressed the interplay between different federal levels nor addressed the importance of governmental cooperation. In 2007, the Swiss Federal Council adopted a genuine *national e-government strategy*, which provides a number of basic principles, a course of action and an instrument for implementation in the form of a catalogue of prioritized projects [19]. At the same time, the Council also institutionalized different boards and units to support the achievement of the formulated goals: (a) a *steering committee*, with political representatives from all federal levels, that is responsible for the coordinated implementation of the strategy; (b) an expert *advisory board* that advises the committee and other involved organizations on various topics and (c) the *e-government program office* that constitutes the administrative unit of the steering committee and coordinates the implementation of the strategy [21].

The realisation of e-government in Switzerland follows the principles of federalism and is conceived as a bottom-up approach [19]. So-called project leader organizations are designated the role of implementing nationally prioritized projects: the catalogue of projects explicitly distinguishes between services where "*coordination across organisations is necessary*" as opposed to those where "*nationwide implementation can be achieved in a decentralised manner through mutual exchange of experiences*" [22]. The project leader organizations are responsible for setting up the project organization and securing the funding. As is stated in the strategy, "[t]he use of ICT for integrated and cross-organizational administration processes and the necessary

modernisation of the administration that this implies must be implemented via the normal management structures in the administration" [ibid.]. Generally, the enhancement of e-government therefore depends on the initiative, capacity and capability of leading organizations on the one hand and on establishing beneficial cooperation between different units on the other. The strategy draws on the assumption that the prospect of achieving efficiency gains by utilising synergies through cooperation will work as a driver for e-government.

Thus, while Swiss government ascribes strategic importance to e-government and considers cooperation as a means for development, the question is how well inter-organizational cooperation is proceeding at the operative level and how it can be supported.

3.2 Discussion of National Quantitative Surveys on E-Government

Since 2008, the institute gfs.bern has been mandated by the federal IT strategy unit and the cantons to conduct studies on the state of e-government on a yearly basis. The studies are based on a survey among officers responsible for e-government on all federal levels, they are representative and allow for discussing some conditions for, the state of and the necessities for inter-organizational cooperation in Swiss e-government. The following discussion is based on the data provided in the 2010 survey [23]. The results will be discussed in light of the different dimensions relevant to cooperative e-government as proposed by the frameworks presented above. The aim is to identify which affordances and challenges are salient in the Swiss context and whether the federal structure of the political system plays a role in that respect.

3.2.1 Political and Legal Dimensions

With regard to the contextual factors that influence the development of e-government it has been pointed out that a lack of political support and the state of legal requirements and regulations may constitute major challenges for inter-organizational cooperation. When looking at the data in the Swiss national surveys we find that regardless of the political level, the majority of public administrations appraise the legal setting for e-government and Internet activities as adequate. As for the administrations that consider the legal foundations to be insufficient, we find notable differences between the three levels: while cantonal officers quite often asserted that they don't perceive the legal setting as being adequate, this was less the case for municipal and federal officers. Furthermore, there are differences with regard to how e-government officers assess the legal conditions on federal levels other than their own. Clearly, the adequacy of the legal setting on one's own federal level tends to be rated better than those on the other levels. Strikingly, there also seems to be little knowledge on the legal settings in other public administrations: 72% of the federal administrations did not provide any answers on the legal context of cantons and municipalities, conversely 44% of the municipal and 41% of the cantonal participants are not able or willing to indicate the federal situation. Even though the overall assessment provides a rather optimistic view on legal issues, a lack of knowledge and the differences between self-assessment and peer evaluation potentially pose a challenge for inter-organizational cooperation.

In the literature, political support is considered as a critical success factor for inter-organizational cooperation. Generally, around a fifth of Swiss e-government officers do not feel *supported by their political superiors*. The majority of e-government officers consider themselves to be well or rather politically supported (see fig. 3). Still, there is a significant perceived requirement as far as support from superordinate political levels is concerned. Municipalities and cantons wish for more support from the canton and from the confederation respectively. Cantons would especially appreciate concrete support in the realization process, with regard to planning, strategic issues and coordination. On the communal level the requests are more concrete, focusing on specific e-government services and their implementation.

Focus	**Federal officers**			**Cantonal officers**			**Municipal officers**		
	+	0/?	–	+	–/?	–	+	–/?	–
Legal foundations (1)	(n=46)			(n=23)			(n=981)		
Federal level	**52%**	37%	11%	42%	41%	17%	43%	44%	13%
Cantonal level	24%	72%	4%	**58%**	13%	29%	46%	42%	12%
Municipal level	19%	72%	9%	38%	29%	33%	**61%**	28%	11%
Political support	(n=~40)			(n=~23)			(n=~950)		
Support by own superiors (2)	**57%**	15%	28%	**75%**	4%	21%	**64%**	17%	19%
Need for super-ordinate support (3)	X	X	X	**71%**	25%	4%	**69%**	35%	6%

1: + entirely or partly sufficient, 0/? not answered or don't know, – partly or not at all sufficient
2: + strongly or rather supported, 0/? not answered / don't know, – rather or strongly hindered
3: + clearly or rather more support needed, 0/? not answered or don't know, – rather or clearly less support

Fig. 3. Adequacy of legal foundations and political support for e-government (2010) [23]

One of the prospects of the national Swiss e-government strategy is that it supports accountability across the federal levels. Even though it rather resembles a statement of intent, the strategy is meant to guide action according to a shared understanding of the goals of Swiss e-government and provides a blueprint for different agencies' own e-government strategies. The existence of a strategy at the different federal levels and their orientation towards superordinate strategies therefore allows some reflections on the state of "*networked governance*". The development over time shows that at the cantonal and federal level, strategic e-government has gained in importance. In 2010, almost three quarters of the cantons had an e-government *strategy*, for the federal administrations it was 54%, while on the municipal level the rate was only 21% (see fig. 4). Overall, cantons and federal administrations tend to orient their strategies

Strategic orientation	**Federal administrations** (~n=20)			**Cantonal administrations** (~n=23)			**Municipal administrations** (~n=380)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
Strategy exists	33%	45%	**54%**	65%	74%	**75%**	19%	27%	**21%**
Alignment super-ordinate str.	85%	42%	64%	80%	82%	95%	33%	59%	29%

Fig. 4. Development of strategic e-government across federal levels (2008-2010) [23]

towards those of superordinate levels while this is less the case on the municipal level (see ibid.). Based on the theoretical considerations, we can assume that cooperation between municipalities and other federal levels will be more demanding, especially with regard to administrative and governance aspects (e.g. reaching consent on goals).

3.2.2 Organizational Dimensions

According to the literature in the field, the allocation of roles and responsibilities is crucial for constituting inter-organizational cooperation. However, the results of the surveys show that it is not always clear who is actually in charge of e-government at the different federal levels. As for the municipal and the cantonal levels, responsibility tends to be better clarified over time, while this is not the case for federal administrations (cf. fig. 5). This might pose a challenge for establishing leadership and setting up a functional project organization, however, the fuzziness of responsibilities was not considered as the greatest challenge in the development of Swiss e-government.

First and foremost, problems for developing e-government where identified with regard to questions of financing and the use of an organization's personnel. Thereby, the assessment of the challenges for e-government has slightly changed over time. While in 2008 budget was considered as the greatest hurdle for developing e-government, personal resources were considered as the greatest challenge in 2010, followed by financial resources and time/administrative efforts (see fig. 5). Even though personal resources for e-government have increased on all federal levels, these are not considered to be sufficient. Overall, the results of the surveys suggest that organizational barriers are clearly more salient than those related to legal and political issues as described above (legal groundwork, political support, strategic orientation).

Organizational advantages and challenges	**Federal administrations** (n=~40)			**Cantonal administrations** (n=~23)			**Municipal administrations** (n=~950)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
Clear responsibilities (1)	60%	58%	**57%**	57%	65%	**67%**	49%	62%	**62%**
Salient Challenges (2)									
Budget	47%	47%	**59%**	57%	**74%**	63%	43%	44%	**47%**
Personal resources	X	63%	**65%**	X	57%	**71%**	X	46%	**49%**
Time/administrative efforts*	7%	5%	**54%**	13%	13%	**42%**	11%	2%	**46%**
Legal foundations	X	13%	26%	X	39%	33%	X	21%	19%
Attitude of political actors	7%	11%	17%	28%	30%	21%	18%	13%	16%
Missing/wrong strategy	X	32%	22%	X	4%	13%	X	15%	19%

1: Responsibility is clarified
2: Aspect is considered as barrier to realising e-government
*"Time" was defined as a given option of answers in 2010

Fig. 5. Development of organizational conditions for e-government (2008-2010) [23]

Another aspect concerning the organizational level of cooperation refers to the alignment of processes. Golder et al. [23] note a tendency that even when e-government is gaining in importance within a given administrative unit, the opportunities for e-government (standardizing and simplifying inter-organizational processes) are not exploited.

3.2.3 Technical Dimension

With regard to the technical dimension, the adherence of Swiss administrations to eCH-standards (see http://www.ech.ch/) can serve as an indicator for the relevance of technical challenges. The adherence to national standards has generally increased over time, but seems to be stagnating now. Again, there are differences between the three federal levels. Especially at the municipal level, adherence to eCH-standards still has much scope for expansion: in 2010, 41% of the municipalities entirely or partly stick to standards, while this rate is generally higher for the cantons and the federal administrations (91% and 61% respectively). Again, inter-organizational constellations across federal levels seem to be more demanding with regard to laying the grounds for beneficial cooperation.

3.2.4 State of Cooperative E-Government in Switzerland

Since the beginning of the surveys, inter-organizational cooperation has been seen as the weak point of e-government development. Generally, agencies seem to orientate themselves to other agencies in their own administration [23]. Above all, inter-organizational cooperation takes place between cantons, where the players can profit from each other's development considerably: for instance, 71% of cantons profit from the development of other cantons while this is hardly the case with regard to federal developments (13%) and also less so for developments at the municipal level (26%). This horizontal orientation is also observable on the other federal levels (see fig. 6). Cooperation is however not only taking place across and among federal levels. Swiss authorities also cooperate with partners from the private sector (see ibid.). Regardless of the type of partner, cooperation is not only a potentially challenging endeavor, but also a means for overcoming one of the major barriers to developing e-government: Especially at the cantonal level, a considerable rate of administrations (38%) already have reached financing through cooperation.

Focus	**Federal officers**			**Cantonal officers**			**Municipal officers**		
Positive spill-over effects	(n=46)			(n=24)			(n=981)		
From federal developments	59%			50%			15%		
From cantonal developments	13%			71%			26%		
From municipal developments	0%			13%			51%		
From intern. Developments	9%			21%			1%		
Financing through cooperation	7%			38%			13%		
PPP	(n=46)			(n=24)			(n=981)		
Is an issue	46%			67%			27%		
Projects exist already	11%			25%			3%		
Need for strengthening coordination / co-operation (1)	(n=~40)			(n=~23)			(n=~950)		
	+	0/?	–	+	0/?	–	+	0/?	–
	50%	30%	20%	**38%**	12%	50%	**53%**	17%	30%

3: + coordination / co-operation should be enhanced, 0/? not answered or don't know, – coordination / co-operation is sufficient

Fig. 6. Co-operative approach: positive effects and need for enhancement (2010) [23]

When asked whether cooperation should be enhanced, 53% of the e-government officers on the municipal level pleaded for more cooperation, similarly half of the officers from federal administrations were in favor of extending cooperation, while a the cantonal level this rate was 38%.

To sum up, cooperation is taking place most between cantons and least between federal administrations. The authors of the surveys state that on the cantonal level, where cooperation is generally better developed, it seems to be weak especially if we are dealing with cantons that can be considered as strategic precursors. In such settings there is less tit-for-tat reciprocity, diminishing the players' perception of the necessity for and the benefits of cooperation. Organizational issues such as responsibility and resources (personal and financial) clearly pose the greatest challenges for inter-organizational cooperation. With regard to political and legal settings we find that political support for e-government rather favours cooperation. However, the legal setting and specifically the discrepancies between self-assessment and peer evaluation of legal conditions might pose some challenges for cooperation, especially across federal levels. Even though inter-organizational cooperation is a reality, the results show that there is as yet no established culture in the Swiss public administration.

3.3 Cooperation from the View of the Swiss Program Office

The e-government Switzerland program office focuses its activities on the *coordination of Swiss e-government*. The implementation of the Swiss e-government strategy is safeguarded by the list of the concrete priority projects and their controlling, which allows both, the concrete impact and the development of e-government in the country to be measured. More precisely, the program office's controlling efforts encompass 20 projects related to public services that in the view of the stakeholders exhibit a particularly good cost-benefit ratio, and 20 projects aimed at establishing important prerequisites for other services. Besides the state of their implementation, the program office evaluates to what extent strategic goals are achieved, conducts international comparisons and integrates the perspective of target groups on e-government (e.g. policy makers, media).

In its latest assessment [24], the national agency points out several advances, such as: a considerable impact of prioritised projects on "the IT portfolios and IT strategies of the cantons, concerning, among other things, financial, legal or organizational issues", an increasing number of available transactions – especially at the cantonal level and a generally high and increasing satisfaction of the private sector and the population with e-government offerings. Conversely, it also hints at some of the problems currently faced by Swiss e-government at large by the project leader organizations in particular:

1. *Implementation schedule*: Several projects are delayed, due to either the necessity of coordinating complex political and federal processes or to resource problems (cf. e.g. [18]);
2. *Funding*: Around 40% of the projects are only partially funded, the main challenges being initial funding or the question of distributing the costs between several federal levels;
3. *Cost-effectiveness*: While the program office has introduced an instrument for assessing qualitative benefits of the projects, the cost-effectiveness of many projects is difficult to estimate (cf. [8]);
4. *Interoperability*: Is generally improving, but constitutes a greater challenge at the municipal level (cf. e.g. [3]).

Similar to the results presented in figure 5, the view of the program office confirms that resources, finances and time are crucial dimensions that need to be addressed in order to facilitate cooperation at the concrete project level. In accordance to the strategy, the

program office sees *cooperation* as an essential topic in the development of e-government and attempts to sensitize the project leaders to the challenges associated with cooperation by offering different activities such as workshops, presenting international best practices and helping to establish incentives for the financial breakdown (cf. [18]). Providing an instrument for assessing quantitative and qualitative benefits of an e-government project might positively contribute to establishing mutually beneficial relationships.

3.4 Business Case: Electronic Real Estate Information System

The nationwide *electronic real estate information system* (eGRIS) can be considered a successful *prioritized e-government project*. The system will permit retrieval of the most important Swiss real estate information online; authorities and the private sector will obtain real estate register data electronically and the processing of real estate register transactions will be possible without any media break [22].

The project exhibits two life cycles: it started in 2001 under the direction of a federal agency, but now a private organization leads the project, in partnership with various federal administrations, cantons, notaries, banks and further parties. Under the public leadership eGRIS.I provided a basis for a nationwide information portal and an electronic course of business between the different cantonal real estate agencies. On the technical level, eGRIS.I laid the groundwork for achieving interoperability between the heterogeneous precursor solutions (e.g. a short time ago, there were five different real estate information systems in Switzerland and there was no nationwide view on the data). The legal setting has now been clarified and builds the foundation for the services that will be provided by eGRIS.II (electronic disclosure, electronic data delivery and electronic course of business) [25]. Thus, when launching eGRIS.II, two of the four main challenges for inter-organizational cooperation had already been settled (cf. e.g. [16], [18]). Furthermore, eGRIS has an *added value* for all stakeholders: cantons profit from the automation, they can preserve their sovereignty over the data and build on existing cantonal IT-infrastructure. The users (e.g. banks, federal administration) realize efficiency gains through standardization and automation of processes. A business case conducted for the steering committee confirms that in the case of eGRIS, *cost-effectiveness* is a given, which has been an important incentive for the involved organizations to engage in this PPP project and helped to secure top-management support in the private sector. Furthermore, the project has recently been adopted on the list of prioritized e-government services, which potentially helps to grant political top-management support (cf. e.g. [3]). Concerning political and organizational challenges, the project seems to be on a promising way of handling them. In the interviews, the project leader (private sector) and a representative of the cantons asserted that setting up a cooperation organization had been challenging, particularly, with regard to aligning the cantons. In that respect, one of the challenges was that the concerned cantonal agencies were not adequately organised on a nationwide level. The chosen solution was to place the issue with an already existing coordinative organization of the cantons in order to establish consent on representation in the project. By now, the project organization and a governance structure have been set up. Thus, representation of the *stakeholders*, *their interests and constraints* in the steering committee of the project is established and the *assignment of tasks* and the *division of roles* have been clarified (cf. e.g. [16], [17]). With regard to sensitive issues (e.g. in the context of data or in the legal dimension)

efforts to retain the *autonomy* of the different players (cf. e.g. [16]) have been undertaken, so that one of the bigger hurdles at the outset of eGRIS.II – the concerns with regard to data protection – could be overcome.

The project leader sees his role as *enabling leadership*, in developing ways to cope with complexity – in the sense of managing dependencies between activities and interests, as quoted in [3]. In the interviews, critical topics like *power* and *trust* were openly addressed and the involved partners actively engage in reconciling potentially diverging interests. From a leadership point of view, it is remarkable that very soon a *double project lead* (*business view* and *technical view*) was established, among others in order to assure *tailored communication* (cf. [11], [8]). In an interview the eGRIS project leader considered the following success factors to be particularly decisive in order to facilitate cooperation at the operational level:

- To conduct consistent and regular *stakeholder management* and to engage in *tailored communication*
- To *adhere to a clear policy* and communicate this effectively, in order to *build trust*
- To address *stakeholders as participants* and to cultivate *cooperation* instead of *coercion*
- To *preserve the autonomy* of the different stakeholders (cf. here [17]).

This case both confirms the relevance of the dimensions of cooperation as proposed by research on inter-organizational e-government as well as a shift in the prevailing challenges over time. While political and legal issues initially posed particularly critical challenges, the emphasis has moved to organizational ones. Besides mutually beneficial financial incentives for the project, enablement and enactment of leadership seem to be decisive, confirming theoretical assumptions.

4 Concluding Remarks and Further Activities

The aim of this paper was to discuss the state and relevance of inter-organizational cooperation for the development of Swiss e-government by adopting different stakeholder perspectives. In particular we looked at the major challenges and necessities as formulated by different players. By doing so we validated existing concepts on inter-organizational cooperation in e-government – mainly derived from case studies – on the basis of quantitative and qualitative empirical data. The categorization of barriers to and strategies for cooperative government along a political, legal, organizational and technical dimension has proven to be useful for analysing cooperation in e-government.

The results show that there are different foci and perceptions of the barriers to e-government development, depending on a given stakeholder perspective, especially across federal levels. The view of the national coordination agency is clearly shaped by the aims defined in the national e-government strategy: cooperation is considered as major driver for e-government in a federal setting. As for the accentuated challenges, governance issues such as finding agreements on the allocation of costs, organizational issues such as aligning processes in a complex (political) setting and technical issues (interoperability) are salient. E-government officers who are engaged in cooperative e-government at the operative level particularly stressed budget, personal resources and time as salient challenges. Even though less salient, the relevance of political and legal barriers to the development of e-government

and cooperation are confirmed as well. A closer analysis further shows that there are different foci and perceptions across the federal levels, suggesting that the affordances for enabling cooperation are likely to differ according to a given constellation of partners. Data attests that cooperation in the field of the Swiss e-government takes place especially between cantons, where the players can profit from each other's development considerably and where cooperation is not only associated with challenges, but also appreciated as a means to overcome financial shortages, thus confirming a cornerstone of the national strategy. The business case once again reinforces the relevance of organizational issues such as defining a cooperation organization, setting up a functioning governance structure or addressing trust issues at the operative level. Additionally, the case supports models that point to the importance of setting preconditions and addressing specific context factors for initiating the project, e.g. legal issues.

Further scientific activities could analyze a broader spectrum of qualitative cases in order to identify and categorize the main challenges and demands for leading inter-organizational cooperation in the context of e-government more precisely. Based on the findings presented in this paper, it could be interesting to examine the relation between political and legal as opposed to organizational challenges (less so technical ones) over time, i.e. in relation to general advances in a country's development of e-government. Further empirical evidence is also needed for developing methodological approaches to support leadership in cooperative e-government.

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Scarcity, Exit, Voice and Violence: The State Seen through eGovernment

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Abstract. This paper examines if, and how, the manner in which the state is viewed changes when an e-government system is implemented. The motivation for this paper lies in the fact that the nature of the state is under-theorised in e-government literature. The state, in a developing country context, is formulated as being scarce, presenting choices of exit and voice to citizens, and of having authority over violence. A specific grievance registration system from India, called Lokvani, is used as an example to show the effect of the system on how residents of that region view the state. Field data collected from participant interviews of those interacting with the system is analysed. The results show that the nature of the state changes when the system is used, however, for some aspects it remains the same. Further, the paper concludes that it is imperative to have a formal theory of the state for evaluating and designing e-government systems.

Keywords: e-government, state, scarcity, exit, voice, violence, India.

1 Introduction

In order to understand the role that e-government is expected to perform, it is necessary to assume the role of the state. E-government, after all, is a "technology" of the state; the state is deploying such a technology to address certain concerns it has about its own functioning or about the effects it expects to see from its functioning. The state remains an entity that is assumed to have an over-arching, ideology-like presence in the examination of e-government, more in the background as assumptions and a priori notions, and less as an explicit object of study.

The state is under-theorised in e-government literature. When the role of the government, the bureaucracy, the administration, elected representatives, and public bodies are examined, the state is a referent and an implicit construct. This hides the complexity of the nature of the state, its manifestations, and the manner in which its role is assumed in e-government design, implementation and evaluation. When the state is explicitly examined, as is the case in a few papers, the focus is more on the functions and the mechanisms of the state, through its administrative and governance capacities, rather than on its intentions, role, ideology and how it is perceived.

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This paper examines the nature of the modern nation state, in the context of e-government deployments in developing countries. The state manifests itself in a manner that is 'seen' by the population in different ways. In this situation, the technologies used by the state, such as e-government, too are seen in different ways by different population groups. It is important to understand the manner in which the state is manifested to fully understand the role and impact of technologies such as e-government. In the absence of a theory of the state, e-government research is bereft of an ontological basis.

2 Background Theory and Research Questions

2.1 The State

The state is theorised in myriad ways in the political science, sociology and anthropology literature. It is often used with the term 'nation' as the nation state or as the nation-state. Theorists contend that the state embodies the notions of territoriality and sovereignty [13], where a specific geographical region binds the territory of the state within an administrative structure that has power and authority. The nation has a cultural connotation, as a formation to which citizens identify and from whom the authority of the state is legitimised.

The ideas of both the state and the nation have endured considerable modification with the advent of the globalised, connected world [12,13]. The state's territorial control is challenged by free flows of money, information, and in some cases, labour, across boundaries. The state's sovereignty is challenged by multilateral bodies such as the World Bank and the United Nations that impose authority over the state and its mechanisms. Such issues crop up most prominently when the territorial boundaries are challenged by protectionism or insularity, to prevent free trade of goods or free flow of labour. Those states that would once have championed free flows are bound to demand restrictions, owing to their own vulnerability to global forces.

The idea and the discourse around the nation too is contested in the modern globalised age. A national identity is often questioned on the grounds of regional differences and ethnic identities, a national agenda is often regarded as co-opted by the elite, and the idea of being a national is challenged, and reinforced, by trans-national migrations and loyalties.

The state is the provider of the *mechanisms of rule* - all the institutions that perform governance, ensure security, and regulate the markets ([13]; page 10). It is embodied in the institutions of governance, such as the bureaucracy, elected representatives, the judiciary, the constitution and the system of laws and policies. When contrasted against the market - as is often the case in popular writing - the state is all that which has authority outside of the market and civil society.

It is important to recognise that the state is an abstract idea that has different meanings in different contexts and to different people. People often 'see' it in different ways [4]. Further, it is enmeshed in the everyday lives and practices of ordinary people. "The sphere of everyday practices is the primary arena in which people learn something about the state. Whether it is the practice of

standing in line to obtain monthly rations or to mail a letter, getting a statement notarized or answering the questions of an official surveyor, paying taxes or getting audited, applying for a passport or attending a court hearing, the state as an institution is substantiated in people's lives through the apparently banal practices of bureaucracies." ([13]; p11).

The state is seen to have a particular form and character, and ways in which it is visible, experienced and rendered in the popular imagination. It is both an objective real, external and powerful to the lives of people, and realised through subjective experience. Scholars argue that the legitimacy of the modern state is bound in popular sovereignty [3], or in the will of the people.

When the state is "encountered" or experienced in the everyday practices of ordinary people, it impresses its presence upon those who experience it. This impression varies by the nature of the encounter - for some it may mean a loss of money or dignity, while for others it may entail a satisfying experience. The memory of this experience shapes the way the state is seen. Corbridge et. al. (2005) have created a typology of experiences that ordinary citizens, particularly poor and marginal citizens, have of the state. We present below a brief review of this typology.

One reason why the poor and marginal have to meet with the state is to avail of entitlements and subsidies. These may form incentive transfers under specific schemes, or as direct assistance for disabilities or relief. Representatives of the state, bureaucrats and functionaries at the lowest levels of the state machinery, are the ones who have to be seen for this purpose. These encounters entail transfers of monies, from the state to the citizen, and also, in many cases, from citizens to the state. Citizens see the state as both providing incentives and money, and also as demanding and extracting monies through bribes. These experiences vary across situations and contexts.

Experiencing the state is also quite varied when it comes to transfer of information. In India, the poor experience the state through the census, the regular surveys that are carried out by various agencies, and, recently, through IT-enabled means (iris-scans and finger-printing). The state demands and obtains information, either through the voluntary effort of filling out surveys or through the need to fill out forms for incentive payments. The state also informs citizens, usually through newspaper reports, posters in villages, and through radio and television. Citizens experience the information from the state directly, through viewing or hearing, or indirectly, by hearing experiences of others.

The state is experienced in everyday practices and as such is shaped as an entity with some characteristics in the view of citizens. There are many characteristics or properties, but in the situation of marginal populations viewing the state in a developing country like India, a few properties stand out. These are discussed below.

2.2 Properties of the State

Scarcity. For marginal populations the state is never abundantly available. Its most important property is scarcity. Even though the presence of the state, in

terms of officials and functionaries, is evident in a broad geographical spread across India, the availability of such functionaries is invariably scarce. Citizens have to travel long distances, in many cases, to avail of the state's facilities, have to wait in long queues, have to deal with someone who is not of the same caste or community, may speak a different language, and may require engaging with a number of intermediaries.

The 'grand designs' of the state, crafted in national capitals and in the think-tanks and centres of policy planning, is far removed from the everyday experiences of ordinary citizens, and when they are to be realised 'on the ground' face challenges of resistance, denial and distortion. The state becomes scarce here owing to the disjunction between the design of the policy prescriptions and the reality of the specific region.

The scarcity of the state is also a function of the emerging political economy ([4]; page 34). With large middle castes and community groups emerging as powerful political blocks, in most parts of India, who have access to the resources of the state, marginal communities are excluded.

Exit and Voice. In a seminal book, Hirschman [8] explored the ideas of Exit and Voice that customers, citizens, employees have with regard to the organisation or the state. The idea of exit is that of withdrawal from participation or engagement. When customers are not satisfied with offerings available at a commercial establishment they may exit and go to a rival. Similarly, citizens who are demanding a service from the state may want to exit if the service is not provided, by not demanding at all or moving to another state. Exit represents a physical or mental withdrawal from participation, having once considered the option.

Exit is often enabled by or inhibited by various conditions, of the organisation or the state in which the individual is in, or by the material conditions of the individual. Immovable property, for instance, prevents citizens from exiting the state, or, for citizens of countries with dictatorships there may be stiff penalties for emigrating. The possibility of exit drives behaviour of individuals - those who can may exercise a choice of staying on to see if conditions improve, whereas those who cannot have to modify their behaviour to suit the existing conditions.

Voice is the ability to provide feedback or protest the conditions of the organisation or state in which the individual currently resides. Voice is conditioned by the situation of the agent, and is prompted by the treatment the agent receives. Positive feedback to the organisation by the agent reassures the organisation that it has served well, however, voice is more important when the feedback is negative. In the latter case the organisation or the state receives a signal to amend or repair its service. In the modern era, voice can and does assume many forms - email messages, phone calls, letter campaigns, street protests, class action lawsuits, and so on.

Voice too is amplified or damped by various conditions. In situations where the agents can exit, voice simply does not arise. In situations where there are severe penalties for raising a voice, such as in a dictatorial state or within some organisations, where exit is not possible then voice is usually muted or silent.

Hirschman argues that the combinations of possibilities of exit and voice can lead to nuanced arrangements of individuals and organisations. For example, when the state is providing a substandard service, such as a healthcare facility without any supplies, and if the residents in the nearby area have an option to exit, there will be none who will raise a voice, and enable the state to continue with the same sorry state of affairs. This happens frequently in India - for schooling, healthcare, city transportation - where the alternatives provided by the private sector allows citizens to exit and not raise their voice. "Once this avoidance mechanism for dealing with disputes or venting dissatisfaction is readily available, the contribution of voice - that is of the political process - to such matters is likely to be and to remain limited." [9].

Violence. Max Weber's classic definition of the state is that of an entity that has the sole authority over violence in a given territory. The state exercises this authority over violence through the police and the army. Although other organisations may have a right to use violence, through a private army for instance, this is only possible within the authority of the state.

Marginal citizens of developing countries often see only this view of the state, as a violent enforcer. The police are often viewed as agents of those who have access to state power, with their violence unleashed only on those without access.

2.3 Existing E-Gov Literature

The existing literature in e-government theory implicitly assumes the role and function of the state. In the normative view the state is assumed to want to improve the efficiency and effectiveness of the administration by providing services through electronic means. This view is effectively shared by many research papers, those commenting on the basis for e-government development and its trajectory, as well as those that critique the current status of research [10,1,7,17]. The intentions of the state are implicit in the efforts to increase efficiency, help create networks for interconnectivity, improve service delivery, increase interactivity, and help with decentralisation, transparency and accountability [17].

In the descriptive view, where researchers depict the functioning of the state, the intention of the state is not explicated but is revealed by the manner in which the state implements or designs e-government systems. In describing the implementation of a system in Guatemala [15], for example, the authors uncover that the state has 'deep structures' such as organisational arrangements, distribution of power, core beliefs and values, and control systems that determine how the system is eventually received. The functioning of the state evolves as a 'punctuated equilibrium' with brief periods of rapid change between long stretches of very little change.

In another example, the researchers [2] find that the state is moulded by certain 'regimes of truth' and 'the care of the self' that shape the implementation of e-government systems. The state alternately passes through discourses of modernisation and maintaining status quo, as harboured by different regimes. Further, the planning and design of systems is influenced by a rationality that, through critical reflection, assumes certain truths about life experiences.

In few cases, e-government research has explicitly assumed a form and role of the state [5], where it is assumed to foster centralisation of control and operate through a discourse of de-politicisation. However, there is very little research of this nature. The state remains largely un-theorised in the extant e-government literature. This leads to the central research question of this paper.

2.4 Research Question and Methodology

The state is experienced by citizens in particular ways, in that, the viewed state has certain properties. These properties include those of scarcity, exit and voice, and violence. E-government research has implicitly assumed a function and role of the state, but has rarely theorised it formally. The central issue addressed by this paper is how a theory of the state can be formed in light of e-government systems implementations. The main research question is:

How is the state viewed through the lens of an e-government system? More specifically, how are the properties of scarcity, exit and voice, and violence of the state experienced when e-government systems are implemented?

To answer this question, we examine one particular e-government system from India. This system is used primarily as a complaints registration system that enables citizens of a particular district in a relatively poor province in India, that of Uttar Pradesh. The system mainly enables residents of the district to file complaints and grievances online through public kiosks.

The methodology for this study was an ethnographic case study method [18]. The data for this particular e-government system was collected as part of a much larger research programme that included several e-government projects across India. This methodology was adopted as the objective was to study the phenomenon of the e-government system in its natural setting where there is little control over the system or the people using the system. Further, the research entailed asking how and why type of questions (rather than what type), and also required probing the respondents through follow-up questions.

One researcher, a co-author of this paper, resided in the district of the project for two months, in early 2010. The researcher lived in a village house, as a guest of one of the residents. Using this as a base he made deep contacts within this village and in surrounding villages. He traveled to the project kiosks located in the district, interacted with the kiosk owners, the users and also those who did not use the kiosks. During the fieldwork, data was collected through unstructured and semi-structured interviews, focus group discussions, document reviews, participant observation and by collecting physical artefacts. The researcher maintained notes on all interviews, and wherever permitted, took photographs of the respondents and the locations. A total of 78 interviews of independent citizens, kiosk owners, government officials, and village council members were conducted. In addition, 2 focus group interviews were conducted, and documents amounting to about 500 pages were obtained to support the analysis.

One particular line of questioning that was maintained throughout was that of seeking the differences in perceptions of the system between dominant and non-dominant caste groups [6].

3 The Lokvani System

Lokvani was initiated in December 2004 in the Sitapur district of the state of Uttar Pradesh, as an internet-based computer kiosk with a facility for registering online grievances. Being a backward district with only 38% literacy, Lokvani was envisioned not only to open a channel for redressing citizen's grievances through an online portal but also for a potentially large application of ICTs - such as providing information about various government schemes, issuing land and caste certificates etc. After its launch Lokvani became more popular for its grievance facility because of its ability to directly connect people to the highest authority, the District Magistrate (DM) of the district for their general complaints, without physically visiting the DM's office. The user interface of Lokvani was designed in the local language of Hindi and was hosted on an internet web server so that any person could register a complaint from anywhere, not necessarily from their village centres. The entrepreneurs charged fees as fixed by the government from the citizens, in a public-private partnership model [14]; these were Rs 15 (about $0.3) per complaint.

After the implementation of Lokvani, an aggrieved citizen could go to the Lokvani centre and lodge a complaint with the help of the kiosk operator. The operator logs in to the Lokvani system with a login and password through a web browser and enters the details of the complaint in a specific format. When the operator submits a complaint, the system generates a complaint number that the operator passes to the complainant so that he can track or check the status of the complaint on the next visit to the centre. All the complaints logged through the system are addressed to the DM irrespective of the concerned department, thus neither the operator nor the citizen have to bother about whom to send the complaint. After the complaint is submitted it is sorted at the DM's office which has a six-member team dedicated to this job. Here complaints are marked to the concerned officer/ department (if it is a police matter then it is marked to the relevant police station officer). Depending on the nature of the complaint a timeframe of resolution is determined by this team. The name of the officer to whom the complaint is marked is noted, and the deadline for the resolution is uploaded on the server. If required, either the concerned officer or field level employees visit the complainant. In a police case, station officers direct the constables to visit the place to enquire about the dispute registered. When the officer responds to the complaints, the response or resolution description is entered back into the system against the complaint number which citizens will have access to, to see the outcome of the resolution.

4 Data and Analysis

In this section we present the field data on the Lokvani system and our analysis of it. The two are combined to save space.

Scarcity - the original design of the Lokvani system was to address the issue of scarcity. This is evident from the statements made by the then Chief Minister of the state, in a media interview in 2005:"... the Lokvani project particularly

will benefit the common man greatly...realisation of the benefits will be most by the villager who wanders to district headquarter and tehsil office for his general grievances... Now there is a facility - Lokvani near the village from where he can avail all the services [Translated from Hindi by authors.]"

Within the current governance mechanism available at the village level in Sitapur, there are three broad approaches exercised by the citizens to voice their grievances and disputes. The first mechanism is that of mediation by local individuals or bodies; when individuals seek help of an influential person or approach the Village council to resolve the dispute. Village councils often deal with complaints by providing suggestions on public administration [16]. However, such councils reinforce the enduring social structures due to the presence of dominant caste or community members in their administrative bodies [11]. The second mechanism is local government intervention either through the DM's office or through the relevant government department, including police officials. The third mechanism consists of formal legal institutions, such as the court, to solve grievances and disputes. Dispute resolution touches everyday life in the village society.

Prior to Lokvani, persons of non-dominant castes, minorities and the poor generally relied on the first two mechanisms for dispute resolution. The relatively rich and politically connected persons tended to access the official justice system. If an aggrieved citizen had to seek the intervention of local government for dispute resolution, he had to physically visit either the DM's office at the district headquarters, the sub-district headquarters or the local police station (if it was a police matter). Sometimes, if the complaint was not registered at the local police station, citizens could seek intervention from the DM's office to get it registered. In Sitapur, citizens have a window of two hours a day to interact with the DM for registering their grievances. A heavy work load at the DM's office and a very short time window for citizens resulted in very few grievances being addressed and sometimes citizens traveled multiple times to get their complaints acknowledged. This process actually discouraged individuals to even seek redressal.

The state's scarcity is considerably reduced by the presence of Lokvani. Where earlier there were three manual means of accessing the state, the Lokvani system has enhanced the second method, of going to the DM, through electronic means. This is evident from both the type and volume of complaints registered within the system. Looking at the secondary data on usage of the Lokvani system we find the types of complaints depicted in Table 1. This summary is based on a random sample of complaints at various Lokvani centres.

The total number of complaints in the system was 11,697 in the the year 04-05, which peaked at 45860 the following year, and then gradually declined to about 11k by 2011.

Exit - While removing scarcity Lokvani enabled citizens of Sitapur to find an electronic means by which to access the state. This process also allowed them to find ways of exiting other engagements with the state.

Table 1. Category of Complaints

Category	Description
Farming-Related	Problem with tenant cultivation; dispute with Batai (tenancy) agreement; problem with government land use; problems in dealing with a government office (concerned with farm loan, government shops of fertilisers or seeds)
Money-Related	Dispute in collecting work pay; dispute in money lending; a problem with a government official (accusation of bribery)
Land Related	Housing construction rights (drainage system, yard related); dispute with encroachment of farm land; Medh Bandi (farm boundary dispute)
Neighbour	Problem with a neighbour, intimidation, harassment
Personal Injury	Complaint of personal injury or theft
Other	Dowry related; a consumer dispute; matrimonial problem; a family dispute (property division) etc.

Ram Ajore of Sitapur (of a non-dominant caste), of Biswan sub-district (Bhauli village), had complained at the DM's office related to an encroachment of land. He had first tried with the police, and not succeeding there, had then tried to register the complaint with the DM about 10 years ago. Then, for a decade, he engaged with the state to seek a resolution, but to no avail. When Lokvani was introduced, he exited his earlier engagement and filed a fresh complaint through the system in 2006. In another case, Munni, a 22 year-old married woman from a non-dominant caste community, was assaulted by a youth of a dominant caste while her husband was away at work. Later, when her husband returned and tried to file a complaint with the police, he was rebuffed. He did not return to the police, as he had been instructed, but filed a complaint through Lokvani.

In the district of Sitapur, the marginal and non-dominant castes would exit the system of filing a complaint owing to the scarcity and the difficulties associated with dealing with the state. Exit meant not filing a complaint, withdrawing a complaint, or reneging from long queues outside the DM's office. Exit would also happen in the case of demands of state-mandated incentives or entitlements, where denial or unavailability of access would force recipients to exit, or give up on their entitlements.

Lokvani has changed the situation with regard to exit. Residents can file a formal complaint, or register a request, as compared to the past, but they are not assured of recompense from the state. There is exit from an earlier form of engagement, however there is no guarantee of redress.

It must be pointed out that engagement with Lokvani too is being exited. The data regarding usage of Lokvani shows that citizens of Sitapur, not being assured of redress through Lokvani, are not using it as much as in the initial stages.

Voice - The field data clearly shows that post Lokvani, citizens were not silent about their grievances and it has given them freedom to voice their problems.

As a focus group transcript highlights this situation: "...before Lokvani people went to Sitapur only in very serious cases..when Lokvani came more people are talking about their problems."

One respondent, Damyanti, from a non-dominant caste, is currently separated from her husband and living with her sister. She showed a printout of a complaint that she had registered and said: "My husband has kicked me out from the house forcibly...I want the house which my husband is not ready to give. I went to the police but they did not listen to me and said it is a matter between husband and wife. Now I have done Lokvani ..., (hopefully) sarkar (government) will listen to me otherwise God will listen to me." This case was forwarded to the sub-district's block development officer for further investigation.

A critical issue is that citizens, particularly women and the poor, face problems in registering their complaints with the district administration and with the local police. This problem has also has been acknowledged by the Human Rights Watch throughout India. The Human Rights Watch (2009) report states that:"Crime victims frequently face police delays or refusal to investigate their complaints of crime. Victims of violence, particularly violence that is gender-based, frequently fail to report crimes because they fear being physically harmed at the police station or while traveling to it, especially at night. Crime victims who are poor and without legal counsel are especially vulnerable to police intimidation. (2009:p-42)."

Not having enough means or the fear of facing government officials acts as a barrier and the poor, landless labourers and women stand out as a particularly reluctant group, when it comes to registering complaints for seeking redress. Lokvani was conceptualised to give a voice to these groups and also to make the grievance redressal system more efficient. Where the manual system was rife with caste politics, the new system at least allows members of non-dominant castes to register their complaints.

Both the (former) Chief Minister and the project champion assured citizens that they now had a voice they did not have before. This voice was enabled through Lokvani. The implication of having a voice, in theory, means that the organisation or state that listens to this voice adjusts its own functioning to respond to the needs of its clients. Although, Lokvani did enable voice in terms of initiating the first part of the process of registering the complaint, there is little evidence to suggest that the state significantly changed its functioning or its efficiency. The problems were localised to a large extent, without having any impact on state policy, procedures, new laws, or re-arrangements of administration. The project champion almost admitted this in an interview.

Violence - In Sitapur district, violence is legally sanctioned to the police. This aspect of the state remains the same even with the presence of Lokvani. Local caste politics and dominance remains a determinant of how state power will be aligned.

Shyama is a widow who lives with her small daughter. She used to pile cow dung cakes in front of her house, which also faces the front yard of her neighbour. Her neighbour, belonging to a dominant caste, objected to the cake piles as it was

damaging their aesthetic view of the yard. They also threatened her of physical violence if she ever did it again. This is what Shyama had to say: "When I first went to the police station they did not register my complaint...even yelled at me saying that it is a minor neighbour dispute...but after Lokvani, police came to my house for an inquiry." Though Shyama was not allowed to pile the dung cakes in front of her house after the resolution meeting, she pointed to the fact that Lokvani forced police officials to visit her house. Shyama's case clearly shows that violence is condoned for those within dominant groups, but for her the promise of violence ensured she changed her behaviour.

5 Conclusions

A summary of the differences in the view of the state is provided in the table below.

Property	Before Lokvani	After Lokvani
Scarcity	Three ways of accessing the state, though each was scarce for marginal citizens	Scarcity is reduced, particularly for accessing the DM; marginal citizens benefited
Exit	Exit was a way of life	Lokvani is a means to exit earlier engagements and re-enter new ones
Voice	Voice was limited	Voice is heard and localised; the state remains the same
Violence	Police aligned with dominant groups	Same as before

This paper addresses a gap in the e-government literature, that of an adequate theory of the state. The analysis of the data shows that when e-government systems are implemented the view of the state, for the target population of the e-government project, changes. When seen from the theoretical lens of scarcity, exit, voice and violence of the state, we find that the e-government system changes some of the these properties.

These findings have two implications for e-government research and practice. 1) The legitimacy of the sovereign state is bound in the will of the people [3], so the view the people have of the state is very important. As Lokvani is a new 'face' of the government (not the only one though), its evaluation also has to include its new view. Evaluations of all e-government systems thus should include how citizens view the state, and how their perceptions change, not just of the system alone. 2) An explicit understanding of the view that citizens have of the state will enhance practice of e-government design and deployment. Citizens experience the state through the technologies that it deploys. When systems are deployed that enable and amplify access and voice, they should also ensure that marginal citizens do not have to exit their engagement as their concerns are not redressed. Further, design of the systems could address the issue of violence, by seeking possible mechanisms that preclude it.

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A Conceptual Model for G2G Relationships

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Abstract. This paper proposes a conceptual model that groups different factors that can influence relationships between government agencies. The model is based on a systematic literature review of published papers related to Government-to-Government (G2G) relationships. Through analysis of selected papers, we identified, classified, and organized factors that may impact relationships between government agencies. The proposed model may help government managers to improve their G2G policies.

Keywords: E-Government, G2G, Governance, Conceptual model.

1 Introduction

One objective of e-government is to provide a single entry point for all government services to citizens. Generally, these services are organized as life-events [10]. For example, in the province of Quebec, Canada, becoming a father requires 25 services in 15 government agencies whereas moving from one place to another requires 16 services in 13 different government agencies [15]. The success of a single entry point will depend on service quality.

E-government has gone through four phases: the information phase, the interaction phase, the transaction phase, and the integration phase [4]. The integration phase is more than the government having a web presence. In fact, government agencies collaborate with each other to provide this service, to share information, and to integrate their processes. Hence, several government agencies can be involved in delivering each service at a single entry point. Consequently, e-government success depends on relationships between the different government agencies that have to coordinate their activities to serve citizens better. These relationships are referred to as Government-to-Government (G2G).

Government-to-Government (G2G) is a relationship between two government agencies. A successful G2G has the necessary resources for collaboration and communication between government agencies with the aim of better serving citizens. Hence, G2G improves and builds up cooperation and collaboration between government agencies. Communication between government agencies, i.e., exchange of data, depends on the collaboration and cooperation mechanisms that they put in place.

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This partnership cannot be established without developing a governance relationship between government agencies [16]. Consequently, it may be important to develop many strategies as well as policies for inter-agency coordination and collaboration for the implementation of G2G. To create and implement such a one-stop single-entry point, it is first necessary to eliminate hierarchies and remove physical barriers between the different government agencies.

The objective of this paper is to identify, organize, and classify the different factors that influence governance relationships between government agencies. To this end, we propose a conceptual model of factors and dimensions, using inductive qualitative analysis of scientific papers selected through a systematic literature review. This model is part of a research project on the relationships between the central Quebec government and its regional government agencies. The objective is to see how regional government agencies can inform the central government about the specific needs of citizens, and how the services are made available online to citizens.

This paper is organized as follows. Section 2 presents the systematic literature review on G2G. Section 3 presents a review of selected G2G studies. Section 4 details the proposed conceptual model of factors. Finally, section 5 is the conclusion.

2 Literature Review Methodology

We adopted a systematic literature review approach. Such an approach provides a rigorous, reproducible, transparent, and scientific process for selecting and filtering scientific papers [5]. It also helps to reduce errors, strengthen legitimacy, and improve result reliability [3].

The literature review was performed (see Figure 1) on the various studies to identify the factors that affect relationships between government agencies. There were three stages. The first stage was to determine which databases would be searched. The chosen databases were 1) Proquest, 2) EBSCO, 3) ISI Web of Science, 4) ScienceDirect, 5) Social Science, and 6) GPO Access.

The second stage defined a list of key words for the search. The key words were: G2G, e-government, online government, online service, municipalities, agencies, ministries, administrations, local governments, public agencies, cities, regions, public relations, governance, technology, collaboration, communication, sharing, factor, challenge, acceptance, reluctance, manager. To improve the search, we associated each key word with a thesaurus. Figure 2 illustrates the thesaurus for the key word government. The thesauri were generated using the tool provided by the web site www.visaulthesaurus.com. A thesaurus provides the terms of a specific domain using semantic relationships (synonyms, antonyms, homonyms, relationships, etc.). Figure 3 gives examples of our search queries. The queries were based on the entire thesaurus, and applied to abstracts or full texts.

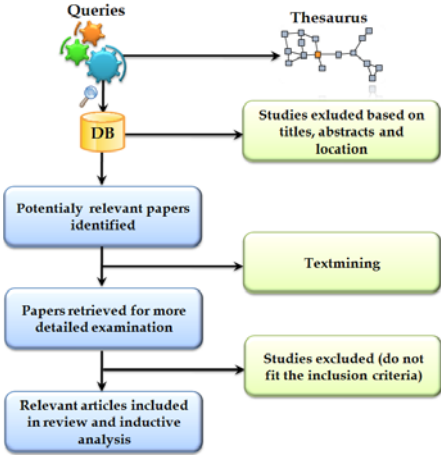

Fig. 1. Systematic review process

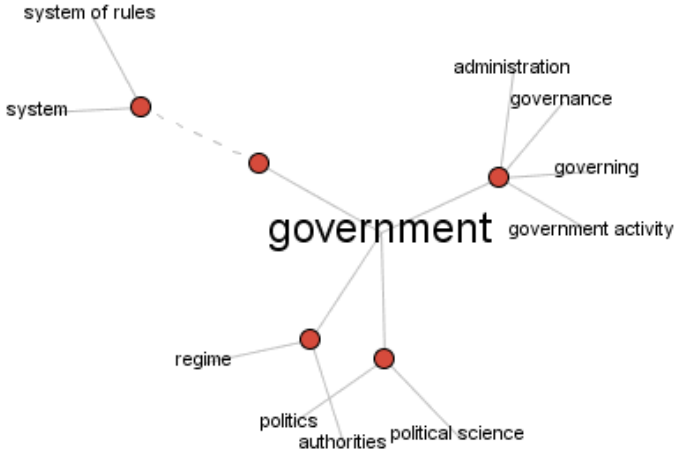

Fig. 2. Thesaurus of government concepts

More than one thousand papers were retrieved from the six databases. This number made it difficult to go through all of the selected papers. Hence, we used text-mining techniques in order to eliminate irrelevant ones. A paper was considered irrelevant if it contained a keyword less than five times. These techniques reduced the final number of papers to eight hundred.

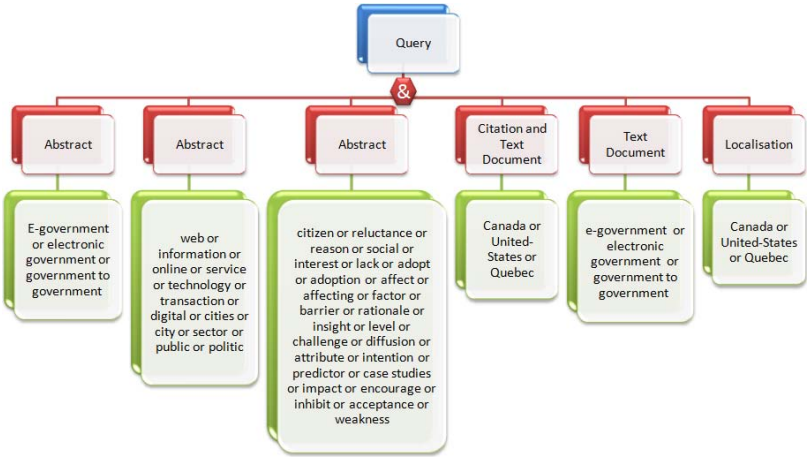

Fig. 3. Example of a query used to search articles on the topic of G2G

Finally, the third stage was to apply the selection criteria to the eight hundred papers in order to select those that were related to the subject at hand. The selection criteria encompassed inclusion and exclusion criteria. The inclusion criteria were:

- The paper should include definitions of services available electronically, as well as definitions of G2G procedures, policies, and stakeholders.
- The paper should describe relationships between government agencies.
- The paper should describe the factors that influence governance relationships between government agencies.
- The paper must explore the dimensions associated with various factors that enhance relationships between government agencies.
- The paper should address strategies and the best ways to improve G2G service delivery.

We rejected papers on government-to-citizen (G2C) and government-to-business (G2B) relationships. Furthermore, we decided to study only papers from developed countries, since those countries have the most G2G-related papers. Finally, we rejected papers on e-election, e-democracy, and the social impact of e-government.

Table 1. Results of selection of studies

Database	Number of shown studies	Number of selected papers	Number of excluded papers
PROQUEST	137	47	90
EBESCO	149	15	134
ISI Web of Science	177	33	144
Science Direct	149	1	138
Social Science	65	4	61
GPO Access	123	2	121
Total	800	112	688

Table 1 summarizes the results from this literature review for the number of found, selected, and rejected papers. Out of the 800 papers, only 112 were selected and 688 were rejected.

3 ICT and Organizational Factors

This section presents an analysis of the different selected papers. Due to limited space, we cannot present all of them. Only the ones mainly used to develop the conceptual model are referred to in this paper.

Successful G2G requires implementing more rational management and collaboration policies, more reliable strategies, and sustainable investments. G2G has gone through two phases of growth or change: catalogue access and transaction capability [18] . Catalogue access provides government agencies with information-sharing infrastructure, e.g., via intranets. Transaction capability provides government agencies with means to exchange data and manage transactions in real time.

Several studies have identified the factors that impact G2G relationships. The factors are mainly related either to information and communication technologies (ICT) or to organizational aspects. Some studies focus only on ICT factors, others on organizational factors, and others still on both.

3.1 Studies That Focused Only on ICT Factors

In this subsection, we present the works of McKinnon, Morgeson and Mathias, and Moon. [14] has studied relationships between government agencies as an exchange of data between these agencies. Electronic data can be exchanged if the computing systems use the same data format. The agencies should thus adopt and disseminate a common format. Government agencies should ensure secure exchange of data [14]. Security makes it easier to create and develop an efficient G2G system [14].

Furthermore, as in [14], [17] identified factors relating to information and communication technologies. These factors are the adoption of information technology, the creation of a strong technological infrastructure, and the development of G2G Information Systems. Improving G2G services requires adopting new information and communication technologies within government agencies. Specifically, the ICTs should make the following possible: orchestrate and integrate IT services within government agencies; strengthen communication between government agencies; adopt effective strategies and best practices for improving the web sites of government agencies; and finally adopt business information systems and service-oriented architecture (SOA) to organize and orchestrate government agencies' services.

Finally, in [16], four major ICT factors can impact relationships between government agencies: (1) establishment of a secure government Intranet and a central shared database to enhance cooperation, collaboration, and interaction between government agencies, (2) delivery of online services, (3) more effective application of e-commerce in transaction activities between government agencies, and (4) transparency in governance.

3.2 Studies That Focused Only on Organizational Factors

In this subsection, we present the works of Streib and Navarro, Tat-Kri Ho, and Tolbert et al. [23] studied and analysed the factors that affect G2G development. They found that development depends on the creation of organizational strategies. To this end, they proposed two organizational strategies: effective governance strategy to ensure control of both information flow and information sharing, and effective management strategy of operations in government agencies. These strategies can be supported by ICTs and can help develop G2G applications in government agencies, build G2G infrastructures, remove bureaucratic obstacles for the purpose of transforming G2G architecture, and satisfy the business requirements of different organizations included in the G2G.

G2G growth depends on the organizational structure of government processes and human resources management [7]. For [24] delivery of a public service requires coordination between the service centre and a one-stop single window with functional departments, such as local police and planning or transportation officials. Several dimensions can affect development of a strategic G2G vision: inadequate staffing; lack of funding and lack of staff for online service development and maintenance; the digital divide between racial groups; resources for technological changes in an organization; operations carried out by ministries; social concerns; economic disparities; and racial disparities in the digital age.

Finally, [27] identified dimensions related to human resources management that can impact G2G relationships. These dimensions are institutional capacity building, slack resources, and environment of innovation policies associated with human resources management for the G2G. Institutional capacity is defined as the technology implemented to facilitate organizational changes through the flattening of hierarchies, decentralization, and new reforms. Slack resources are defined as government income per capita with respect to degree of investment in technical and administrative infrastructure.

3.3 Studies That Focused on Both ICT and Organizational Factors

In this subsection, we present the works of Siau et al., Reddick, Kung et al., and Coursey et al. The first model is by [22]. This model uses ICT factors and level of human development factors. ICT factors are government information, government services, and computer science technologies. Government information refers to data stored in different formats such as hard-copy documents, electronic documents, electronic spreadsheets, databases, and knowledge. Government services are online facilities provided by government Web sites. Computer science technologies are telecommunication infrastructures. The factors associated with level of human development are longevity (as measured by life expectancy at birth), knowledge (as measured by combining the adult literacy rate and enrolment rates at primary, secondary, and tertiary levels of education), and finally living conditions (as measured by GDP per capita). Therefore, '*the higher the level of information technology and human development, the more advanced is e-government development*' ([22]). [21] recommend considering additional factors

(culture, government policies, and leadership) that can influence governance relationships.

[18] states that the governance model has an impact on the degree of cooperation between government agencies. It can be influenced by factors grouped into three categories: (1) external influences (requests from citizens for online services) ([26]), (2) key characteristics of e-government (e.g., efforts by government agencies to reduce their administrative costs), and (3) organizational factors that enhance growth (e.g., creation of separate IT departments) [9]. Furthermore, in another study, [19] focused on other key factors that affect the perceived effectiveness and performance of G2G relationships. These factors are the management capacity of the administration, security and confidentiality, and collaboration (demand for intergovernmental, interagency, and inter-sector developments) [11]. Each factor has several elements. The management capacity elements are content, leadership, strategic planning, and collaboration. The security and confidentiality elements are information security, IT administrators, and organizational factors. Finally, the collaboration elements are expressed through information sharing between different government levels [8].

In [12], G2G relationships succeed because of three main elements: the government works to upgrade the skills of professionals in new ICTs to improve G2G application quality, the government agencies take into account both their IT infrastructure and the development of their human resources, and finally the government agencies ensure that their online services are delivered to citizens securely. To meet these constraints, several factors must be addressed. These factors are grouped into a theoretical model [12]: (1) technology (2) information security, (3) development of business processes, (4) project management, (5) communication, (6) lawyers, and (7) human resources.

Finally, [6] focused on the governance factors that can impact G2G relationships. These factors are interactivity, interactions, integration, and information provision. Interactivity represents the ability of citizens to interact and contact governmental agencies. Transaction is defined by [29] as the exchange of value between two entities (an entity can be either a government agency or a citizen). Integration is of two types: vertical integration and horizontal integration. Vertical integration is the sharing of information between government agencies of different levels (e.g., municipal, provincial, and federal). Horizontal integration is the sharing of information between government agencies of a single ministry. Finally, information provision or cataloguing allows governments to move toward a transactional stage [13].

From these different studies, several factors have been identified. In the next section, we will provide a conceptual model that encompasses all of these factors and their relationships.

4 Design of a Conceptual Model of Factors That Influence the G2G Governance Relationship

The proposed conceptual model is developed using a general inductive approach [25] with the following objectives: (1) summarize the raw data, (2) determine

the categories for analysis of raw data with reference to research objectives and finally (3) develop a model that organizes the links between different categories. An inductive approach was chosen because there is no limit to our knowledge of a comprehensive taxonomy of factors that affect the governance relationship between government agencies. The inductive approach is guided by the research aims and allows us to analyze the data and knowledge in scientific papers, to develop a codification process for data reduction, and to encode the data in a comprehensive framework to identify, organize, and classify the potential factors that influence the governance relationship between government agencies.

The big challenge is to ensure that the identified categories of factors share the following characteristics that have been defined with respect to the recommendations of [25]:

- gives each category a label or a text segment (word, term or phrase).
- describes the meaning of each category by defining its key features and scope and delimitation (delineation) of its borders.
- associates a detailed description with each category extracted from selected scientific papers and studies, including portions of text, quotes, and images.
- establishes links between the different categories.
- and develops a conceptual model that describes the network of the identified categories.

Referring to the various recommendations proposed by [25], we undertook a process of consolidation to create well-defined categories of the identified factors. First, we identified several sets of text segments that have a unique meaning. At this level we assigned labels to each unit of meaning to describe new categories. After identifying different categories, we gave them initial definitions.

At this stage, we reviewed the categories we identified to eliminate redundant ones and to refine them. Furthermore, we identified sub-categories and their links to establish networks of concepts that represent the end point of the analysis. Then, we went through the different papers a second time in order to identify the links between the different categories from the previous stage. The theoretical model after revision and refinement of the categories of factors is shown in Figure 4.

The proposed model has 26 categories. It is organized as follows. First, coordination involves three subcategories: local coordination, regional coordination, and national coordination. In general, coordination is supported by a collaborative process between government agencies that depends on new information and communication technologies. At this level, ministries and government agencies make some investments to implement digital infrastructure through information and communication technologies. The ICTs provide fast and reliable access to information sources and government services. In addition, they facilitate information sharing and enhance security and confidentiality. Also, the governance relationship between G2G agencies depends: first on effective deployment of information and communication technologies and institutional capacity; second on legislation that regulates the governance structure; and third on institutional

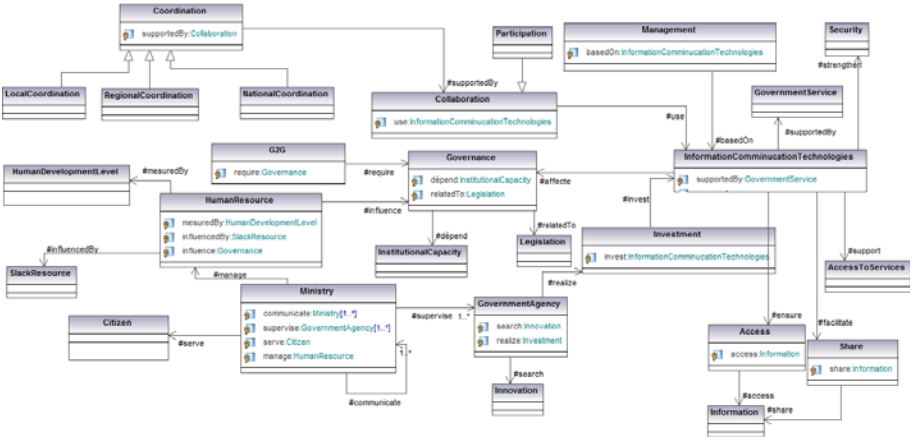

Fig. 4. Conceptual model of factors that influence the G2G governance relationship

capacity to operate with other government agencies. Each ministry serves citizens and manages human resources. Human resources are influenced by slack resources and measured by human development level.

5 Conclusion

G2G consists of electronically supported ICT activities between the business units of government, including those within the same governmental body. For many of these activities, the aim is to harmonize procedures, and to improve the effectiveness or efficiency of government [28]. Moreover, we can say that G2G primarily involves the use of ICT among various government agencies to increase effectiveness and efficiency of available services. G2G is a prerequisite for other e-government services, such as G2C and G2B.

This study had two objectives. The first one was to identify and classify the factors that influence the governance relationship between the central government and its regional agencies. The second one was to develop a conceptual framework in order to describe and understand this governance relationship. Thus, our research project used general inductive analysis to develop a general conceptual model of factors that influence the governance relationship between the central government and its regional governmental agencies.

As a future avenue of research, we wish to investigate the classes of factors identified by this study. We aim to develop a methodology based on the work of [20], which focuses on assessing factors that influence the alignment of business and information technology. Thus, the first stage is to develop questionnaires. The second one is to interview a number of actors from the central government and its regional agencies and take notes. The third one is to develop a relationship site. The last one is to examine each factors relationship separately to assess

its influence on the governance relationship. An additional avenue for research would be to identify ways to overcome the socio-technological barriers to the penetration of G2G in outlying regions.

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Coverage of eGovernment Security Issues in Mass Media

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Abstract. Public administrations have introduced eGovernment systems for many years. However, citizens' willingness to use these applications is still rather small. As proved by surveys, one major reason for this lacking acceptance is security concerns. In this paper, we investigate the role of mass media in this process of creating mistrust towards eGovernment. In doing so, we analyse three different newspapers concerning their way of reporting on IT risks and security issues in eGovernment systems using the method of content analysis. It shows that their news coverage is indeed quite biased and emotional possibly influencing the readers' attitudes towards eGovernment systems. Different media effect theories predict various models of affecting the recipients' stance, some of which are applied in our analysis. The outcome of this research is a set of assumptions stating in which way the communication of security issues in eGovernment systems in mass media influences the audience's attitudes.

Keywords: eGovernment, mass media, media effect theory, IT risks.

1 Introduction

The public administration has increasingly been providing its services in the internet for years. 'eGovernment' shall facilitate the administration processes. It promises advantages for both, the administration as well as the citizens. On the side of the public authorities cost savings should be achieved and media breaks are avoided leading to lean processes. The citizens on the other side shall benefit from a faster processing of their requests, a facilitated handing in of documents, availability of the administration twenty-four-seven, and the abolition of waiting time. Typical eGovernment systems are for example electronic population registers and voting machines. However, despite the advantages, citizens hardly use these offerings in the internet. According to a survey, only 6% actually make use of eGovernment services [1]. The decisive obstacles are security concerns.

Where does this objection come from? Are there certain prevailing reservations with regard to security issues and IT risks in eGovernment systems and if so how are they formed? There are several factors influencing the citizens' opinion on eGovernment. Besides personal experience also the public opinion, which is mainly published via mass media, plays a crucial role in creating trust or distrust towards these systems. In which way does this published opinion affect the citizens' attitudes?

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This link between the presentation of IT risks in eGovernment systems and the population's concerns has hardly been investigated. Therefore the present work contributes to close this gap by analysing how security issues of eGovernment systems are presented in the media and by deducing impacts this presentation could have on people's attitudes. The research question of the present work is:

How are IT risks of eGovernment systems presented in mass media?

In order to answer this question, different media are analysed according to certain criteria. Renowned media effect theories are applied to these findings in order to derive assumptions on how the public is influenced by the media coverage in IT risks in eGovernment systems.

The paper is organised as follows. In section 2 we give an overview of the current literature on risks in information systems and the most important media effect theories which describe the influence media consumption has on the recipients. Based on this theoretical background, in the following section we derive our hypotheses to be tested and present the material which will be analysed. Section 4 and 5 contain the presentation of our results as well as their interpretations. In the final section we will draw some conclusions and point out at further research to generalise our findings.

2 Related Work

2.1 Risks in Information Systems

Even within the domain of IT security there is no unambiguous definition of risk. Often the literature does not explicitly distinguish between threats and the damage they cause, which are two main components of risks. The third important constituent of a risk is the probability of a possibly occurring damage. With regard to the research conducted, here the risk of a threat is perceived as the probability of an occurrence of damage and the amount of damage that might be caused by the threat [2].

Threats describe ways in which vulnerabilities can be exploited to cause damage. They can, for instance, arise due to programming mistakes or due to the user's ignorance of security configurations which for example allows for attacks of Trojan horses or worms. However, nowadays most of the security gaps can be exploited remotely. In 2008, more than 75% of the newly discovered vulnerabilities could be taken advantage of from afar [3].

Damage occurs when one or more protection objectives are derogated. These objectives aim at protecting information respectively data. They include the restriction of data access (integrity and confidentiality) and the exclusive permit for authorised users to access them (authenticity). Furthermore, it needs to be assured that authorised users can use the desired data (availability). After having accessed or modified the data it is often necessary to relate these actions to the user who has executed them (auditability or non-repudiation) [4].

The third constituent of a risk besides the threat and the damage caused is the probability of damage, i.e. the probability that a threat actually exists as well as the probability that this existing threat will cause harm. Both probabilities depend on several factors. First, the attacker's motives play an important role as they will

influence the persistency; second factor is the sophistication of the attacks, third the vulnerability of the affected system largely codetermines the success of an attempted attack [5].

eGovernment systems can be regarded as a subgroup of general IT systems [6]. Besides the risks related to the damage of assets worthy of protection, Evangelidis et al. (2002) define four other main generic risk factors of eGovernment: technological/implementation, social/human, financial and legal risk factors. According to their understanding risk does not only mean the damage of the assets worthy of protection but comprises all elements that can lead to the failure of an eGovernment project. This might, for instance, also include the risk of the citizens' lacking acceptance of eGovernment systems due to privacy and security concerns.

2.2 Media Effect Theories

In order to draw conclusions in which way citizens are influenced by the coverage of IT risks in newspapers we resort to some of the most prominent media effect theories. However, the impact of media on the recipients' attitudes is discussed controversially. There is not one single theory but a multitude of explanation attempts. The assumptions of media effect on the recipient have changed in the course of time. Nowadays media impact research is acknowledged as a complex, multi-factorial process which cannot be described generally but which has to distinguish sub-models. The *stimulus-response approach*, which dates back to the 1920s, assumes that a media stimulus is fired at a defenceless individual and will exactly cause the effect that the sender intended [7]. This rather simple explanation of media influence is based on the assumption that the sender is not subject to other influences which provide information contradictory to the received message. The stimulus-response approach is mainly popular because of its simplicity. However, in today's media research its assumptions are seen as too unrealistic. Nevertheless most of the further approaches use the stimulus-response theory in an alleviated form.

According to the *two-step flow theory*, which was developed in the 1940s, it is not the media which affect the recipients but other people in their social environment, the so called "opinion leaders" [8]. The impact of media depends on conditions that lie in the social context, i.e. beyond the media. However, it is remarked that in industrialised societies everyone is exposed to media and their influence and thus the distinction between opinion leaders who consume media communication and the rest of the society that does not is untenable. Despite this criticism the two-step flow model is rather popular even today.

A significant finding in the late 1950s and early 1960s was that mass media do not cause a change of attitudes but rather enforce already existing opinions. According to the theory of *cognitive dissonance and selective exposure* individuals tend to actively look for information which support their beliefs [9]. Thus they will only consume those media offerings that accord with their opinion. This approach is nowadays mainly applied in advertising campaigns, which cannot motivate the consumers to buy products but can serve as retrospective legitimation of purchase decisions.

In 1970, the theory of the *knowledge gap* was developed, which stated that the knowledge communicated by media is used differently by different parts of the population. "[S]egments of the population with higher socioeconomic status tend to

acquire this information at a faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease." [10] The effect is not caused by the medium itself but by a consumer's socio-economic status. The knowledge gap theory is nowadays often applied in connection with the proliferation of the internet, e.g. in the field of eInclusion [11].

Shortly after the emergence of the knowledge gap model, the so called *agenda setting* approach was introduced. It does not deal with the question whether media influence *what* people think about certain topics but *which* topics they think about [12]. Accordingly, those topics that are ranked highly in media presentation are also regarded as important by the recipients. However, it is not clear whether certain topics are important for the recipients because media report on them or whether media merely pick up common topics in order to address the wishes of their target groups.

The assumption of the *spiral of silence* theory, which was set up in the 1970s, is that people are anxious to avoid social isolation [13]. Individuals observe their environment through their direct social context and indirectly via mass media. Whereas the former conveys to them which opinions cause isolation in public, mass media draw a picture of the assumed majority opinion. According to the spiral of silence theory, people tend to conceal their opinion when it differs from the assumed majority opinion due to the fear of social isolation. People who believe to represent the majority opinion, on the contrary, are likely to express their opinion openly. This behaviour will lead to a spiral in which finally the opinion assessed as dominant becomes the actually dominant opinion.

Even though the above mentioned media effect theories differ with regard to their conclusions they are all subject to the same arguments of criticism. First of all there is no general procedure how to 'measure' the effect of media. There is no scale to categorise attitudes or behaviour. A second point of criticism is that there are no long-term studies which analyse how media affect a recipient's attitudes. The conducted studies were all laboratory experiments creating an artificial situation. In addition the number of probands was very small so that no significant results were obtained.

Due to this plethora of media theories, which in parts proclaim complete opposites, it is difficult to draw substantiated conclusions. Media certainly have effects on their audience but can explain changes in attitudes and behaviour only to a certain extent. Media effects are just possible when the boundary conditions allow for them.

A further theory that has to be considered is the news value theory stating that to every event a certain news value is assigned, which represents its worthiness of publication. News values are derived from combining several characteristics like simplification and sensationalism. This means, for instance, that complex events are presented in a simplified way and that there are more reports on dramatic and scandalising events because they draw the readers' attention more intensely [14].

3 Research Methodology

In the research conducted here the communication of IT risks of eGovernment systems in mass media was analysed based on the theoretical considerations addressed in the previous sections. eGovernment is a rather young application area of information systems. However, it affects the matters of all citizens. Especially the connection between the application of eGovernment systems and the population's

concerns has hardly been investigated. The contribution of the present work is to close this gap by analysing how risks of eGovernment systems are presented in the media and by deducing impacts this media coverage could have on people's attitudes. The underlying research question is:

How are IT risks of eGovernment systems presented in mass media?

In the following this research question will be transformed into a catalogue of hypotheses, which were at first derived from the theoretical foundation presented in the previous sections and were later on complemented by a first review of the material to be analysed. We divided our hypotheses into the four categories *triggers of articles*, *topics of articles*, *assessment of risks*, and *quality newspapers and tabloids*. As it is difficult to obtain television or broadcast material ex post only print media were included in the investigation.

Triggers of articles:
As with most topics newspapers mainly deal with IT risks in eGovernment systems when there are events that 'trigger' the reporting. On the one hand, these triggers can be 'neutral' or 'positive' events as in the case of the introduction of a new eGovernment system. On the other hand, these events can be 'negative' as in the case of an attack on a system. According to the news value theory shocking events are more worthy of publication. Thus, it may be assumed that in newspaper articles IT risks in eGovernment systems are mainly linked to 'negative' events.

Hypothesis 1: Newspapers do not report on risks in eGovernment systems continuously over time but especially when specific negative events happen, i.e. for instance when attacks occur.

Topics of articles:
What are the topics of articles dealing with IT risks in eGovernment? Are there specific topics that newspapers put an emphasis on and are there in return certain topics that are neglected? According to the above mentioned news value theory it is likely that a negative event is the key issue of an article on IT risks. When describing IT risks is there a balanced description of disadvantages and advantages of eGovernment systems?

Hypothesis 2: The key issues of articles dealing with risks in eGovernment systems are specific events of damage.

Hypothesis 3: In articles dealing with risks in eGovernment systems the advantages of such systems are neglected.

Assessment of risks:
How do newspapers assess IT risks in eGovernment systems? Is there a clear tendency in the assessment or does the assessment vary depending on the circumstances? Because of its very nature – eGovernment systems often deal with sensitive data of the entire population – it might be that risks are always judged as serious independently of the circumstances. This assessment could be emphasised by the use of polemic language and by a non-objective reporting.

Hypothesis 4: Risks in eGovernment systems are in most cases presented as high, i.e. either the probability or the amount of damage or both are judged as high.

Quality newspapers and tabloids:
In which way does the reporting in quality newspapers and tabloids differ? Tabloids are renowned for reducing events to entertaining elements, exaggerating and using colloquial polemic language [15]. Therefore it is likely that all assumptions of the hypotheses 1-4 hold even more strongly in tabloids.

Hypothesis 5: In tabloids all criteria mentioned in the hypotheses 1-4 are intensified in contrast to quality newspapers.

The sampling units are issues of *Süddeutsche Zeitung (SZ)*, *Frankfurter Allgemeine Zeitung (FAZ)*, and *BILD*; all of them are newspapers that are published in Germany. With 442,000 issues sold the *Süddeutsche Zeitung* is the nationwide newspaper with the highest circulation. Its political positioning is considered as liberal [16]. The second largest nationwide newspaper is the *Frankfurter Allgemeine Zeitung* with about 365,000 issues sold daily. As its political positioning is regarded as rather conservative [17] the *FAZ* and the *SZ* represent opposite editorial directions and thus cover the spectrum of journalistic positioning concerning controversial topics. With a circulation of about 3.03 million issued sold daily and more than 12 million readers [15] the *BILD* is the most read newspaper in Germany. It reaches about 20% of the German population. It is characterised by emotional and selective reporting and offers a composition of facts, service elements (like weather forecast or television programme), sports and entertainment including sex and crime.

The investigated time period is 1st January, 2008 to 31st December, 2009. It did not seem logical to analyse material that dates back many years because eGovernment is a rather new development. Practical reasons for this time span were that the investigated media were fully available. The sample was determined in two steps: Firstly, all articles whose title or subtitle contained certain keywords as well as their truncated forms were chosen (the English translation of these keywords can be found in Table 1). These keywords were derived from theoretical considerations on IT risks and by scanning exemplary issues of the *Süddeutsche Zeitung*. The *Süddeutsche Zeitung* and the *Frankfurter Allgemeine Zeitung* could be scanned electronically. The *BILD* had to be scanned manually. In the second step all the articles that were found were read and it was checked whether they dealt with IT risks in eGovernment even if just marginally.

Table 1. Keywords used in article research

administration	criminal	hacker	net	spy out
attack	damage	hardware	non-repudiation	state
authentication	danger	information	online	threat
authorisation	data	integrity	password	Trojan
availability	denial	internet	PC	virus
brute force	eavesdropping	IT	phishing	voting
buffer	Elster (electronic	key logger	risk	weakness
computer	tax revenue portal)	LAN	social engineering	web
confidentiality	government	malfunction	software	worm

For analysing how newspapers report on eGovernment risks, we applied the content analysis to our sample. Content analysis is an empirical methods often used in social science in order to analyse both the manifest as well as the latent content of communication. Therefore categories are developed in which the material to be analysed is coded. For further information cf. [18] and [19].

4 Presentation of Results

For presenting the results of the research conducted we aggregated the outcomes of the coding phase. In the period from January 1st, 2008, to December 31st, 2009, altogether 79 articles were identified that specifically deal with IT risks in eGovernment systems. The *Frankfurter Allgemeine Zeitung* published 31 articles (39.2 %), the *Süddeutsche Zeitung* 27 articles (34.2%) and the *BILD* 21 (26.6%).

Triggers of articles:
77 of the 79 articles, which are 97.5%, refer to a specific event that happened in that time. Only two articles did not refer to such an event. An event is regarded as negative if a protection objective is directly threatened or harmed. 42 (54.5%) of the current events the articles referred to could directly be classified as negative. In the remaining 35 articles (45.5%), which mentioned an event, this event was not immediately assessed as negative. Thus, this hypothesis cannot be verified at first sight. However, most of the non-negative incidents indirectly base on a negative event. The court decisions on voting machines, for instance, only took place as these machines were said to be insecure. Thus, when including these 'second-order' negative events, 72 articles, which is 93.5%, refer to negative events, and only five articles base on non-negative ones (these are articles that were triggered by upcoming or happened elections). Taking that perspective, hypothesis 1 can be considered as verified.

Topics of articles:
The key topics of the 79 articles, which mention IT risks in eGovernment systems, vary significantly (cf. Table 2). We identified 21 categories of main topics. The key issues of 47 of the 79 articles (59.5%) are specific events of damage like attacks on government websites, the loss and theft of computers or the exposure of sensitive data. The remaining 32 articles (40.5%) do not mainly deal with such specific events. Although the results are not unambiguous there is a clear tendency and hypothesis 2 can thus be verified. 42 of the articles contain a further sub-topic. When including these 'second-order' events of damage, 62 articles (78.5%) deal with specific incidents of damage and only 17 articles (21.5%) do not discuss such incidents in detail.

Merely in 11 articles (13.9%) the advantages of the mentioned eGovernment system respectively the use of the discussed devices were mentioned. The ratio of the sentences which discuss these advantages and the sentences which address IT risks is 0.43 on average. This means the articles (and only those which mention advantages at all) discuss IT risks of eGovernment systems about 2.3 times more 'intensely' than their advantages. In addition the positive assessment of the mentioned advantages is generally weak. None of the advantages is characterised as 'high'. Four of the 11

articles describe the advantages in a way that can be characterised as 'medium', three see the advantages as 'low' and the remaining four articles present advantages without any comment or describe them in a way which neutralises any positive assessment. Based on the findings, it can be concluded that advantages of eGovernment systems do not play an important role in articles that mention IT risks in such systems. Therefore hypothesis 3 is verified.

Table 2. Distribution of the ten most frequent key issues

Frequency	Key issue	Specific event of damage
10	Reflections on (un)constitutionality of voting machines	No
9	Attack on government website/computer	Yes
8	Loss of sensitive data/computers/peripheral devices/other self-inflicted mishaps	Yes
6	Theft of computers from authorities	Yes
5	Attack on enterprise (website/server/computer) or NGO	Yes
4	Exposure of sensitive data	Yes
4	Attack on/theft of military data	Yes
4	Cyberwar	No
4	Malfunction of eGovernment software/hardware	Yes
4	Functionality of voting machines	No
21	Other	

Assessment of risks:
In 32 articles the probability of damage or the amount of damage (or both) are presented as high (40.5%). 18 articles (22.8%) assess them as medium, 6 articles (7.6%) present risks as low and the remaining 23 (29.1%) do not assess them or neutralise the assessment by counterarguments. Thus, there is a clear tendency to assess risks as elevated. However, the majority of articles do not present risks as particularly high. Therefore hypothesis 4 can be verified partly, but not without reservation. Even though not being the majority, 40% of the articles assessing risks as high still represent a considerable amount of articles.

Quality newspapers and tabloids:
For identifying differences between quality newspapers and tabloids, the results of hypotheses 1-4 were contrasted for both media types, i.e. on the hand the *Süddeutsche Zeitung* and the *Frankfurter Allgemeine Zeitung* and on the other hand the *BILD*. Hypothesis 1 held for tabloids at least in the same way as for quality newspapers. The assumptions of hypotheses 2 and 3 were significantly intensified in tabloids. The statement of hypothesis 4 was not intensified in tabloids. However, in general, it can be said that tabloids intensify most of the hypotheses.

5 Interpretation

First of all, it is striking that newspapers report on IT risk and security issues in eGovernment systems relatively infrequently. Only 79 articles of three different newspapers deal with this topic within a period of two years. Thus, it can be concluded that this topic does not play a very important role for the citizens respectively the readers of the newspapers. When taking into account the *agenda setting* approach, which argues that the topics discussed in media determine the 'agenda' of the recipients, it can be concluded that IT risks in eGovernment systems are not a topic the recipients are strongly aware of.

As people are not interested in the risks of eGovernment systems it is likely that they are not interested in eGovernment systems at all, which has also been proved by several surveys [1]. The low relevance of IT risks in eGovernment in the media is also reflected in the temporal distribution of the articles. Newspapers only publish articles when specific events happen. Thus, in general this topic is not discussed.

The underlying events of the articles are in most cases incidents which can be assessed as negative and if that is not the case they often have a negative context (e.g. the declaration of a data commissioner is based on the loss of sensitive data). In accordance with the *stimulus-response* model, which assumes a direct media effect, the readers of such articles are more likely to automatically link risks in eGovernment to negative incidents than in the case of continuous reporting on such IT risks or when discussing them in connection with non-negative events. Advantages, which would have moderated the negative presentation of eGovernment systems, are hardly mentioned in articles on IT risks. Thus, an objective reporting on this topic, which contrasts risks and advantages, does not take place.

A media effect theory which can give hints to the different effects of tabloids and quality newspapers on consumers is the *knowledge gap* hypothesis. It states that the levels of knowledge of higher educated and of lower educated parts of society will further differentiate as the former are able to process information more quickly and will therefore create new knowledge more easily. This effect could be further intensified by the different levels of detail in objective reporting on IT risks in eGovernment (or on any topic in general) of quality newspapers and tabloids. Quality newspapers, which mainly address people with a higher degree of education, inform about these IT risks and especially the threats or security issues in a more detailed and objective way than tabloids. Hence, the readers are offered more background knowledge. This broader information content increases the knowledge of readers of quality newspapers more strongly than readers of tabloids, which provide less information on the actual incidents. Hence, the knowledge gap between people with a higher degree of education and people with a lower one might increase due to the different styles of reporting.

Although it could not be verified that newspapers assess the IT risks of eGovernment systems as high, in most cases there is a clear tendency to do so. This is achieved by both explicit arguments and a polemic choice of words. If again a *stimulus-response* effect is assumed the recipients of newspapers will adopt the idea of eGovernment systems representing high risks. This might explain why such systems are not used.

It is striking that tabloids, which are known for their polemic communication, do not assess IT risks as especially negative. However, this might be due to the fact that there are many articles of the journalistic form 'news', which report in a short and objective way leaving out assessing expressions [20]. Nevertheless, the mere mention of events without referring to possible consequences or explaining limitations of the amount of damage allows for readers' interpretations. This 'non-mentioning' of further details can therefore create more negative associations from the readers' point of view than a more detailed reporting would have done. Again, the neglected coverage on IT risks in eGovernment systems shows the low importance that is assigned to this topic by the *BILD* and – according to the *agenda setting* approach – also by its readers. Apparently, IT risks in eGovernment systems do not possess a high *news value* as they are hardly included in people's personal experiences and therefore remain vague and abstract.

Moreover, as mentioned above, the most decisive obstacle for citizens to use eGovernment applications are security concerns. If a generally existing fear concerning data security and privacy is assumed, the *cognitive dissonance* respectively *selective exposure* hypothesis would imply that these citizens would consume those articles which confirm their opinion and even intensify it. Another aspect of the *cognitive dissonance* and *selective exposure* theory explains that people try to get their actions confirmed by consuming those messages that attest them a right behaviour. It is likely that this is the case with IT risks in mass media, too. When people do not want to use eGovernment systems because of security concerns and they later on read about incidents in these systems they will get confirmed that it was sensible not to use them.

Another theory leading to a negative attitude towards eGovernment systems due to the media coverage of IT risks is the *spiral of silence*. As media report on IT risks in eGovernment systems rather negatively, a dismissive attitude towards eGovernment systems will be assumed to be prevailing. Critics of eGovernment systems might further contribute to this negative attitude whereas supporters of such systems might fear to express their opinion openly. Therefore, the negative attitude towards eGovernment systems might finally become the prevailing one.

6 Conclusions and Further Research

In conclusion, it can be stated that the presentation of IT risks in eGovernment does not play a very important role in media coverage – but for users of eGoverment-Services, i.e. the citizens [21]. If, however, newspapers present this topic they will assess it in a rather negative way. This is achieved – not necessarily intentionally – by discussing IT risks in eGovernment systems mostly when negative incidents occur. Furthermore, the key issues of such articles are in most cases a negative event. Advantages of the discussed systems are rarely mentioned and in the cases they are, they are assessed as rather marginal. However, this is limited to the scope of the investigation, mass media in Germany.

Generally, all media effect theories assert that the negative reporting on IT risks in eGovernment has an impact on the audience. However, according to the assumed media effect model these impacts vary significantly. In accordance with the *stimulus-response* model the recipients of such negative reporting are directly influenced and

also form a negative attitude towards eGovernment systems. Less drastic influences are, for instance, suggested by the *cognitive dissonance* or *selective exposure* theory, which merely assume the fortification of already existing attitudes. This approach asserts furthermore that citizens who did not use eGovernment applications get confirmed that they decided correctly when later on reading articles on IT risks in eGovernment systems. The *spiral of silence* approach states that the opinion which is assumed to be prevailing – in this case a negative attitude as communicated by the media – will also become the actual dominant opinion. Another point of view is taken by the *knowledge gap* hypothesis, which assumes that due to the differing levels of detail in media which address people with a higher degree of education on the one side and media addressing people with a lower degree of education on the other side, the discrepancy of knowledge between these two social groups is intensified.

However, the conclusions presented here are only assumptions which were derived from applying media effect theories to the findings of the analysed material. Therefore, the next step would be to check these assumptions empirically. This could be achieved by carrying out an experiment where the actual effect of different newspaper articles on the readers is investigated or by an enquiry. These results could, for instance, be used for public administrations promoting eGovernment systems more effectively. In order to analyse a broader data base and to generalise our findings, it would be sensible to extend our research to IT systems in general and not to limit ourselves to eGovernment systems. Another aspect arising for further research is the change of the coverage of IT-Risks through the use of social media and social networking sites like Facebook and others. This definetly will have an effect on the cosume of news and stories and actually additionally leads to a change in the mass media landscape. Both effects of change have to be investigated in the future.

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A Context-Aware Inter-organizational Collaboration Model Applied to International Trade

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Abstract. In international trade, there are a number of aspects that influence the interactive relationships between business organizations and governmental organizations, which makes it difficult to regulate the business processes in an integrated way. Modeling such kinds of organizational interactions requires a mechanism to differentiate interactive environments and elaborate regulations according to their characteristics. For this purpose, a context-aware inter-organizational modeling approach is proposed in this paper. The approach analyzes organizational interactions through three phases from abstract to concrete: (1) general specifications which describe organizations in terms of atomic roles with intellectual objectives, (2) contextual specifications which extend general specifications by applying contexts to derive composite roles with details on how to accomplish the objectives, and (3) operational specifications which construct a set of complete models of an inter-organizational collaboration by assembling contextual specifications according to the run-time environment. An example consisting of two scenarios of direct control and self-regulation in international trade is used to illustrate our model.

Keywords: Context, international trade, OperA, organization modeling, roles.

1 Introduction

With the rapid development of international trade, strategic alliances, collaborative commerce, virtual corporations, and value chain integration of multiple organizations are established to achieve better performance [1]. Collaborative organizations are involved in the value chain to accomplish not only their own goals but also the cooperative goals. On the one hand, business organizations try to operate as efficiently as possible. On the other hand, governmental organizations have to perform tasks in the area of security to regulate business performance. Governmental control and regulation of complex multi-organization alliances is not only time-consuming but also costs a great deal of human resources. Hence, interactions between business and governmental organizations is changing from monolithic control by regulatory authorities to distributed environments where private enterprises are free to regulate their affairs within boundaries set by the regulatory authorities. The former way of controlling is called *direct control* and the latter is named

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self-regulation. In order to determine the effects and possibilities of different approaches for direct control and self-regulation, a careful analysis is required to make sure that integrated business processes are performed in a secure and smooth way. To this end, we propose a framework that enables modeling and comparisons between different inter-organizational collaborative approaches. A large number of aspects influence the regulative relationships between business and governmental organizations, such as:

- Diversity of business types: food, clothes, electronic devices, etc.
- Diversity of regulation policies: AEO[1], C-TPAT[2], etc.
- Diversity of partnerships: long-term, short-term, etc.

Combinations of these factors result in different relations between governments and businesses due to the different policies applicable in each case. For example, the safety requirements for an AEO certificate are interpreted quite differently for a company that is exporting dairy products (risk of food safety) than for a company that is exporting scrap metal (risk of hidden bombs). Even though at an abstract level, regulative relations between governments and businesses can be modeled in the same way, the diversity of specific contexts and their characteristics leads to an explosion of interactive models (i.e., models are case specific and not re-usable), which makes it difficult for both business and governmental organizations to articulate their interactions. Context-aware applications provide potential solutions to this problem as they look at *who's*, *where's*, *when's* and *what's* to determine *why* the situation is occurring [2].

Moreover, the individual characteristics of actors in the interactions need to be further detailed to make sure that they can fit the requirements and restrictions of both businesses and governments. Therefore, the main objective of this paper is to describe how to model organizational interactions following a contextual refinement process, i.e., from abstract to concrete. This enables each partner in the supply chain to specify their responsibilities precisely and avoid unpredictable failures such as unmatchable information, misbehaving, etc.

Business organizations and governmental organizations interact with each other within a set of regulations, which can be described as a Multi-Agent Systems (MAS) where multiple intelligent agents interact within a set of norms. In a given MAS, cooperation between agents that possess diverse knowledge and capabilities facilitate the achievement of global goals that cannot be achieved by a single agent. MASs have been shown to be highly appropriate for the modeling of open, distributed, and heterogeneous systems [3]. OperA [4], being an agent-based modeling framework, has provided a basis for modeling multi-organization interactions. Therefore, in this paper we extend its architecture and present a framework that not only involves the notion of context but also supports a contextual refinement modeling process. The remainder of this paper is organized as follows. In section 2, the background and

[1] The Authorized Economic Operator (AEO) is a European-wide customs initiative that aims to secure the supply chain while at the same time reducing the administrative burden for actors through the use of self-regulation.

[2] The Customs-Trade Partnership Against Terrorism (C-TPAT) is a voluntary supply chain security program led by U.S. Customs and Border Protection.

related work of our research are presented. Section 3 illustrates the proposed model by explaining its formal definitions with an example. Then, in section 4 the design guidelines of the model are presented. Finally, section 5 draws the conclusions and discusses our future work.

2 Background and Related Work

Comprehensive analysis of agent systems has shown that different design approaches are appropriate for different domain characteristics [5]. In particular, multi-agent organization frameworks are suitable to model complex environments where many independent entities coexist within explicit normative and organizational structures. Numbers of MAS methodologies with a clear organizational vision have been developed such as Gaia [6], Tropos [7], MOISE+ [8], AGR [9], INGENIAS [10], etc., which provide potential approaches for modeling inter-organizational interactions between business and governmental organizations.

All these approaches adopt the notion of *role* enacted by *agents*. Role is defined as functions and/or responsibilities that guide individual behaviors and regulate group interactions [11]. Strijbos et al. [12] discern three levels of the role concept: micro (role as task), meso (role as pattern) and macro (role as stance). Dahchour et al. [13] present a generic role model in which both static and dynamic aspects of the role relationship are considered. There is a different perspective in the field of Role-based Access Control (RBAC), in which roles are used to identify use classes for systems.

As discussed in the Introduction, context-aware applications are appropriate for modeling different interactive environments. In the field of computer science, context is regarded as a set of attributes associated to specific situations. From the perspective of cognitive modeling, a dynamic theory of context considers context as the set of all entities that influence human cognitive behavior on a specific occasion [14]. In the field of sociology, context is regarded as networks of interacting entities and focuses on the structural properties deriving from recurrent interactions among entities. In international trade, we define context as a set of states associated to interactive entities in specific environments. The regulation of business activities by governments is different according to the context of operation. An example of self-regulation context in international trade is the Authorized Economic Operator (AEO) program [15]. In this paper, we use this specific case of AEO to analyze and compare the two scenarios of direct control and self-regulation by the proposed model.

Based on the studies of MAS, Role and Context, we propose a context-aware inter-organizational collaboration model which (1) gives an elaborated analysis of roles, (2) explicitly considers the influence of contexts on organizational interactions, and (3) supports a contextual refinement process for modeling organizations. We use the OperA framework as a basis for our work because firstly it is a formal organization model, secondly it has a well-defined structure for roles and dependencies, and lastly it has a software analysis tool that can be used for evaluation.

The OperA framework [4] consists of three interrelated models: The *Organizational Model* (OM) is the result of the observation and analysis of the domain and describes the desired behavior of the organization. The *Social Model* (SM) maps organizational roles to agents and describes agreements concerning the role enactment in social contracts. Roles are typically declarative entities meant to

represent a part of the organization's design and can be taken up by the agents enacting the role. Objectives of an organization are achieved through the actions of agents. Finally, the *Interaction Model* (IM) specifies the interaction agreements between role-enacting agents. This paper focuses on the *social structure* in the OM dimension of OperA which describes organizational interactions from the designer's perspective and is also the first step in the methodology of OperA framework.

3 A Context-Aware Inter-organizational Collaboration Model

In this section, we introduce our model and illustrate it by an example. In the example, we apply the proposed model to describe two scenarios of direct control and self-regulation using the specific case of AEO in international trade.

3.1 Fundamental Concepts

We first illustrate several concepts extended from OperA, which provide a basis to the proposed model. We only show a part of the properties of each concept to keep it simplified. Note that an element presented by a lowercase letter is a member of the set indicated by the corresponding capital letter, e.g., $r \in R$.

1) Role (r)

A role is a set of objectives *Obj*. Objectives of a role indicate its individual responsibility, i.e., if a role is enacted, its individual responsibility is undertaken. To facilitate multiple levels of modeling from abstract to concrete, we define two kinds of roles in OperA+.

(1) *Atomic role* (r_A = (*name*, *Obj*))

Atomic roles are roles as stance which hold relatively general objectives. They provide a macro-level understanding of what tasks will be carried out.

(2) *Composite role* (r_C = (*name*, *Obj*, *intl*))

Composite roles are roles as pattern which not only express the stance through their objectives but also give more details on how to accomplish the objectives through lower level organizations, each of which is indicated by an inter-level link *intl* = (*r*, *org*). The pattern is represented by the sub-roles in the lower-level organization.

2) Organization (*org* = (*name*, *R*, *Dep*))

An organization is a set of connected roles. Roles in an organization connect with each other through a set of role dependencies *Dep* which promotes group cohesion. $dep = (r_1, r_2, obj)$ indicates that r_1 depends on r_2 for objective *obj*. Moreover, there is only one top level organization marked as org_0 in each model and all the other organizations are derived from composite roles.

3.2 Contextual Refinement Modeling Process

In order to provide actors in international trade with an evolutionary understanding of their responsibilities, our proposal illustrates a modeling process for organizational interactions from an abstract level to a concrete level as depicted in Fig. 1.

First, a general specification is constructed to express the common objectives of inter-organizational collaborations in an abstract way, which captures the root goals

of an international trade from a comprehensive perspective. For example, whether an international trade is exporting food or clothes, the general specification contains the same set of roles at an abstract level, such as exporter, carrier, customs, etc. General specifications only consist of atomic roles which give stances of how interactions are organized. Then, according to different contexts, the general specification is contextualized into different contextual specifications which describe the interactive relationships in a more detailed way and present the differences between different situations of an international trade. Contextualization applies contextual information to general specifications and transforms some of the atomic roles to composite roles which contain more information or constraints on how to realize the objectives of the roles. Finally, the whole set of contextual specifications is transformed into different operational specifications which depict complete pictures of an inter-organizational collaboration model in different executable situations. That is, actors in international trades will match their status with the contexts in contextual specifications and select corresponding roles. We can see that the three phases form a contextual refinement modeling process which gives each actor a better understanding of its individual part as well as its interactive parts. For detailed illustrations, we give the following definitions.

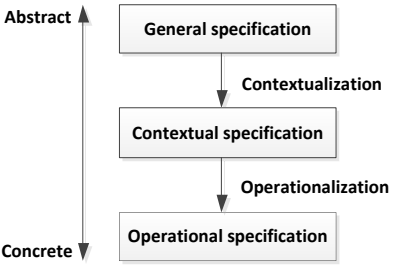

Fig. 1. Three phases of the modeling process. This figure illustrates the three phases to model organizational interactions from an abstract level to a concrete level in our proposal.

3.2.1 General Specification

To capture the vision of the organizational goals from the designer's perspective, we first formalize the concept of a general specification.

Definition 1. (*general specification*). A general specification $org_i^{gs}, i \in N$ of an organization org_i is a tuple (*name*, R_A, *Dep*) such that:

- *name* is an identifier,
- R_A is a set of roles,
- $\forall r \in R_A$ is an atomic role and
- *Dep* is a set of role dependencies.

A general specification shows a map of abstract expectations for the collaboration model without providing detailed information or constraints on how to accomplish the objectives of each role.

To illustrate our proposal, we use a running example to explain how *Regulatory authorities* and *Private enterprise* collaborate with each other in two scenarios, viz. those of direct control and self-regulation in international trade. Table 1 shows the general specification org_0^{gs} of the top-level organization org_0 in the example.

Table 1. Role table for the top level organization. The table explains the roles, their objectives and dependencies in the top level organization.

Organization	Role	Role objective	Role dependencies
org_0	Regulatory authorities (*Ra*)	Efficient regulation	*Pe*
	Private enterprise (*Pe*)	Efficient action	*Ra*

The objectives of the *Ra* and *Pe* in org_0 are intellectual attitudes of the designer's expectations and little information is given on how to reach the objectives. Therefore, at this level, role enactors have the freedom to decide on how to perform their tasks. Furthermore, the two roles are inter-dependent for their objectives.

3.2.2 Contextual Specification

In international trade, organizational interactions are not only determined by individual roles or organizations but also dependent on the environment. Therefore, the notion of a context in our model is defined as the environment of a general specification that satisfies a set of given conditions, which is as follows.

Definition 2. (*context*). A context *ctx* associated with a general specification org_i^{gs} is a tuple (*name*, org_i^{gs}, *State*) such that:

- *name* is an identifier,
- org_i^{gs} indicates the contextualized organization,
- *State* is a set of *states* related to the roles in org_i^{gs},
- $\forall state \in State : state = (R_S, Cond), R_S \subseteq R_A(org_i^{gs})$ and
- *Cond* is a set of *conditions* which define the state of the roles.

State defines the context for the general specification org_i^{gs}.

$\forall state \in State : state = (R_S, Cond), R_S \subseteq R_A(org_i^{gs})$ indicates the inter-state between multiple roles. For example, (*exporter*, *carrier*, *long-term*) indicates that the exporter and the carrier interact with each other in the context of long-term cooperation. Specifically, when there is only one role in R_S, the intra-state of an individual role is specified.

In the example, we use a specific case of AEO certification to illustrate the notion of context. With an AEO certification, a company is trusted throughout the EU for customs related regulations and is granted the power of self-control [16]. Therefore, in our example, with AEO corresponds to the scenario of self-regulation while without AEO corresponds to the scenario of direct control. Based on these two scenarios of direct control and self-regulation, we define two contexts below.

$(ctx_1,\ org_0^{gs}$, {(*Ra*, *Pe*, *without an AEO certification*)}),

$(ctx_2,\ org_0^{gs}$, {(*Ra*, *Pe*, *with an AEO certification*)}).

The influence of a context on an organization is realized through role transformation from atomic role to composite role. In this sense, context adds more information to some of the roles by extending them to lower level organizations, which realizes the process of adding regulations on some of the roles in international trade. Based on the definition of context and its influence on other modeling elements, we formalize the concept of contextual specification as follows.

Definition 3. (*contextual specification*). A contextual specification org_i^{cs} of an organization org_i is a tuple $(name, ctx, R_A^{'}, R_C)$ such that:

- *name* is an identifier,
- *ctx* is a context,
- $R_A^{'}$ is a set of atomic roles,
- R_C is a set of composite roles and
- $R_A^{'} \cap R_C = \phi \wedge R_A^{'} \cup R_C = R_A(org_i^{gs}(ctx))$.

R_C specifies which roles in the general specification associated with *ctx* are transformed from atomic roles to composite roles. This is in accordance with the fact that different contexts have different influence on different sets of roles. $R_A^{'} \cap R_C = \phi \wedge R_A^{'} \cup R_C = R_A(org_i^{gs}(ctx))$ indicates that all the roles either atomic or composite in contextual specifications are derived from the roles in a general specification. Besides, a role can be influenced by multiple contexts in which it is extended to different lower level organizations of sub-roles and dependencies.

Given org_0^{gs} , there are two contexts with different sets of R_C. Therefore, two contextual specifications are constructed.

$(org_0^{cs_1}, ctx_1, \{Pe\}, R(Ra))$ and $(org_0^{cs_2}, ctx_2, \phi, R(Ra) \cup R(Pe))$.

$org_0^{cs_1}$ shows the scenario of direct control described by ctx_1 in which the *Pe* is fully regulated by the *Ra*. $org_0^{cs_2}$ shows the scenario of self-regulation described by ctx_2 in which the *Pe* undertakes a part of the responsibilities from the *Ra*. Detailed descriptions are shown respectively in Table 2 and 3. Note that we use the same name for the atomic role in the general specification, its corresponding composite role in the contextual specification and its referred lower level organization.

In ctx_1, only the *Ra* transforms to a composite role which refers to a lower level organization consisting of five atomic roles that are fine-grained divisions of the *Ra*. This is the situation of direct control in international trade and the *Ra* is extended to restrict the behaviors of its enactors. That is, role enactors of the *Ra* should follow the pattern constituted by the lower level organization. Therefore, at this level, as the context brings more information from the environment, detailed specification of the organizational interactions should be specified.

Table 2. Role table for the lower level organization in context ctx_1. The table explains the roles, their objectives and dependencies in the lower level organization of *Ra* in ctx_1.

Organization	Role	Role objective	Role dependencies
Ra	Norm maker	Effective norms making	
	Norm specifier	Specify valuable norms	Norm maker
	Control indicator maker	Make efficient control indicators	Norm specifier
	Action monitor	Efficient action monitoring	Control indicator maker
	Sanctioner	Correct sanctioning	Action monitor

Table 3. Role table for the lower level organizations in context ctx_2. The table explains the roles, their objectives and dependencies in the lower level organizations of *Ra* and *Pe* in ctx_2.

Organization	Role	Role objective	Role dependencies
Ra	Norm maker	Make effective norms	
	Control monitor	Efficient control monitoring	Norm maker
	Sanctioner	Correct sanctioning	Control monitor
Pe	Norm specifier	Specify valuable norms	
	Control indicator maker	Make efficient control indicators	Norm specifier
	Action monitor	Efficient action monitoring	Control indicator maker

In ctx_2, both the *Ra* and the *Pe* transform to a composite role. It can be seen that some of the roles in the lower level organization of *Ra* in ctx_1 shift to the lower level organization of *Pe* in ctx_2. This is the situation of self-control in international trade in which a part of the responsibilities of the *Ra* transfers to the *Pe* with AEO certification. We can see that the same general specification transforms to two contextual specifications with different extensions or restrictions on how to reach the collective goals of the top level organizations in a detailed way. This is an intuitive way to explain how the organizational interactions are evolved.

3.2.3 Operational Specification

A general specification has multiple extensions because of different contexts. That is, the high level abstraction can be re-used in different situations by applying different contexts. However, at runtime, there must be a complete specification which describes the model in a whole. Therefore, we give the definition of an operational specification below.

Definition 4. (*operational specification*). An operational specification *os* of an inter-organizational collaboration is a tuple (*name*, Org^{cs}, org_0^{cs}, R^*, $Intl^*$) such that:

- *name* is an identifier,
- Org^{cs} is a set of contextual specifications,
- $\forall org_{i_1}^{cs}, org_{i_2}^{cs} \in Org^{cs}, i_1 \neq i_2 : org_i^{gs}(ctx(org_{i_1}^{cs})) \neq org_i^{gs}(ctx(org_{i_2}^{cs}))$,

- $org_0^{cs} \in Org^{cs}$ is a contextual specification of the top level organization,
- $R^* = \bigcup_{org_i^{cs} \in Org^{cs}} (R_A^{'}(org_i^{cs}) \bigcup R_C(org_i^{cs}))$ is the set of all roles,
- $Intl^* : \bigcup_{org_i^{cs} \in Org^{cs}} R_C(org_i^{cs}) \rightarrow Org^{cs} \setminus org_0^{cs}$ is a bijective function which maps each composite role onto a lower level organization, and
- $\forall org \in Org^{cs} \setminus org_0^{cs} : \exists! intl \in Intl^* : org(intl) = org$.

$\forall org_{i_1}^{cs}, org_{i_2}^{cs} \in Org^{cs}, i_1 \neq i_2 : org_i^{gs}(ctx(org_{i_1}^{cs})) \neq org_i^{gs}(ctx(org_{i_2}^{cs}))$ indicates that in an operational specification there can't be two contexts associated with the same general specification. $\forall org \in Org^{cs} \setminus org_0^{cs} : \exists! intl \in Intl^* : org(intl) = org$ indicates that except the top level organization, all other organizations have only one inward inter-level link so that no loop exists in operational specifications. An operational specification is a hierarchy in which the top level organization forms its root while lower level organizations form its inner nodes and leaves. The set of all contexts in an operational specification builds up the runtime environment.

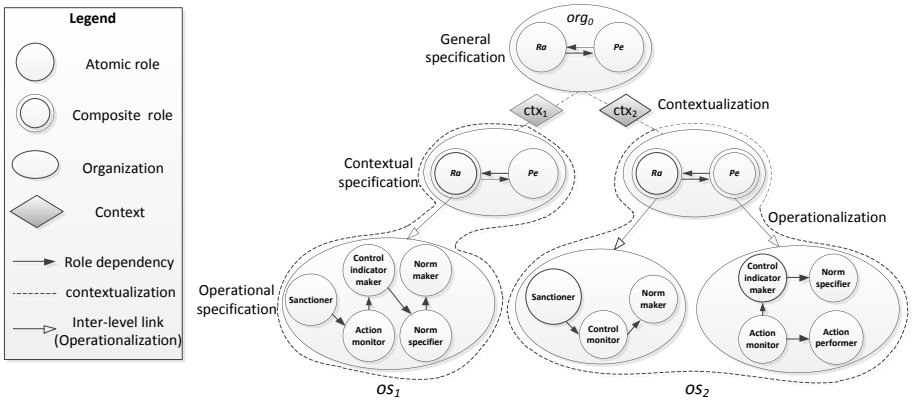

Fig. 2. Modeling process of the example. This figure illustrates the legend of the proposed model and how the two operational specifications are derived from the general specification.

Fig. 2 shows the two operational specifications os_1 and os_2 circled by dashed lines. They are respectively derived from $org_0^{cs_1}$ and $org_0^{cs_2}$. Each operational specification contains a complete description of organizational interactions associated with its context, which is an executable specification that can be seen as the assembling processes of different agents. For example, a company with an AEO certification in the Netherlands exports goods to another country in the EU and the Dutch Customs has to perform regulations on it. In this case, the company and the Dutch Customs fit in with the interactive environment of ctx_2, which indicates that each of them has to perform as the specifications of the lower level organizations in os_2.

4 Design Guidelines

In order to illustrate how contexts influence specifications, we give the design guidelines of the proposed model continued with the example which is shown in Fig. 2 as a tree-like structure.

At the top, the root of the tree is a general specification of the top level organization which is made up of atomic roles. That is, in international trade, regulative authorities and private enterprises have the same interactive relationships at an abstract level. Contextualization is depicted as dashed lines and the root of the tree is extended to different contextual specifications through transforming some of the atomic roles into composite roles. It can be seen that a general specification has multiple dashed lines connected with it, which indicates that there can be multiple contexts related to one general specification. Contextualization is the process of detailing information on how to realize the objectives of a role in a specific circumstance, which provides an adapted way of generating concrete regulations according to different situations in international trade. Among the different contexts of contextualization connected with the same general specification, they have different effects on the general specification. Contextual specifications are differentiated by the extensions of their composite roles, i.e., the referred lower level organizations. Those lower level organizations are the concrete information or regulation on how to accomplish the objectives of the composite roles in a specific context. Operationalization is the process of selecting and assembling among all the alternative contextual specifications during run time according to the real interactive environment, which generates an operational specification that illustrates the whole executive environment and how the global objectives are achieved in terms of finer-grained organizations and roles. Moreover, those lower level organizations in the contextual specifications can again be contextualized according to their own contexts, which facilitates a recursive modeling process.

Organizations usually have multiple contextual specifications, which is in accordance with the fact that business and governmental organizations have different collaborative relationships under different circumstances. However, for each situation, only one of the contextual specifications with the same general specification can be instantiated, i.e., only one dashed line (contextualization) connected with the same general specification is selected. Therefore, each operational specification contains a unique set of contextual specifications with different general specifications from an abstract level to a concrete level.

Interactions between business and governmental organizations are subject to a large number of norms and regulations [17]. Norms of regulative issues are very complex and are to a large extent only implicitly represented by governmental organizations. Most of the knowledge is only in the heads of the government experts. Therefore, there are two difficulties with respect to the communications between business and governmental organizations: (1) Business organizations have to elicitate themselves the norms from the governmental organizations, (2) The norms have to be customized to the specifics of each business organization, e.g., safety risks for a dairy company is primarily food-safety, whereas safety risks for a scrap metal trading company is hazardous waste, or even hidden bombs, as bombs can be easily hidden in scrap metal. To this end, our proposal can help to solve these two difficulties: (1) by

structuring the contextual refinement modeling process to guide both business organizations and governmental organizations to build their interactions from an abstract level to a concrete level, which provides both of them a better understanding of their responsibilities, and (2) by using contexts to differentiate the communications between business organizations and governmental organizations according to their status, i.e., business type, regulation policy, etc. Thus, the interaction process between business and governmental organizations can be viewed as a norm negotiation process in a multi-agent community, where agents can communicate with each other to determine their contextual norms through lower level specifications in the proposed model. This provides a potential solution to deal with the communication problems about self-regulation between multi-agents that jointly create shared norms, i.e., business and governmental organizations that co-create an operationalization of the open norms in legislation [18].

5 Conclusions and Future Work

This paper proposes a context-aware inter-organizational collaboration model, which spans the model development process from abstract attitudes to concrete implementation. The three phases in the proposal are a natural reflection of an intuitive modeling procedure but with formal definitions. We have applied the model to analyze and compare the direct control and the self-regulation contexts in international trade. The framework supports users to understand their models during the procedure and makes it possible for users to reflect their design patterns even at the final operational stage.

Our current and future work includes extending the proposed model to the enactment layer which focuses on how to model enactors of roles such as business organizations, governmental organizations and individuals in the international trade environment, and obtain a good match between agents and roles in the specifications according to their characteristics. Moreover, a software platform is being developed to simulate the interactions between business and governmental organizations to find better solutions for the problem of norm negotiation between them. We will also work on modeling evolution from one to another organization form.

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KPI-Supported PDCA Model for Innovation Policy Management in Local Government*

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Abstract. A comprehensive model for the management, monitoring and assessment of the innovation projects implemented by the local government is presented. The model is based on the classic Deming PDCA quality-oriented process. It is defined in collaboration with our local government partner in order to measure the effective impact of the innovation policies developed by the public administrations. An "eGovernment Intelligence" framework has been designed and is currently being developed and tested. The main features are: (a) the qualification of the policies/projects and the definition of innovation targets, (b) a systematic and staggered measurement of the relevant innovation, economic and social indicators at the needed scale, (c) a detailed, geo-referentiated analysis of the territorial evolution pattern of the indicators, (d) the reassessment of policies and projects against the results obtained.

Keywords: eGovernment, Business Intelligence, Quality Management.

1 Introduction

A key issue for local governments aiming at promoting digital skills and supporting social and economic developments, is the combination of eGovernment policies and ICT policies. The effects of correlated innovation projects should be measurable via focused analysis of specific statistical indicators [1,2]. These can be either direct eGovernment or ICT indicators (as is the case, for instance, of portal/online services access, wide band internet coverage of population, availability of PCs, eCommerce transactions, etc) or indirect/impact socio-economical indicators (as, for instance, average income, local GDP growth, availability of qualified software engineers and so on).

The impact analysis for general ICT availability and specifically for publicly funded ICT initiatives is a difficult task. Dedicated studies have been conducted in order to analyze the impact of ICT in education [3], local area [4] long-term economy [5], social capital / quality of life [6] and democracy [7]. Government monitoring [8] has also a direct impact on democracy and transparency, offering citizens a direct control of local administration's projects/actions.

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ICT innovation policies implemented by local government and correlated projects should be evaluated [9] in an adequately wide time-span, covering in some cases several years, and the related impact measurements should follow this pattern, by registering at definite temporal intervals the state of the monitored indicators. A comprehensive strategy for medium-term impact measurement, combined with a thoughtful choice of both direct ICT indicators and more general socio-economical indirect impact indicators could help to outline the searched correlations between indicator changes and the effect of the innovation projects [10]. The scale of local government here considered is regional/subregional, and the smallest administrative units are the municipalities.

Statistical *key performance indicators* (KPI) for sub-regional and sub-provincial local territories can be obtained via three main sources:

1. by retrieving online indicators available from official Institutions like the International Eurostat, Worldbank and others, the corresponding National Institutions and even sub-national entities like the local Chambers of Commerce,
2. by harvesting the (raw) web with webbots, data scrapers, crawlers, spiders, searching for digital skill evidence trails left by the citizens and the business to build new classes of indicators,
3. by addressing citizens/enterprises specific surveys aimed at a better understanding of the actual use of the eGovernment services and translating them in indicators.

Each strategy has its pros and cons. The highest quality data is offered via the first approach, which represents the basic reference thanks to its officiality – and comparability. For instance, the *Nomenclature of Territorial Units for Statistics* (NUTS), classification used by Eurostat – a three-level hierarchical system for dividing up the economic territory of the Europe Community from National to regional scale – allows the comparison of the socio-economical indicators among EU sub-administrative units. However, these indicators are not always provided in finer territorial detail than the regional one, corresponding to NUTS-3 in Eurostat language; it is sometimes possible to scale down to the provincial level, and sometimes to the municipal level, by accessing National statistical data or, for business-related indicators, Chambers of Commerce periodic reports. The main problem with this approach is that the data officially monitored are mainly socio-economical data. It is difficult to find systematic measurements of ICT innovation indicators; these are, often, the result of occasional specialized research surveys managed by interested Institutions.

The "raw" web webbot-based strategy is gaining relevance, due to the rapid growth of the quantity and the quality of the information that is available on the web. We expect an increasing trustworthiness of the measurements that will overcome the critical point of this strategy, i.e. the reliability of web-related indicators data. It is also interesting from a technical point of view, as it requires to address the issue of extracting data from web sources that are dynamically

changing. The *webbots*, said also *data scrapers* when extracting data from a single web source, or *crawlers*, *spiders* when moving between links finding for the needed information [11], need to be updated when the source web sites change their content or even their appearance. Indicators connected to social community-related sources, like blogs, forums, social networks, extracted by web raw data have the advantage to be continuously up-to-date.

Government-supported surveys offer the opportunity to select specific ICT innovation questions, generally not inspected by official national/international statistics – at a cost, however, of a consistent effort needed for the preparation, communication and submission of the survey campaigns. Survey campaigns are generally limited in time (campaigns rarely last for more than a year) and in space (they are conducted frequently at a provincial or municipal level). Online tools for survey submissions and a regional-level eGovernment infrastructure [12] could help in maintaining some efficiency trade-off in the use of this information channel.

The goal of our research is to explicit a comprehensive model for (a) the management of eGovernment policies and ICT innovation policies, (b) their systematic monitoring and (c) the impact analysis measurement and to (d) support the model with an integrated *eGovernment Intelligence* information system capable of registering and monitoring such policies, monitor the relative innovation projects against their goals, systematically evaluating their impact and finally reviewing the policies themselves on the basis of the resulting analysis.

We conducted our research in collaboration with our local government partner, Regione Veneto (in northern-east Italy).

The information system developed by Regione Veneto provides public administrators capability to continuously improve their services via an objective evaluation of the resulting impact; the local government stakeholders, citizens and enterprises, on the other hand, could be better informed and up-to-date regarding goals set in advance for the policies and the success rate of the local government funded ICT initiatives carried out for the public benefit.

The paper is organized as follows. In Section 2 a comprehensive model for policy management is introduced, and in Section 3 the supporting eGovernment Intelligence framework, its modules and its interaction with the model are presented. Then, in Section 4, some conclusions are drawn.

2 A Model for the Management of ICT Innovation Policies and Projects in Local Government

A comprehensive [13] model for monitoring the ICT innovation projects, validating the related policies and evaluating the effective direct and indirect impact on the areas affected could improve the success rate of the local government initiatives [14,15]. Policies and related projects, which we consider relating to eGovernment [2] as well as related to the wider context of ICT infrastructures [16] should be assessed also by the citizens themselves [17]. We adapted the classic Deming plan-do-check-act (PDCA) cycle to the Local Government re-

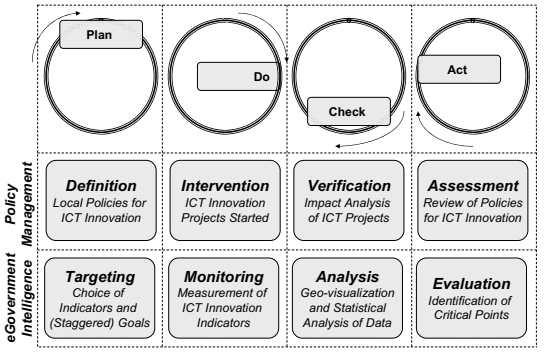

Fig. 1. The comprehensive model for Policy Management, supported by the framework and tools of eGovernment Intelligence

quirements for ICT innovation policies management. Each policy management PDCA phase is identified by a organizational process and is supported by specific subsystems of the eGovernment Intelligence framework. The complete model is shown in Fig. 1.

The goals of this model are:

- finding an *objective validation* for the effectiveness of eGovernment and ICT innovation projects,
- *qualifying and quantifying* the effectiveness through appropriate impact statistical territorial indicators,
- *gathering the relevant indicators* via automatic (webbots/scrapers) and semi-automatic (extractors/wrappers), completing the data when needed with focused survey campaigns,
- *representing and mapping the indicators* showing the explicit relation with the affecting innovation projects and the areas involved.

We classify the indicators in two categories: (a) *direct* ICT indicators enabling the Information Society, connected to the technology – examples of indicators in this category are population reached by the internet wide band, eGovernment services offered, eGovernment use of services, ratio of PCs/users, ICT education knowledgeability; (b) *indirect* socio-economical indicators related to the resultant impact of the ICT main enablers over the local communities, participation, sociality, economy and culture.

Direct, ICT indicators are easier to manage, as they are strictly related to the ICT innovation projects. For instance, internet wide band penetration ratio is related to infrastructure funding by the local governments, while the growth of the number of accesses to eGovernment Portals depends on quality of the offered online services. These indicators require however the setup of specific measurement processes, as ICT innovation evolution is not systematically monitored by the National or Regional Institutions dedicated to statistical data analysis.

Indirect, socio-economical indicators are more easily found in the periodic data reporting produced by National and International statistical or economical

Institutions, but these are *second-level correlated* to ICT innovation projects, i.e. there is the need to estimate and then evaluate their effective correlation with the intermediate ICT indicators which can then be put in direct correlation to the monitored innovation projects. For instance, an investment for wide-area internet wide band could in the long-term sustain new business developments, widen social communities opportunities and in general improve the quality of life. The management of indirect socio-economical indicators requires however carefully staggered gathering of statistical data, and the estimation of the correlations between them and the "raw" ICT indicators.

In the current phase of the research, we concentrate our efforts in extracting direct ICT innovation and eGovernment indicators and in selecting simple cases for the socio-economical impact indicators without modeling the effective correlations between the two classes of indicators – we are leaving this task for subsequent research phases.

3 The eGovernment Intelligence Technical Framework

We developed the eGovernment Intelligence framework around the following elements:

- the reference myPortal/myIntranet regional Liferay-based *eGovernment architecture* supported by our local government partner,
- the *policy manager*, a GUI panel for the management of policies, projects, the selection of impact indicators and the setting of targets,
- the *events scheduler* for the reliable planning of monitoring events with a minimal temporal unit of a day,
- the *impact monitor* for the management of webbots/data scrapers, wrappers/adapters and for the launch of email/online survey campaigns,
- the *geo-analyzer*, a geo-referentiated visualization engine built around the SpagoBI open source platform.

Let us discuss them in detail.

3.1 An Extensible and Service Oriented Architecture for Local eGovernment

Our reference architecture is based on a dual model with an *external* interface towards citizens and a complementary *internal* interface dedicated to local (municipal) government staff, both interconnected and supporting a constellations of web services-based tools and applications.

The external, front-side of eGovernment is the *government-to-citizen* (G2C) domain, where web publishing is used to give information to citizens, to report news regarding tax procedures, laws as well as local informations about events; citizens browse the web searching for specific information. This is provided by the *myPortal* platform which unifies at the moment a hundred local public administrations.

The internal, back-side of eGovernment is the *government-to-government* (G2G) domain. The *myIntranet* project addresses this issue by selecting the appropriate technology in a service oriented architecture to better support internal collaborations. The myPortal/myIntranet framework has been consolidated in a WS-oriented architecture, open to specific dual-sided tools and applications.[1]

After the initial adoption stage, the project was extended from its initial community to all other local (municipal) communities willing to take advantage of it. This led to the definition of a de facto standard for eGovernment portals and intranets for small and medium administrations in the whole region. The current technological environment for both myPortal and myIntranet is based on the open source JSR286-compliant portlet container Liferay.

3.2 The Policy Manager

Innovation policies are defined and funded by local governments, and then developed into explicit actions/projects. Such projects have definite dates of deployment, they can be geographically localized and they have associated milestones. A policy manager has been designed to provide the system all the available data regarding policies, actions, projects. The policy manager is accessible via the myIntranet G2G backend (see Fig. 2). The policy manager is the tool that supports local government transparency by offering citizens a preventive declaration of intents for each funded policy, and allowing them to verify the effective achievement of the established goals.

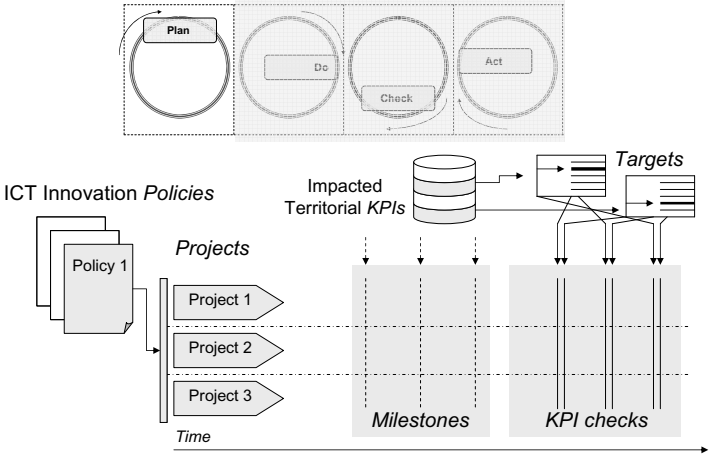

Fig. 2. PLAN: planning the ICT innovation projects and definition of targets

[1] See: myportal.regione.veneto.it

3.3 The Events Scheduler

The scheduler is the core of the eGovernment Intelligence framework. It manages the execution of the daemons that scan the web, access the online repositories or launch the survey campaigns via the myPortal local municipality portals. The scheduler uses as the smallest temporal unit the day, and offers the possibility to activate programmed monitoring for timed events ranging from daily intervals, passing through weekly, monthly, quarterly and other sized periodic intervals. The reliability of the scheduler is a central requirement for the eGovernment Intelligence framework, as the analysis phases need complete data sets in order to produce trustworthy and significative statistical elaborations.

3.4 The Impact Monitor

A class of webbots (for online sources) and wrappers/adapters (for directly accessible sources) and relative subsystems have been designed in order to extract the validated, high quality indicators from official sources that expose structured data from International, National or subnational Institutions. As online data source, Eurostat offers the widest option choices for the gathering of structured data, from CSV to XML to several web interfaces and API to manage data; other official data sources are more limited in the choices they offer, sometimes even limited to a fixed-format PDF file sent via email. We developed specific extractors for the data reported by the National Statistical Institute collected along with other socio-economical data by the regional Statistical Office managed by our local government partner. Specifically, income, number of inhabitants/families, age distribution data is available year by year at the required territorial resolution of a single municipality. Several local Chambers of Commerce, which are distributed at a provincial level, entered in the research collaboration offering the availability of their periodic reporting regarding the evolution of enterprises, like the number of new firms, sales income, etc.

The indicators extracted via this first channel – extractors for official / institutional data retrieval – mainly of socio-economical nature, have the highest reliability. They also offer the advantage of being completely available at the municipality level. This is a *low frequency* channel, as the updates are typically released with an yearly periodicity. The scheduler has to be instructed to wake up the relative daemons at the right date when the updated data are available.

Webbots and data scrapers can also be useful tools to complete the highly reliability data of the first channel with information found on the general web. We experimented simple keyword-based searches via major search engines like Google and Yahoo! (by searching for ICT-related words combined to locality names) and with the same technique we extracted ICT production/consume indicators by inspecting Youtube, Flickr and other popular digital repositories. eGovernment indicators are also inspected (indirectly) via Yahoo! Sites, that counts the referring links to the selected web sites. We are currently experimenting the extraction of information from blogs- and forum-related web sites. These indicators are mainly used to estimate the general population ICT knowledgeability via the analysis of the content produced.

The indicators extracted via this channel – webbots and data scrapers for web data harvesting – have a weaker reliability, due to the nature of raw information they are derived from. On the other way, there is the advantage that this data can be tuned both with respect to the time (as even daily updates can be considered), constituting a *high frequency* channel, and in space (a municipality level is reachable).

Webbots/wrappers for online official data and webbots/scrapers for raw web data constitute the core of the impact monitor (see Fig. 3).

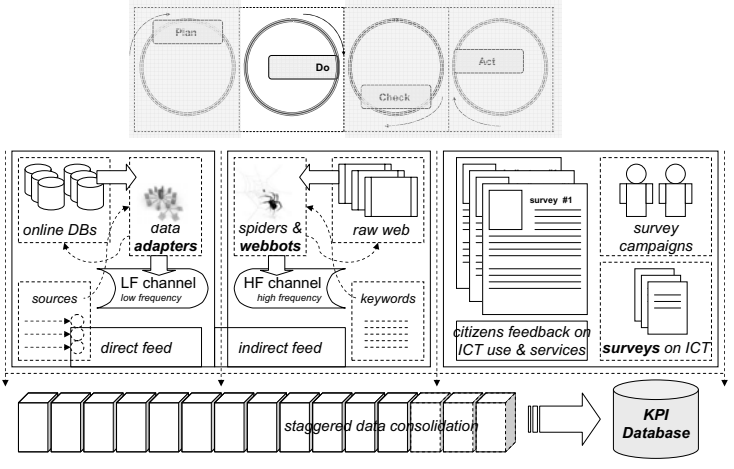

Fig. 3. DO: execution of innovation projects and KPI monitoring

As a third, complementary, input channel, we integrated in the monitor the eGif engine [18,12]. The eGif tool already fits neatly in the myPortal/myIntranet dual model. The eGif G2G/myIntranet interface exposes a complete *survey editor* that allows designers to build arbitrary complex survey structures, including multiple choices, indented questions and different choices for statistical variables. The indicators obtained via this channel – citizen feedback regarding eGovernment or ICT use – are costly for the effort required in the survey campaign management, but can be useful to complete the statistical analysis for specific themes/areas.

3.5 The Geo-Visualizer

The impact analysis of gathered data is managed with the support of a visualization engine (see Fig. 4). We selected the open source SpagoBI engine (see [19] for a comparing review with other open source BI platforms). The visualizer exposes the indicators data over the local territories it allows to localize the impact of the developed innovation projects, both for eGovernment [2] and for ICT infrastructures in general (see Fig. 5). We are currently experimenting extensions of the SpagoBI platform in order to be able to use also multi-dimensional georeferentiated data patterns, as the *travelling time distance grid* research case that we tested for mountain-area municipalities.

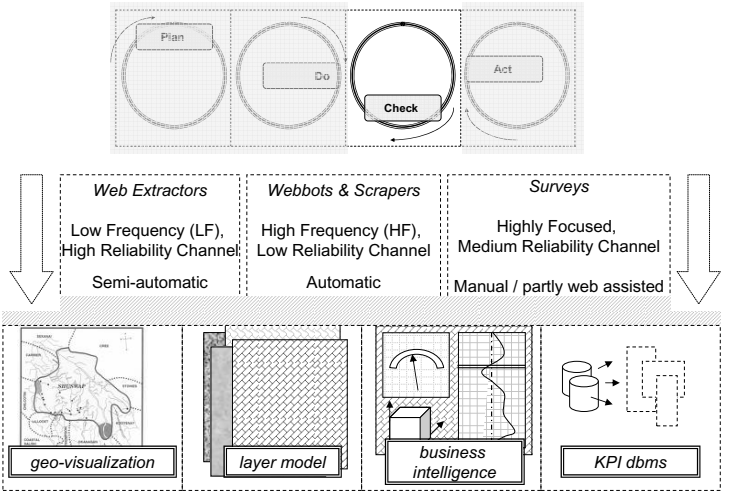

Fig. 4. CHECK: verification of goal achievements via impact monitor analysis

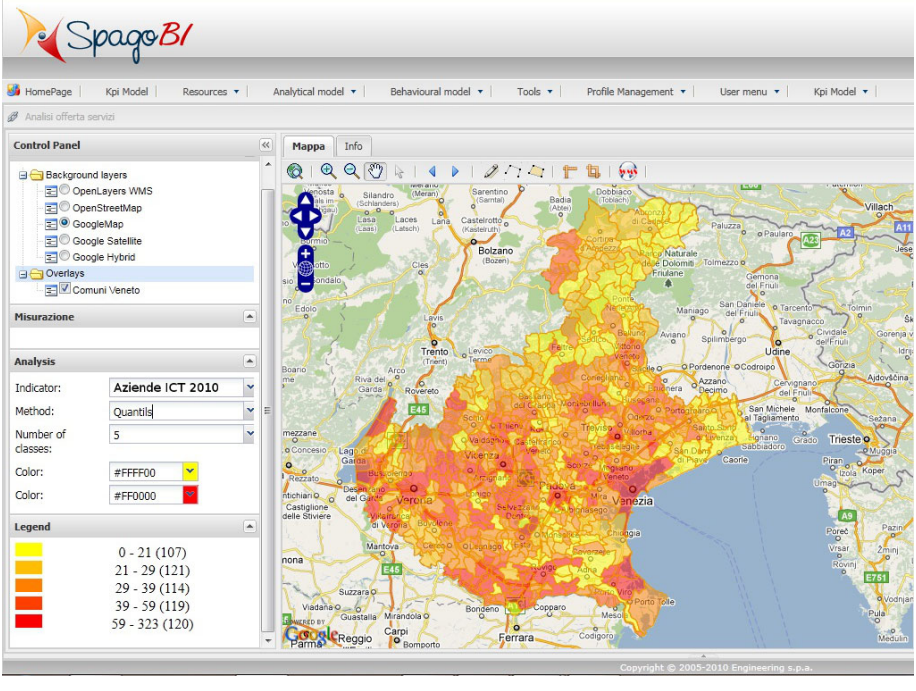

Fig. 5. ICT business presence in Regione Veneto, year 2010

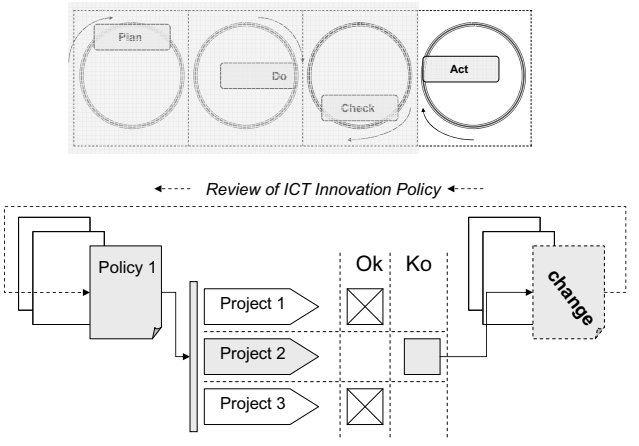

Fig. 6. ACT: review of ICT innovation policies and related projects.

The policy makers are then ready to pass to the *act* phase by reviewing and improving the ICT innovation policies (see Fig. 6). The cycle is then completed and can be restarted.

4 Conclusions

In this paper a comprehensive policy management model and its supporting eGovernment Intelligence framework has been presented; the model, drawn from quality management methodologies, offers the capability to measure the local impact of eGovernment and ICT infrastructure policies. The policy management model and the coupled eGovernment Intelligence framework should help public administrators in reviewing and improving the projects by inspecting the resulting impact in detail. Both are currently being tested in collaboration with our local government partner.

A first set of twenty core indicators (ranging from socio-economical data like population, income, business presence, to ICT-related data related to education, eGovernment usage, user-produced content, wide band infrastructures), was also extracted from official Institutions and raw web sources. A complete data set of the indicators has been created for all of the 581 municipalities of Regione Veneto for the last four years; the results, reported on the SpagoBI-powered maps, are currently discussed with regional government staff and the relations with the local ICT innovation initiatives were analyzed. We are jointly beginning promotions and experimentations of the complete model cycle involving a limited number of local municipalities and selecting definite sets of policies and related KPIs – this test in the field should be completed roughly in a year. We are also working on extensions of this model to include *what-if* simulations that should allow policy makers the possibly to forecast the effects of the planned interventions.

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On the Relevance of Enterprise Architecture and IT Governance for Digital Preservation

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Abstract. Digital Preservation has been recognized as a key challenge in providing trusted information and sustainable eGovernment services. However, there has been little convergence on aligning the technically oriented approaches to provide longevity of information in ever-changing technology environments, and the organizational problems that public bodies are facing, through a systematic framework that aligns organizational and technological issues in the social domain of eGovernment.

In this paper, we discuss the relevance of Enterprise Architecture and IT Governance for digital preservation and analyze key frameworks for digital preservation from this viewpoint. We assess the coverage of the leading criteria catalog for trustworthy repositories in terms of Enterprise Architecture dimensions and in how far these criteria align with established Enterprise Architecture and IT Governance frameworks. We discuss the analysis process we were following and present key observations that result from our work. These point to a number of steps that should be taken in order to consolidate digital preservation approaches and frameworks and align them with established frameworks and best practice models in Enterprise Architecture and IT Governance.

1 Introduction

Recent years have seen an increasing attention to the problems of trustworthy preservation of information as a fundamental part of Information Management. eGovernment efforts have increasingly turned their attention to the problems of trustworthy preservation of information as a fundamental part of their IT Governance responsibilities. An interesting example of this is Austria. In a benchmarking study in 2007, the country scored 100% for online availability and 99% for online sophistication [4] of services. Yet, this clearly did not denote the end of the country's need to focus on eGovernment:

> ... government is not only the sum of its services, it also includes other aspects of citizen-government relations such as accountability, trust, fairness, etc.; aspects that not pertain to service delivery alone but also to service specification, audit, legal rights and responsibilities etc.[16]

M. Janssen et al. (Eds.): EGOV 2011, LNCS 6846, pp. 332–344, 2011.

These responsibilities include the preservation of digital content created every day and the provision of access in a form that is understandable for a specific audience. And in fact, it took another four years until Austria's national archive acquired a digital preservation solution that enables it to not only offer citizens online services, but also ensure that this and other information will be accessible for future generations. While this primarily points to a "limited vision" of the original benchmarking scale for eGovernment [16], it is also exemplary of how digital preservation came into focus: The increasing usage of digital channels for communication caused a surge in digital material created on a daily basis; but these digital materials, unlike analog materials, require constant attention to stay accessible (and understandable) in ever-changing technology environments.

A recent survey showed that '... many organizations are beginning to make a transition from analyzing the problem to solving it. They remain concerned that mature solutions do not yet exist. Nevertheless, 85 percent of organizations with a digital preservation policy expect to make an investment to create a digital preservation system within two years. Such systems are likely to be componentized, mix-and-match solutions.' [19] Procurement of these systems is notoriously difficult without a clear understanding of the alignment of existing system services and capabilities with the specific processes and components required by a Trustworthy Digital Repository. The leading conceptual model for such an archive is the Reference Model for an Open Archival Information System (OAIS) [11]. However, the OAIS provides only a high-level and narrow view on the required capabilities of such a system and no guidance on business-IT alignment. The "solution architecture" of the OAIS does not necessarily fit in an organization's IT landscape, especially in the case of an already existing Records Management System or Enterprise Content Management System.

The social domain of digital preservation, as it is encountered in eGovernment, embodies a significant amount of Business-IT alignment problems in specific enterprise contexts. In order to preserve digital information, technology must provide adequate support to assure the integrity, authenticity, and understandability of this information through time in an ever changing technological landscape. DP solutions must always be a mix of organizational structures with the related set of activities and services, supported by an adequate IT infrastructure fully aligned with the vision for preservation. The conceptual and technical models developed in the DP community are of tremendous value as focused custom frameworks and documented domain knowledge for a specific community. However, they are not without internal inconsistencies, and many of the aspects covered overlap with well-established areas such as Information Security, Risk Management and IT Governance. There has been little convergence on aligning the technically oriented approaches to provide longevity of information and the organizational concerns that public institutions are facing through a systematic framework that aligns organizational and technological issues. This, however, is the essential focus of Enterprise Architecture (EA), which has received increasing attention in the eGovernment field [3,16].

	DATA What	FUNCTION How	NETWORK Where	PEOPLE Who	TIME When	MOTIVATION Why
SCOPE (contextual)	List of things important in the business	List of business processes	List of business locations	List of important organizations	List of events	List of business goals and strategies
ENTERPRISE (business model)	Conceptual data/object model	Business process model	Business logistics system	Work flow model	Master schedule	Business plan
SYSTEM (logical model)	Logical data model	System architecture model	Distributed systems architecture	Human interface architecture	Processing structure	Business rule model
TECHNOLOGY (physical model)	Physical data/class model	Technology design model	Technology architecture	Presentation architecture	Control structure	Rule design
COMPONENTS (detailed)	Data definition	Program	Network architecture	Security architecture	Timing definition	Rule specification
INSTANCES (functioning enterprise)	Usable data	Working function	Usable network	Functioning organization	Implemented schedule	Working strategy

Fig. 1. The Zachman Framework

In this paper, we discuss the relevance of EA and IT Governance for digital preservation and analyze key frameworks for digital preservation from this perspective. We assess the EA coverage of a leading criteria catalog for trustworthy repositories, through the Zachman Framework [22]. We further explore in how far these criteria align with established IT Governance frameworks. We discuss the analysis process we were following and present key insights that resulted from our work. These point to a number of steps that should be taken into account in order to consolidate digital preservation approaches and frameworks and align them with established practice in Enterprise Architecture.

The remainder of the paper is structured as follows. The next section outlines related work in the areas of EA and IT Governance. Section 3 discusses frameworks currently dominating the digital preservation discourse. Section 4 uses established frameworks to assess the coverage of concerns in compliance criteria for digital preservation and analyze concerned stakeholders and responsibilities. Section 5 draws conclusions and points to consequences and future work.

2 Enterprise Architecture and IT Governance

Our analysis is scoped by the holistic framework of Enterprise Architecture and strategic alignment. Based on this, we take a closer look at IT Governance and its relevance to the long-term preservation of digital information.

Enterprise architecture (EA) models the role of information systems and technology on organizations in a system architecture approach in order to align enterprise-wide concepts, business processes and information with information systems. The core driver is planning for change and providing self-awareness to the organization [20]. EA strives to provide complete coverage of an organization and as such received significant attention in the defense domain [8] and in eGovernment research [3]. The leading EA frameworks today are The Open Group Architecture Framework (TOGAF) [20] and the Department of Defense Architecture Framework (DODAF) [8]. The Zachman framework is a very influential early EA approach [22]. It describes the elements of an enterprise's systems architecture in a table where each cell is related to the set of models,

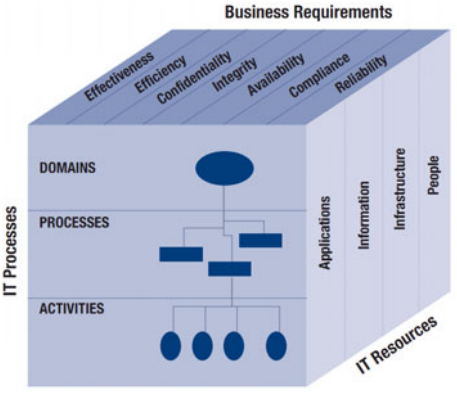

Fig. 2. The COBIT Cube [5]

principles, services and standards needed to address a specific concern of a specific stakeholder, as shown in Figure 1. The rows represent different levels of viewpoints of the organization (Scope, Business Model, System Model, Technology Model, Components, and Instances), while each column expresses a different focus (Data, Function, Network, People, Time, Motivation). This spatial layout and its visual nature makes the Zachman Framework very accessible to a wide range of stakeholders and thus a powerful, yet simple tool for analyzing the scope of domain-specific models.

IT Governance is a key discipline for decision making and communication within IT-supported organizations. The goal is to identify potential managerial and technical problems before they occur, so that actions can be taken to reduce the likelihood and impact of these problems. IT Governance received increasing attention partly because of arising needs of meeting regulatory requirements such as privacy, security, or financial reporting (e.g. Sarbanes-Oxley [14]).

The key IT Governance framework is COBIT: *Control Objectives for Information and related Technology* [5]. COBIT is a set of best practices, measures and processes to assist the management of IT systems. Figure 2 shows the COBIT cube: "IT resources are managed by IT processes to achieve IT goals that respond to the business requirements . . . If IT is to successfully deliver services to support the enterprise's strategy, there should be a clear ownership and direction of the requirements by the business (the customer) and a clear understanding of what needs to be delivered, and how, by IT (the provider)." [5] The framework is not specific to a technological infrastructure nor business area and aims to bridge requirements, technical issues and risks by combining a set of control goals, audit maps, tools and guidance for IT management. This management guide provides a set of processes organized in the domains of (*i*) Planning and Organization; (*ii*) Acquisitions and Implementation; (*iii*) Delivery and Support; and (*iv*) Monitoring and Evaluation. The governance cycle contains processes that address the areas of strategic alignment of IT with the business;

Table 1. Taxonomy of vulnerabilities and threats to digital preservation [2]

Vulnerabilities	**Process**	Software faults	T		
		Software obsolescence	T		
	Data	Media faults	T		
		Media obsolescence	T		
	Infrastructure	Hardware faults	T		
		Hardware obsolescence	T	O	
		Communication faults	T		C
		Network service failures	T	O	
Threats	**Disasters**	Natural disasters	T		C
		Human operational errors	T	O	
	Attacks	External attacks	T	O	C
		Internal attacks	T	O	C
	Management	Organizational failures		O	
		Economic failures		O	C
	Business requirements	Legal requirements			C
		Stakeholders' requirements		O	C

value delivery (creation of business value); resource management (proper management of IT resources); risk management; and performance management.

Enterprise Risk Management (ERM) provides a framework that defines prevention and control mechanisms to manage uncertainty and associated risks and opportunities from an integrated organization-wide perspective. ERM is part of corporate and IT governance, providing risk information to the board of directors and audit committees. It supports performance management by providing risk adjustment metrics to internal control and external audit firms. The Committee of Sponsoring Organizations of the Treadway Commission (COSO) view of ERM is that "Every entity exists to provide value for its stakeholders" [6]. In fact, all entities can face several types of uncertainty, raising a challenge to management on how to deal with such uncertainty in a way that maximizes the value of those entities for the interested stakeholders. The COSO ERM Framework [6] provides a common accepted model for evaluating and aligning effective enterprise-wide approaches to ERM. It defines essential ERM components, discusses key ERM principles and concepts, and suggests a common ERM language.

3 Digital Preservation

Digital preservation aims at optimizing the information life-cycle management, from the creation to the dissemination and use of the information objects, to maintain the knowledge contained in the digital objects accessible over long periods of time, beyond the limits of media failure or technological change, while ensuring its authenticity and integrity [15]. In DP, IT problems and solutions intersect with organizational policies and missions. The complexity of digital preservation increases with the fact that each organizational scenario contains different types of digital objects, each having its own specific requirements.

Digital objects are threatened by *Disasters* caused by operational errors or natural disasters; *Attacks* from inside or outside the organization; *Management* failures of economic or organizational nature; or new or updated *Business Requirements* of legal nature or imposed by stakeholders. To address these threats, an organization needs to manage potential points of failure. *Preservation Processes* can be vulnerable due to faults or obsolescence of software; *Data* can be vulnerable due to storage media faults or obsolescence; and *Infrastructure* can be vulnerable to hardware faults or obsolescence, communication faults, or failures in network services. Table 1 represents a taxonomy of threats and vulnerabilities with a holistic view on digital preservation[2]. Each threat or vulnerability might be triggered by one or more Technological (**T**), Organizational (**O**), or Contextual issues (**C**).

Digital preservation presents a problem faced by all types of organizations that have to manage information, but initiatives on digital preservation have been pushed largely by cultural heritage institutions [21]. The OAIS Model [11] is a conceptual model, combining an information model with a model of key functional entities. It has provided a common language for the domain and guided the design of preservation systems. The OAIS includes a high-level contextual view of an archival organization and its key stakeholders. It provides a high-level and narrow view of the main functions of a preservation system and prescribes a certain solution architecture that may not be adequate for certain organizations. In particular, it is difficult to reconcile these views with scenarios where an Electronic Records Management System or an Enterprise Content Management System is in place. In Records Management, ISO 15489 [10] and the "Model Requirements for Records Systems' (MoReq2010) have been very influential [9]. The Preservation Metadata Implementation Strategies (PREMIS) working group produced a technically neutral data dictionary for digital preservation linking intellectual entities, objects, rights, events, and agents [17].

Efforts to standardize criteria catalogs for trustworthy repositories with the declared goal of providing audit and certification facilities have led to the "Trusted Digital Repositories: Attributes and Responsibilities' report (TDR) [18], a key milestone for establishing trust in national and international information infrastructures building on the OAIS model. Continuing this path, the Trustworthy Repositories Audit and Certification Criteria and Checklist (TRAC) is currently undergoing ISO standardization. It provides criteria for trustworthiness in the areas of Organizational Infrastructure; Digital Object Management; and Technologies, Technical Infrastructure, and Security [7,12].

These references are of tremendous value for the preservation community, but they are not without internal inconsistencies and lack conceptual alignment with established IT frameworks. Some even venture into domains such as Risk Management and Information Security, while neglecting a considerable body of knowledge already existing in those areas. From a different system architecture perspective, the project SHAMAN has presented an Information Systems approach to analyzing DP [1]. This first Reference Architecture (SHAMAN-RA) has strong foundations in EA, but is not based on existing domain models to a degree that enables their convergence in a transparent manner.

	Data	Function	Network	People	Time	Motivation	sum
Scope	42	48	2	50	15	97	*254*
Business	253	451	7	115	92	130	*1048*
System	286	408	28	22	62	15	*821*
Technology	31	144	78	13	25	5	*296*
Components	0	23	0	5	0	1	*29*
Instances	41	8	0	20	3	0	*72*
sum	*653*	*1082*	*115*	*225*	*197*	*248*	*2520*

(a) Sum over all criteria

	Data	Function	Network	People	Time	Motivation	Sum
Scope	0	0	0	1	0	2	3
Business	26	31	0	1	10	3	71
System	20	14	0	1	8	2	45
Technology	0	0	0	0	0	0	0
Components	0	0	0	0	0	0	0
Instances	1	0	0	0	0	0	1
Sum	47	45	0	3	18	7	120

(b) Sum over criteria in B4

Fig. 3. Mapping of TRAC in the Zachman Framework

4 Analyzing Digital Preservation Concerns

Taking an EA viewpoint towards DP, Section 4.1 analyses compliance criteria for trustworthy digital repositories from the perspective of the Zachman Framework. Section 4.2 takes an IT Governance viewpoint and relates the responsibilities and concerns of key stakeholders to digital preservation compliance criteria.

4.1 Coverage of TRAC Concerns in the Zachman Framework

To develop an understanding of the concerns a model covers, the Zachman Framework can be used as a projection space. For instance, TRAC consists of 84 statements of the kind '*B3.2 Repository has mechanisms in place for monitoring and notification when representation information (including formats) approaches obsolescence or is no longer viable.*', each with associated explanation and examples, grouped in 14 areas. In a group exercise, every participant got 10 points for every statement to distribute across the cells of the Zachman framework. Summing these scores over participants, one can obtain a common understanding of the maximum coverage of concerns of single statements, groups, and the totality of statements. Figure 3 displays a visualization of the overall result of such an exercise with 3 participants for the complete TRAC document and for the area B4: 'Archival storage and preservation/maintenance of archival objects' (see Table 4 for the list criteria). This level does not provide a detailed view on specific statements, but it clearly shows that TRAC focuses on functions on data on the business and system levels.

In some cases, an apparent lack of separation of concerns makes the operationalization of criteria a challenge. An interesting example is posed by *B4.4: "'Repository actively monitors integrity of archival objects"'*, which poses the requirement that integrity of content needs to be monitored. This is of course a fundamental concern, which strongly overlaps with the definition of Information Security provided by ISO/IEC 27002:2005: "'preservation of confidentiality, integrity and availability of information"' [13]. The description makes no mention of this standard, but instead describes technical details on the *implementation* approach down to the level of checksums in log files[1]. This one prescriptive criterion alone furthermore spans several rows and columns of the Zachman

[1] Cf. [7], p. 34.

Table 2. Key stakeholders in DP (adapted from [1])

Name	Description	Sources
Producer/ Depositor	The entity responsible for the ingestion of the objects to be preserved. It may be the owner of the object, but it can also be any other entity entitled to perform this action.	OAIS, TDR, PREMIS, TRAC
Consumer	The entity representing the user accessing to the preserved objects, with a potential interest in its reuse and a certain background in terms of knowledge and technical environment.	OAIS, TDR, PREMIS, TRAC
Designated Community	Defined in OAIS as 'an identified group of potential Consumers who should be able to understand a particular set of information' [11]. This group can be characterized not only by domain knowledge, but also by technical means that are available to it, preferred usage scenarios, etc.	OAIS
Executive Management	The entity responsible for strategic decision making on an organization level, ensuring that the mandate is fulfilled and the repository continues to serve its designated community.	OAIS, COBIT
Repository Manager	The entity responsible for ensuring repository business continuity, defining business strategies and thus setting goals and objectives. That means it defines ends to be achieved by the repository and operates on the business domain, interacting with the designated communities, legal environment and constraints, etc.	SHAMAN-RA
Technology Manager	The entity responsible for technological system continuity and the deployment of technological means to achieve the ends set by the repository business.	SHAMAN-RA, COBIT
Operational Manager	The entity that is responsible for continuous policy-compliant operation of the repository, which involves balancing ends and means and resolving conflicts between them, i.e. constraints as set from Technology Management and Preservation Management.	SHAMAN-RA
Regulator	The entity responsible for external imposing rules concerning the preservation of digital assets, such as legislation and standards. These can apply to the organization, the system's technology, or the systems' usage.	SHAMAN-RA, TRAC
Auditor	The entity responsible for the certification if the organization practices, the system's properties and the operational environments are complying with established standards, rules and regulations.	SHAMAN-RA, TRAC
Repository Operator	The entity responsible for the operation of the repository. This business worker may be aware of the details of the design and deployment of the system, but its mission is to assure the direct support to the business, with no concerns about infrastructure management or strategic alignment.	SHAMAN-RA
System Architect	The entity responsible for the design and update of the architecture of the system, aligned with the business objectives.	SHAMAN-RA, TOGAF
Technology Operator	The entity responsible for the regular operation and maintenance of the components of the technical infrastructure (hardware and software) and their interoperability, according to specified service levels.	SHAMAN-RA

Framework, affecting 10 cells in a rather direct way. Moreover, instead of simply defining *ends* to achieve, e.g. Key Performance Indicators and thresholds, TRAC often prescribes *means*, i.e. mechanisms on how to achieve desired goals (without being explicit about the goals). By prescribing solutions instead of the core domain requirements, some criteria mix the problem domain with the solution domain, which makes it difficult to address a concern in a systematic way within frameworks of controlled change.

Finally, the flat representation of the TRAC criteria constrains DP to be analyzed in silos, limiting a multidimensional view of the same problem by different stakeholders (from the executive to the operational level). However, DP should be seen as a an enabler to the organizations, where a complete view of the overall concerns becomes visible to the involved stakeholders, making it possible to incorporate this information into strategic and operational planning. The need

Table 3. Stakeholders concerned with TRAC A: Organizational Infrastructure

TRAC group	Responsible	Accountable	Consulted	Informed
A1. Governance and organizational viability	Executive Management, Repository Manager	Executive Management	Technology Manager, Operational Manager, Regulator	Producer, Consumer, Auditor, Repository Operator, System Architect, Solution Provider, Technology Operator
A2. Organizational structure and staffing	Executive Management	Executive Management	Repository Manager, Technology Manager, Operational Manager	Auditor
A3. Procedural accountability and policy framework	Repository Manager, Technology Manager, Operational Manager	Repository Manager, Executive Management	Executive Management, Technology Manager, Operational Manager, Regulator, Auditor, Producer, Consumer	Producer, Consumer, Executive Management, Regulator, Repository Operator, System Architect, Solution Provider, Technology Operator
A4. Financial sustainability	Executive Management, Technology Manager	Executive Management	Repository Manager, Regulator	Auditor
A5. Contracts, licenses, and liabilities	Repository Manager	Repository Manager, Executive Management	Producer, Consumer, Regulator	Auditor

Table 4. TRAC criteria in group B4 and concerned stakeholders

Criterion	Responsible	Accountable	Consulted	Informed
B4.1 Repository employs documented preservation strategies	Operational Manager	Executive Management	Repository Operator, Solution Provider	Producer, Consumer, Auditor
B4.2 Repository implements/responds to strategies for archival object storage and migration.	Operational Manager	Executive Management	Repository Manager, Technology Manager, Solution Provider, System Architect	Producer, Consumer, Auditor
B4.3 Repository preserves the content information of archival objects.	Repository Operator	Operational Manager	Repository Manager, Technology Manager, Solution Provider	Producer, Consumer, Auditor
B4.4 Repository actively monitors integrity of archival objects.	Repository Operator	Operational Manager	Technology Manager, Technology Operator	Auditor
B4.5 Repository has contemporaneous records of actions and administration processes that are relevant to preservation (Archival storage).	Operational Manager	Executive Management	Regulator, System Architect	Producer, Consumer, Auditor

to have a common knowledge of the same problem by different stakeholders is currently recognized and addressed by established standards in the domains of IT Governance and Enterprise Risk Management.

4.2 Stakeholders and Responsibilities in Digital Preservation

As COBIT emphasizes, 'Understanding the roles and responsibilities for each process is key to effective governance'[5]. To enable us to establish responsibilities, Table 2 presents key stakeholders generally concerned with digital preservation in an organization that has a responsibility to preserve information. These stakeholders are based on a substantial analysis of domain references in the DP

domain that goes beyond the common stakeholders as they are referred to within standard references in DP. They are essentially the result of a reconciliation of established governance frameworks, specialized to cover the variety of concerns specifically relevant in a DP environment.

On this basis, we can analyze which core issues in DP are of concern to which stakeholders, using the common tool of a RACI chart that provides mappings between concerns and the stakeholders that are (R)esponsible, (A)ccountable, (C)onsulted and (I)nformed. Table 3 provides an overall view of 5 of 14 areas covered by TRAC and associates corresponding responsibilities to the stakeholders of Table 2. In more detail, Table 4 describes all criteria of group B4 (Archival storage and preservation/maintenance of archival information packages) and the concerned stakeholders. Applying this model of stakeholder involvement is seen as a key success factor for effective governance and an essential enabler for improved communication.

4.3 Observations

While space does not allow an in-depth discussion of all criteria and aspects covered by frameworks such as TRAC, the analysis presented in the last section allows us to draw some observations:

- The growing acceptance of standardized frameworks such as COBIT and the COSO ERM framework has not yet had a visible impact on digital preservation practice. In fact, the most prominent risk management approach for repositories, DRAMBORA[2], proposes a generic risk management life cycle and uses the OAIS Model and TRAC for a functional decomposition of repository activities to facilitate risk identification. An integration of these risks into a multi-dimensional enterprise view is required to achieve a common vision of risks and strategic planning in an organization-wide perspective.
- Domain-specific models are very appealing to stakeholders in the domain, since they involve the community, use its terminology, and explicitly address concerns voiced by key stakeholders. However, considering the wider picture of EA and IT Governance, it appears that the coverage of these catalogs and models is often overlapping with established models. Moreover, some criteria are a mix of requirements and solutions and as such not always aligned with best practices (such as a clear separation of concerns) which are considered essential enablers of successful change processes in Enterprise Architecture and IT Governance.
- Analyzing the overlap of TRAC with the ISO 27000 family of standards and COBIT, it seems that several areas of TRAC may benefit from a closer alignment and stronger references to these standards.
- In contrast to best-practice IT Governance, the definition of responsibilities for processes and goals in digital preservation is yet rather vague and informal. Since this is a key success factors for effective governance, it seems

[2] http://www.repositoryaudit.eu/

advisable to elaborate on explicit responsibilities in future revisions of conceptual domain models for DP.
- For COBIT, capability assessment based on a maturity model is a key part of implementing IT governance: "... maturity modeling enables gaps in capability to be identified and demonstrated to management. Action plans can then be developed to bring these processes up to the desired capability target level." COBIT also defines six information criteria that describe business requirements for information: Effectiveness (timely, correct, consistent and usable); Efficiency (productive and economical); Confidentiality (protection from disclosure); Availability; Compliance (with laws, regulation and contracts); and Reliability. For an organization that already follows COBIT, a close inspection of these criteria will clarify that DP is in its essence addressing the effectiveness and integrity of information. An extension of COBIT could explicitly address information longevity and integrate DP capabilities into the organization's Enterprise Architecture.

5 Conclusion and Outlook

Meeting DP requirements is in its very nature close to information security and privacy. For many organizations, it is a cross-cutting capability orthogonal to the value chain. However, it has been increasingly found of fundamental importance for enabling the actual value delivery, and intersecting with information, services and technology across the enterprise.

This paper analyzed key frameworks for digital preservation from the perspectives of Enterprise Architecture and IT Governance frameworks. We discussed the coverage and overlaps of the OAIS-based criteria catalog for trustworthy repositories, TRAC, in terms of established frameworks, and discussed stakeholders and responsibilities for DP.

In the light of the observations drawn, a sole reliance on domain-specific models appears a risky endeavor. It seems advisable to rely primarily on established governance models and feed into these the particular knowledge represented in domain-specific models. This should ensure not only strategic alignment between business and IT responsibilities and goals, but also consolidate domain-specific concerns and reconcile potential conflicts between them.

A formal grounding and alignment of DP concerns in terms of EA and IT Governance frameworks is needed to bring together these very distinct communities and enable communication between domain stakeholders responsible for solutions procurement and potential solution providers with a much more IT-focused background. Current work motivated by these conclusions is applying established Enterprise Architecture frameworks to develop a coherent architecture vision for DP *capabilities*. Based on this, we aim to express TRAC criteria as goals and constraints on such a DP architecture and develop an assessment model for DP capabilities in a maturity model aligned with COBIT.

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Interoperability, Enterprise Architectures, and IT Governance in Government

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Abstract. Government represents a unique, and also uniquely complex, environment for interoperation of information systems as well as for integration of workflows and processes across governmental levels and branches. While private-sector organizations by and large have the capacity to implement "enterprise architectures" in a relatively straightforward fashion, for notable reasons governments do not enjoy such luxury. For this study, we evaluated 77 successful projects of government interoperation and integration from across Europe and found that the governance of highly interoperated information systems needs very close attention not only from a functional point of view, but also from a more general-policy perspective. If unchecked, interoperation and integration in government might have the potential to offset or neutralize important safeguards put in place by the constitutional design of separated powers and checks and balances. We found that IT governance might play a more important role than commonly acknowledged and could even provide important clues for informing potential changes in the model of democratic governance in the 21st century.

1 Introduction

The Western model of governance, that is, government "of the people by the people and for the people" [13], is built on some core principles, which among others include the principles of limited government, separation of powers, checks and balances, judicial review, and the rule of law [3]. The implementation of these principles in practice has led to a type of government, which is effective, but unlike private enterprise deliberately not geared towards efficiency and gain. As a consequence, whenever a policy problem transcends the mandate and jurisdiction of a given governmental entity, this entity along with all other agencies and parties involved in the problem need to co-determine an outcome, which satisfies their respective needs. This process can be repetitive and tiresome; however, such inefficiency was intended by constitutional design.

Whenever separate jurisdictions intend to exchange information, in many cases laws, statutes, or regulations limit such exchange; or, the exchange might hinge upon the approval of individual government officials on a case-by-case basis. Typically, the process was slow and cumbersome. Despite the advent of modern information and communication technology (ICT), nothing much changed this state of affairs until the

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Internet made possible the effective connection of diverse information systems. At the end of the 20th century, governments also began more systematically connecting and interoperating their ICTs (please note that henceforth we will interchangeably use the acronyms *ICT* and *IT*, that is, information technology). It soon became clear in that process that sustainable and effective inter- and intra-governmental interoperation required more than just the technical connectivity via some smart middleware [4]. In many cases, administrative, statutory, and legal rearrangements had to be made. However, quite a few interoperation projects appear to have flown underneath the radar screen of public scrutiny, evaluation, and approval. We believe that the latter projects have been carried out as mere "technical" projects with little public visibility and attention. While we favor the improvement of government operations by means of modern ICT, we are also afraid of a mere technocratic understanding and implementation philosophy permeating and determining the model of governance.

The paper is organized as follows: We first briefly review the extant literature on interoperability, IT governance, and enterprise architectures in government. Then, we pose our research questions and detail the methodology used. Next, we present our findings followed by a discussion and an outlook on future research.

2 Brief Review of Related and Relevant Literatures

Interoperability has been distinguished from the act of *interoperation* as the capacity to engage in interoperation [15], that is, the more capable processes and systems are to engage in interoperation, the more they are interoperable (ibid). If such interoperability allows for ad-hoc interoperation based on adherence to standards and norms of operation, then such processes and systems are called highly interoperable (ibid). According to the authors interoperation and interoperability are distinct from *integration* (ibid). While the former refer to system and network-related aspects of operation, the latter encompasses the organizational and governance side of operation on process and workflow levels. This in turn can lead to tightly coupled, interoperable, and "integrated systems" on all levels. As Chen et al [5, p. 648] put it, "two integrated systems are inevitably interoperable; but two interoperable systems are not necessarily integrated." Various frameworks have been proposed to define the dimensions of *interoperability* [5], for example, as ability to exchange and use information between information systems [9, 18], or the exchange of information based on adhered-by standards [2]. The European Commission distinguished technical, semantic, and organizational interoperability [1]. Yet, others break down the technical level into a low-level technical protocol level and a higher-level syntactic level. When synthesizing the various frameworks, four levels of interoperability emerge, (1) the (low-level) technical level, (2) syntactic level, (3) the semantic level, and (4) the organizational level, the four of which form a hierarchy. Part of the semantic and the organizational levels encompass what Scholl and Klischewski [15] have referred to as integration.

Enterprise architectures have emerged in the private sector over the past decades in order to more effectively utilize and coordinate enterprise resources and enterprise-wide decision-making [11, 16]. Such architectures have been the underlying concept for designing enterprise systems, for example, enterprise resource planning (ERP) systems. Although enterprise systems regularly interoperate well on lower technical

levels, for the lack of common architectural standards, which would encompass all levels of interoperation (including the process, structural, and strategic levels) leading to high degrees of process and system integration, enterprise systems still do not satisfactorily interoperate on those higher levels of process and business [5]. The aforementioned interoperability frameworks attempt to fill this gap, however, with observably limited efficacy (ibid). Enterprise architectures in the public sector have been no exception to this observation [7]. Since government is markedly distinct from private enterprise, the more appropriate term for the public-sector context would be "institutional architecture." Where enterprise systems and architectural standards were imposed in the public sector, problems from resource asymmetries, redundancies (for dual processing), and rigidities of operation and in terms of future development have been reported [10]. Beyond these constraints several other constraints to interoperation and integration have been discussed such as legal, jurisdictional, collaborative, organizational, informational, managerial, cost, technological, and performance constraints [15]. Governance of interoperability and institutional architectures, hence, extends beyond the technical realm.

Public-sector IT Governance has not yet been defined in a widely accepted fashion in scholarly research. However, on a general plain, (public) *governance* has been defined "as regimes of laws, administrative rules, judicial rulings, and practices that constrain, prescribe, and enable government activity, where such activity is broadly defined as the production and delivery of publicly supported goods and services." [14, p. 235]. When transposing this broad definition of governance to public-sector governance of IT, one could define IT governance as "regimes of IT-related standards, agreements, methods, rules, and practices that constrain, prescribe, and enable the implementation and use of ICTs to support government activity." Other scholars have proposed definitions, which in part overlap our definition, which heavily leans on Lynn and friends' more general definition (cf., [17, 19]). Important elements of public-sector IT governance, hence, also include the concepts and practices of standardization and centralization, which Child had juxtaposed in his discussion of strategic choices [6]. In the context of decentralized systems operated by relative independent organizational entities as typical in government, the adherence to standards is a prerequisite for any basic interoperability, which, however, also predetermines a certain model of participative and consensual IT governance that cannot rely on any central command and control outside jurisdictional boundaries [5, 7].

In summary, as demonstrated above interoperability, institutional (or enterprise) architecture, and IT governance are closely intertwined phenomena, which have not been systematically documented in the academic literature, and whose relationships are not fully understood in the public-sector context. Institutional architectures have to encompass the principles and define the mechanisms and levels of interoperability. The institutional architecture and principles, mechanisms, and levels of interoperability, in turn, are subject to the governance models of an institution and its IT. Once those principles, mechanisms, and levels are observed, architectures and IT governance models can be inferred. Also, conversely, given the model of institutional governance, institutional architectures as well as the principles, mechanisms, and levels of interoperability can be assessed with regard to their respective suitability and compatibility.

3 Research Questions and Methodology

Case Method. In the absence of any comprehensive study on the subject in the area of government, we pursued a multi-stage exploratory approach, in which cases of interoperability in government were identified, systematically documented, and analyzed. These cases were further scrutinized regarding indicators for institutional architectures and governance structures. We first performed qualitative and quantitative in-case analyses followed by comparative cross-case analyses.

Study Question. For reasons of space constraints in this paper we present our high-level research question as,

(RQ) What are the characteristics of interoperability projects in government, also in terms of institutional architectures and governance structures, and how do they match up?

Sample. We identified and were able to validate a total of seventy-seven cases of interoperability projects in the public sector from all across the European Union. These "good practice" cases contained sixteen back-office studies, thirty "eEurope Award" good practice cases, six Terregov study cases, and twenty-five good practice cases based on national nominations (please see http://www.egov-iop.ifib.de/). These interoperability cases broke down into thirty-one cases of specific services, seventeen integration cases, six infrastructure development cases, and twenty-three portal development cases. In terms of geographical breakdown seventeen cases were taken from Northern Europe (Denmark, Estonia, Finland, Iceland, Norway, and Sweden), seven cases from Eastern Europe (Bulgaria, Hungary, Montenegro, Poland, and Romania), another seventeen from Southern Europe (Greece, Italy, and Spain), eighteen cases from Central Europe (Austria, Czech Republic, Germany, and Switzerland), and another eighteen cases were found in Western Europe (Belgium, France, Ireland, the Netherlands, and the United Kingdom). With regard to the level of government, forty-six cases were located at the national or federal levels, four cases encompassed multiple regions (or federal states), fifteen cases were found on the regional (or state) levels, five cases involved multiple local governments, and seven cases pertained to the level of local government.

The sample size and the case distribution seem to be fairly representative. However, all cases had been either nominated or proposed as "good-practice" cases, which creates a strong sampling bias in this study towards somewhat "good" and successful interoperability cases. When discussing the generalizability of our results, we will reemphasize this sampling bias.

Data Collection. In previous rounds of study, comprehensive and systematically structured case reports had been created, which were used as base input data to this study (please see http://www.egov-iop.ifib.de/). For eighteen cases, which stood out in terms of centralization, standardization, or semantic interoperability, further in-depth interviews with project owners and project members were conducted. As a next step, some forty experts from across Europe were invited to discuss these eighteen cases in a number of workshops. The data generated from the original case reports, the additional interviews and workshops were then compiled into extended case reports, which we then also used for this study.

Data Analysis. Case reports were analyzed in terms of the aforementioned four layers of interoperability (technical, syntactic, semantic, and organizational/business process) as well as (along these layers) in terms of the implementation, that is, the extent of standardization and, as an alternative, centralization. The coding was based on interoperability criteria and elements shown in Table 1. We employed a scalogram approach [8] in order to inductively verify whether or not the structures we found in the data were cumulative. These so-called Guttman scales indicate how strong a cumulative structure under study is. In other words, the occurrence of the higher level makes the existence of the lower layers in the structure more likely the more the overall structure is a cumulative one.

4 Findings

Hierarchy of Interoperability Layers. As indicated above, according to theory we expected to find the four levels of interoperability to represent a hierarchical structure, in which the next higher and more specific level of interoperability rests on the previous less specific one. As a consequence, higher layers of interoperability should not

Table 1. Analytical breakdown of interoperability (IOP) levels

Interoperability Layer	Characteristics	Objects	Implementation	Examples
Business Process IOP	Automated processing between different business processes	Workflows	Architectural models	SOA with WSDL, BPML
Semantic IOP	Automated recognition of individually received data	Information	Common directories, data keys, ontologies	EAN location number, UPC (Universal Product Code)
Syntactic IOP	Automated recognition of certain classes of objects	Data	Standardized data exchange formats	EDIFACT; XML
Technical IOP	Technically secure data transmission	Signals	Protocols of data transfer	HTTPS, SMTP

be found when lower levels were absent. Such a hierarchical structure would fit the definition of a so-called cumulative structure. In fact, in the vast majority of the cases, we were able to identify at least the lower two or three of four interoperability layers. The scalogram analysis [8] showed a strong cumulative structure (see Table 2) with areproducibility coefficient of 0.987 (reproducibility coefficient = 1–(number of errors/number of cases*number of items)).

In fact, only four cases do not expose the overall pattern of cumulative interoperability layers. In all four cases, interoperability has been achieved on the business process level without a semantic interoperability layer underneath. However, this type of business process interoperability is achieved at the expense of “hard-wired” rigidity

of process to use a technology term. When disregarding the four special cases, the four layers of interoperability have been found implemented in almost all cases forming an almost perfect Guttman scale.

We would like to remind the reader that the 77 cases were identified as good-practice cases. In other words, it appears that the vast majority of good practice cases follow a layered architectural approach. In the absence of failure cases in this study, we cannot be sure, but we would not be awfully surprised to find this architectural principle of interoperability as a key success factor for successful interoperability projects in future research.

Table 2. Summary scalogram of 77 IOP cases

IOP Layers	Number of Cases
IOP Layers 1 to 4	40
IOP Layers 1 to 3	20
IOP Layers 1 to 2	13
IOP Layer 1	0
IOP Layers missing	2
No IOP Layers	2
n =	77

Standardization and Interoperability. In a completely decentralized IT environment, interoperability would be possible when two conditions were met (a) for every recurring exchange a specific exchange procedure needed to be established ex ante. This would be tiresome and costly if the demand for new exchanges increases; or, (b) interoperability would be enabled by means of standardization of exchanges (as, for example, via standardized protocols and procedures as prescribed by the four layers of interoperability. With perfect adherence to standards, hence, new exchanges would be implementable with relative ease. We were interested in what standards we would find in the cases with regard to the various interoperability layers. It was clear from the outset that we would sure find basic routing and directory services on the technical level. However, in the syntactic layer, we looked for data exchange formats such as EDIFACT or XML, in the semantic layer we expected to find data keys and ontologies for data fields, and in the business process level, we looked for workflow definitions based on common description languages.

Following the layered hierarchy, we hence found directory service definitions, data exchange format definitions, data key definitions, and workflow definitions. Table 3 shows the distribution of standards across the interoperability layers. For the thirty-one cases of specific government services, we found twenty-eight cases with a perfect Guttman scaling structure, twenty-three of which exhibited the standardization elements on each layer. The reproducibility coefficient of 0.9355 (all cases) and of 0.9677 (special government services) showed an almost perfect cumulative structure for these cases.

Centralization and Interoperability. When IT services are provided centrally, standards can but do not have to be used for providing interoperability. We found a

number of centralized vehicles used for facilitating interoperability, which were not based on public standards such as (a) centralized directories for address translation and message routing (which we found in 62 of 77 cases and in 27 of the 31 specific government service cases), (b) centralized directories for user authentication (60/77 and 23/31), and (c) so-called core directories for data keys used in message data fields (38/77 and 14/31). We also found some centrally provided process functions, (d) data format conversion (33/77 and 17/31), (e) process control such as format validation, tracking, or tracing (55/77 and 25/31).

Select Observations. Elsewhere, we identified interoperability requirements as (a) multi-service exchanges when common data are exchanged for different services, (b) multi-stage exchanges when workflows occur between different stages of a service, (c) multi-area exchanges when data are exchanged between units in different geographical areas, and (d) multi-file exchanges when common services are provided for different files [12]. We cross-tabulated these interoperability requirements with the respective standards identified on the four interoperability layers and found for the 31 specific government services complete standardization for data exchanges (syntactic layer), and very high standardization also for data keys (semantic layer) and workflows (business process layer). However, standardization was relatively weak for directories (technical layer). When we analyzed how the interoperability requirements were met via centralization, we found that centralization was high to very high for address directories and process control, however, relatively low for authentication directories and core directories, and medium for conversions.

Permanent and/or temporary institutions. IT governance encompasses the assignment of authority for planning and controlling of IT infrastructures and services to organizational and functional units. In inter-governmental interoperability projects it was not always clear from the outset, which units had been assigned to planning the various options. Scholl and Klischewski [15] mention federations as more permanent configurations and working groups for more loosely-connected projects. In our sample we found different governance structures in the various phases of a given project life cycle. In the planning phase, the task of planning for interoperability assigned to either existing or new, and, either permanent or temporary institutions. If interoperation between already existing government services had to be established mostly existing institutions orchestrated the cooperation between the agencies involved because these existing institutions were able to build upon their experience in planning electronic exchanges. Wherever integration of processes was required between agencies spanning branches and levels of government and no previous collaborative relationship had pre-existed, new temporary institutions were formed such as project groups. Only in a single case a new permanent institution was formed where a clearinghouse for the whole social security sector (in Belgium) had to be created.

IT Governance: Agreements, Ordinances, and Adherence to Standards. If not centrally governed, that is, controlled by law or ordinance and enforced by monitoring or budgetary means, interoperability frameworks, standards, and institutional architectures are only as effective as the various parties involved adhere to them. Scholl and Klischewski [15] have argued that the more government agencies operate in an integrated fashion, the more they need formal agreements ensuring that modes and standards of interoperation on all levels are adhered to. When we inspected the data

regarding the arrangements for enforcing the compliance with ordinances and/or the adherence to standards as well as to an agreed upon model of IT governance, we were able to identify mandatory standards in 14 of 31 specific government services, while 17 of 31 cases were based on recommended standards. Whereas mandatory standards had mostly been enacted by law (10 of 14 cases), quite many recommended standards had been established via agreements or contracts. While such outcome was expectable, we found it surprising that standards when sanctioned via formal agreements between collaborating partners still were found mandatory in only four cases and recommended in the other twelve. Obviously, in most cases signatories do not completely enact what they had agreed upon. Adjusting existing legacy systems to standards might have proven to o expensive, so that the signatories appeared to have opted in favor of greater flexibility.

5 Discussion and Summary

We set out to investigate the characteristics of interoperability projects in government. In 77 overall cases, and more so, among those in the 31 cases of specific government services, we found that in these projects the various layers of interoperability (technical, syntactic, semantic, and business process) were specifically addressed. Particularly, on the higher layers high degrees of standardization were found across the cases, especially, in the 31 specific government service cases. This high degree of standardization is complemented by some degree of centralization of various services such as address directory service and process control. Interoperability in technical and functional terms appears to be ever better understood and executed in practice. The high use of standardized approaches also indicates that public-sector IT leadership understands the benefits of so doing. We would, however, like to reemphasize that these results are based on 77 cases of evidentially "good-practice" interoperability in government. We explicitly refrain from inferring that standardization (complemented by some degree of centralization) in government interoperability makes project success more likely. As Scholl and Klischewski [15, p. 911] suggested, we would need to analyze not only unproblematic outcomes as in this study but also problematic outcomes of *type A* (unsuccessful project aiming at desirable project goals) identifying the failure causes, and of *type B* (successful projects producing undesirable results) analyzing the sources and causes of undesired side effects.

For a type-B problematic outcome analysis, the 77 case reports rendered too little insight for us to make any qualified statement on that ground. However, what we noticed was an at least unmindful approach to transferring architectural (and that means, governance) principles from the private sector into government. Public-sector IT governance might incorrectly be interpreted as a purely technical and functional affair, which it is not. The laws and ordinances as well as the collaborative agreements regarding institutional architectures and IT governance models used by collaborating government agencies need to be carefully reviewed and assessed.

As mentioned above a linchpin in the Western-style model of governance is the notion that government needs to be and stay limited; and, in order to assure that government stays within those constitutionally designed explicit limits several safeguards have been devised such as the division of governmental powers and a system of

checks and balances, as we pointed out in the introduction. However, interoperability, and, hence, the public-sector IT governance thereof, needs to be pursued by upholding these constitutional principles.

Our research results from these seventy–seven "good-practice" cases, that is, cases of successful interoperation in government, highlight that a successful model of governance of interoperability for a project in one area of government does not easily transfer to projects with other services in different areas, levels, and branches of government. We were able to describe and systematize the processes and instruments for establishing interoperation in the public sector. Also, we developed an empirically grounded framework for the governance of interoperability in government. However, we caution that the high-level categories in this framework have to be broken down and adopted to the respective context in any given interoperability project. Although seemingly impossible, it would nevertheless be undesirable to establish a single IT Governance regime across all sectors and levels of government. Based on empirical insight we dismiss the drive for establishing Enterprise Architectures in the public sector as inappropriate and problematic, at a minimum. Institutional architectures represent governance structures, and interoperability in the public sector requires governance structures different from the private sector. Even in industrial conglomerates with formal Enterprise Architectures we know of no cases, in which all affiliations completely adhere to the architecture. For good reasons, powers in the public sector have been separated and must remain so, in order to maintain the very foundations of the democratic system at large. Our findings show that IT governance needs to be established anew in each single case of cross-sector and cross-level interoperability. From a constitutional perspective, this is a comforting insight. Yet it will remain necessary to check new networked e-services for their capacity to uphold "democratic interoperability."

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Exploring Information Security Issues in Public Sector Inter-organizational Collaboration

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Abstract. Joining up service delivery of multiple organizations often requires public organizations to exchange citizens' information. To ensure their privacy and realize information security, controlling data access is paramount. However, limited research was found on issues that emerge when realizing data access control in inter-organizational collaboration. Security is typically achieved by implementing security patterns, which are proven technical solutions. This paper explores data control issues for realizing information security by looking at the application of security patterns in practice. By investigating a case study of inter-organizational collaboration in the Netherlands we explore the use of two security patterns that control access to information: Extended Role-Based Access Control (ERBAC) and Single Access Point/Check Point. We investigated whether those patterns were implemented in the right way and whether they were sufficient for guaranteeing access control. We found issues related to access control to be crucial in realizing information security, which can only be realized by implementing organizational arrangements in addition to technical solutions. Therefore, we recommend development of a framework for information security in inter-organizational collaboration including technical and organizational aspects.

Keywords: Information Security, e-Government, Inter-Organizational Collaboration, Security Patterns.

1 Introduction

Public organizations aim to improve their service delivery to citizens and businesses by realizing integrated service delivery. From the perspective of a client, service delivery is integrated when multiple organizations collaborate and the client need not provide the same information to each of these organizations but, instead, just once to one organization [1]. Thus, for realizing integrated service delivery, multiple organizations need to share information about their clients. Furthermore, for their daily operations, public organizations increasingly rely on data gathered by other organizations as well as on information stored in vital registries, such as the citizens

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registry, and the address and car registrations. Therefore, unique registries are set up to facilitate information sharing. Governments, thus, retain, process, and exchange citizens' data that are increasingly being re-used.

To ensure the privacy of citizens, information security is key to these e-government initiatives [2]. Information security is threatened by attacks on networks and data transactions and through unauthorized access by means of false or defective authentication [3]. Besides tightly securing information systems in the public domain, controlling access to citizens' information is the main challenge for realizing information security [4,5]. This paper investigates issues that emerge in relation to access control of citizens' information for realizing information security when multiple public organizations collaborate. We found that there is limited research on information security in the field of e-government as it is often primarily seen as a technical matter. Moreover, most of the studies on security in e-government are concerned with security in e-participation or e-voting (e.g. [6-9]) or of government websites (e.g. [10]). Carter and McBride [4], therefore, call for more research on information privacy in the field of e-government.

This paper aims to contribute to e-government security by identifying information access control issues. Looking at a large case study of inter-organizational collaboration in the Netherlands, we investigate how information security was realized. Security is often realized through the implementation of predefined security patterns. Security patterns are reusable solutions to security problems [11]. They are used to implement pre-specified and tested solutions. Studying e-government access control security applying the state of the art in methodology and designed patterns would reveal if the technology sphere could solve such issues or if there is a need for enhanced solutions. As these design patterns are central to achieving information security, we first examine existing security patterns for data access control. Then, we carry out the case study to find out how these security patterns are implemented in practice and whether any other security arrangements are used. The case study findings are followed by a discussion and by conclusions and recommendations.

2 Security Patterns for Information Access Control

A common way to ensure information security is through the application of security patterns [12-16]. Security patterns are based on the notion of design patterns. A *design pattern* is defined as a general reusable solution for a commonly occurring problem [14,17]. It is a high level description of 'what to do' or 'which steps to follow' in order to solve a recurring problem. Applying tested design patterns to solve a security issue saves time and effort, as they allow for the rapid design of a robust solution by using proven techniques. Besides providing commonly used solutions, design patterns provide a common vocabulary to designers, architects and developers to allow them to convey ideas without having to describe every detail of the intent of the design [13,15]. Many different types of patterns exist, such as structural design patterns that are essential to building complex systems, computational design patterns to identify the system's key computations, algorithm strategy patterns related to the high level strategies to exploit the system's characteristics, implementation patterns related to the realization of the source code, and security patterns to solve security related problems [18-21].

To access control information, security patterns were also designed. The access to citizens' personal information needs to be controlled and monitored in order to assure privacy and information security of entire population. The use of Access Control Mechanisms (ACMs) is a mandatory implementation step to assure that only authorized users can deal with personal citizen information [5]. Although many different types of ACMs exist [22-25], in this paper we focus on two of the most commonly used patterns: the Extended Role-Based Access Control (ERBAC), which is an extension of the standard Role-Based Access Control (RBAC) pattern, and the combination of Single Access Point and Check Point. Single Access Point/Check Point is the most commonly used design pattern able to provide identification and authorization of the final user [26].

2.1 Role-Based Access Control Pattern

One of the most commonly used security pattern to control access of information is Role-Based Access Control (RBAC). It controls access to information by associating users to roles that are allowed to access to specific information [24,25]. Although it was a theoretical pattern, it can be easily applied in practice using an implementation model [23]. Most organizations have a variety of job functions that require a different set of skills and responsibilities. Most of the time employees (and employers) can be classified according to their functions or tasks; common tasks require similar sets of rights. The RBAC pattern helps organizations to define precise access rights for its members according to the 'need-to-know' policy. As many other security policies this policy aims to make unauthorized access to information difficult. The 'need-to-know' policy also aims to discourage 'browsing' of sensitive material by limiting access to the smallest possible number of people.

The RBAC model is shown in Fig.1. The 'ProtectionObject' class represents the information that needs protection from unauthorized users. It has an ID and a name to distinguish between different protected information sources. Users (employees) are assigned to detailed roles and roles are given rights according to their functionalities. The association class called 'Right' defines the access type that the user, with his role, has regarding to the protected object. The user may be able to read the protected information, modify or delete it. Each user may have one or more roles, depending on how many tasks he or she performs. Each role may have the rights to use one or more protected objects depending on their functionality. The approach can be extended to a real life scenario using three new entities such as:

1. *Group*: users can be divided into groups depending on their working area;
2. *Session*: representing the way to use a role;
3. *Administrator*: the person who has the right to assign roles and rights to users and group of users.

An RBAC model including *Group*, *Session,* and *Administrator* entities is referred to as the *extended* RBAC (ERBAC). The entity called Group collects the users who belong to the same job category. *Roles* can be applied directly to a Group since the "common tasks require similar sets of rights, ergo roles". A single user can have a specific set of roles in addition to the group roles because he or she may have special

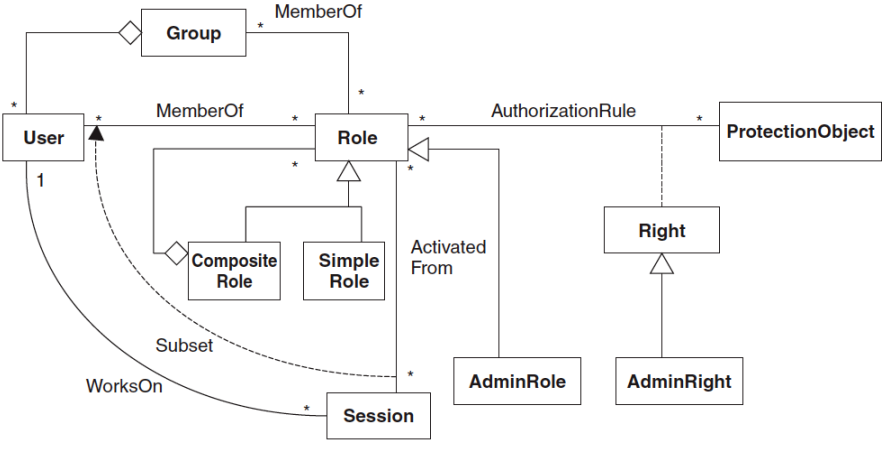

Fig. 1. Extended Role-Based Access Control with Group, Session and Administrator entities

or temporary permission in addition to the ones normally attributed to the group (for example, a medical director can be a doctor with more access rights).

A special case is the Administrator, who has a different subset of roles as the *trusted point* of the model. The Administrator is the root, which initializes the access control mechanism by setting up roles, groups, rights and at least one user. In a company the administrator may be the delegate system that takes care of the process of defining roles, users, and groups. The Session is the entity that keeps track of 'who is doing what'. Furthermore, the Session records which user is working on a specific role. And finally, the Roles can be simple (by meaning of atomic ones) or composite (by meaning of an aggregation of two or more roles).

2.3 Single Access Point and Check Point Patterns

Single access point and check point patterns are often used together to protect the system from misuse or damage. The single access point defines a clear entry point to the system that can be assessed implementing the desired security policy. The check point pattern builds an easy access control mechanism on top of the single access point that is able to distinguish between authorized and unauthorized attempts to access the system [26]. A military check point is a good example for explaining how these patterns work in practice as they apply strict rules to entry. Every time somebody passes the check point that person need to be authorized to enter or leave the secured zone. At the same time, authorized people (clients) need to be able to go easily. Therefore, the difficulty is to distinguish between the two types of users (authorized and unauthorized) as every mistake could turn into a problem. Fig. 2 describes the proposed solution by applying the Check Point pattern on top of the Single Access Point pattern.

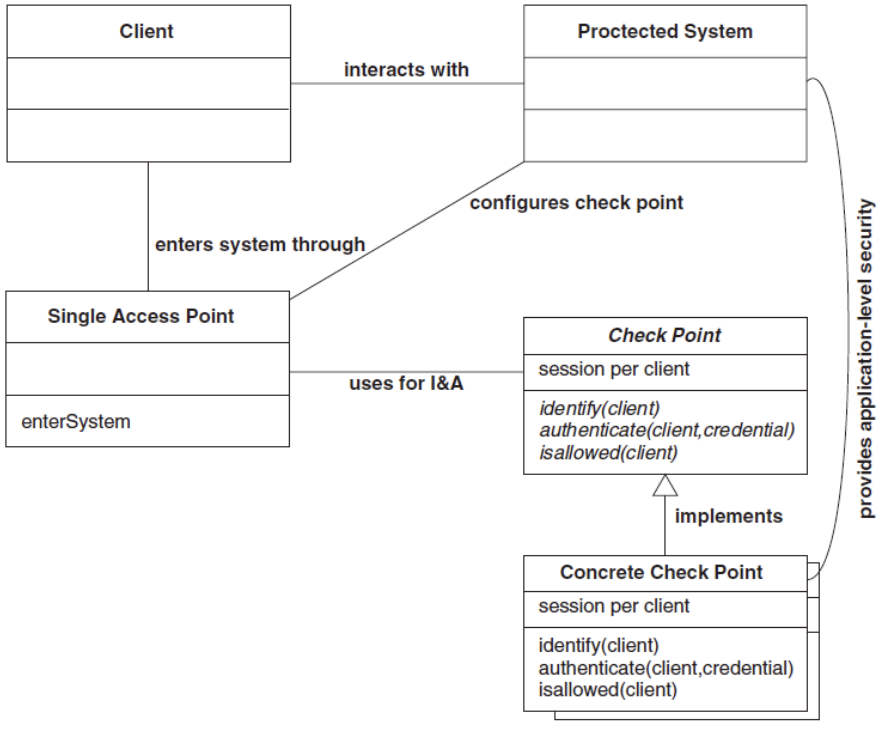

Fig. 2. The Single Access Point pattern and the Check point Pattern

In order to interact with the protected system, the client needs to enter into the environment through a Single Access Point employing a Check Point pattern for identifying and authenticating each client (Fig. 2). The Check Point pattern identifies and authenticates every access to the protected area by tagging each allowed client. This tag represents the security session. Everybody with the right to access in the protected area exhibits a tag certifying the right to be there. Through the security session the client is able to use the protected system. The goal of these two patterns fitted together is to regulate access to a system. They make it possible to deny access to the protected area when too much clients have accessed the area, to control access for statistics, to differentiate tasks and roles and to protect the access to unauthorized clients.

3 Case Study

To study the use of the security patterns for ensuring information security in cross-organizational collaboration we use a case study from the Netherlands. In the Netherlands, several inter-organizational collaborative networks can be identified that share citizens' data. The network under study is a service chain in which multiple organizations collaborate to deliver services to the unemployed, such as helping to

find a job (re-integration) and issuing social security allowances. We carried out the case study by doing semi-structured interviews with people from the business side as well as from the IT-department. We asked questions about current as well as future security issues. Furthermore, we asked them how their current policies for data and system security are set up and what the major challenges were. Finally, we asked them how these policies and arrangements are followed in practice and whether they had to be adjusted over time. Eight people from different organizations were interviewed between October 2010 and February 2011.

The case study is a collaboration between two large executive organizations, one focusing on the social security for pensioners and the other on social security for the unemployed, and the municipal social security offices. This reflects the implementation of social security policies on two levels: on the national level by the large executive organizations and on the local level by the municipalities. The main objectives of this inter-organizational collaboration is to help people get a job when they have become unemployed, and determine the height and length of the social security allowance. To support this process, a number of different systems have been developed. The main systems used for collaboration are an online environment, including an electronic intake and filing system that allows sharing information between the supporting agencies and the unemployed, and a system that the different organizations use to look at and re-use each other's citizens information. These two systems will be taken a closer look at to determine how information security is implemented.

At the front end the executive agency for social security collaborates with the municipalities in 'work centers' where 'work coaches' from both the local and the national level help their clients to find a job. In these work centers citizens' data will only be looked at by the client and by the work coach helping the client. The information that is shared is rich information on the specific working situation of clients. At the back end of the processes, much of the data is processed automatically. For example, the organization taking care of pensioners allowance processes the information mostly at night, with as little human interference as possible. Only in case of a complaint filing, case workers look into citizens' data. The information that is shared at the back end includes age, address, marital status as well as income data and information on the possession of property and vehicles. To estimate the social benefits for the unemployed individual case workers make individual requests of citizens information such as income data from the inland revenue service, car ownership data from the executive organization registering motorized vehicles, and address and marital status from the local level. The case workers from the organization determining the social security allowance for pensioners also have the right to view this information if necessary but the degree of usage is much lower.

The employees that make use of these systems are allowed to use certain applications and access and change certain data based on their role within the organization. However, usage and authorization of usages differs among the different applications. For some shared applications, authorization is based on the role that is given to persons by human relations management (HRM) applications of the social security executive organization. However, as many of the employees at the local governments are not included in the HRM system of the social security executive organization, they cannot be assigned a role to use the system, even though their

function requires them to access information. Therefore, from time to time at the front end of the system, user's credentials are shared between employees, which is not allowed.

To test whether the system is sufficiently secured from attacks from the outside, the system is routinely hacked by professionals. But although the level of security from outside attacks is considered sufficient, the main problem threat to information security is from the inside. Employees from the executive organizations look, sometimes, for citizens' information that they do not need to see as part of their work. For example, information on people often appearing on television is much more often retrieved that that of others. A shortlist of names and addresses is, therefore, blacklisted and cannot be accessed by the employees of the executive organizations. Furthermore, the retrieval of citizen's information outside the normal case load, is reported to the manager of the person retrieving the information and also published in the organization's in-house magazine.

Another measure to secure the personal information of citizens is an agreement between all the parties involved in sharing citizens' information on the norms of information sharing. Still, employees of the pensions executive organization found that while they applied very strict rules to information management, this is not the case in all municipalities. While sometimes evading rules on security may be useful for individual citizens when employees try to help them with their re-integration process, this can result in security breaches with severe consequences. And finally, also a general law on information security is in place. In the Netherlands, both the provider and the user of personal information at the government level are subject to legislation protecting personal data by having to be goal bound and proportionate in their information sharing. This means that both can be held accountable in case of the misuse of personal data.

4 Findings

The main differences between the case study and the discussed security patterns are summarized in Table 1. The left-most column represents the desired high level elements, or blocks, that need to be present to ensure information security by following the security patterns. The correct implementation of these blocks assures the correct use of information providing control, identification and authorization to the protected resource. The next two columns describe how each designed pattern implements these high level blocks. Finally the right-most column describes how the case study implements (or not implements) the high level blocks.

The blocks one the left side, such as Groups, Roles, and Type of Users, represent the technical properties that need to be in place to implement the security patterns presented in section 2. As shown in Table 1, a number of these basic blocks that are part of the implementation of the security patterns are properly implemented in the case study, such as the assignment of groups with different access rights and the single entry point by implementing a log in mechanism. Other blocks, however, are not properly implemented, leading to security threats. The main threats that we identified are the sharing of username/password combinations among employees of different organizations that need to collaborate and access the same applications and

Table 1. Implementation of the security patterns in the case study

Blocks	**E-RBAC**	**Single Check Point**	**Case study**
Groups	Groups managed with different roles	NA	Different groups are distinguished
Types of users	Different types of users with different roles	NA	The different groups have different roles to information access
Roles	Implements roles, simple roles, composite roles and administrator roles	NA	Simple roles implementation
Rights	3 Way rights implemented (Read, Write, Execute)	NA	Multiple way rights
Protected Objects	Implemented	NA	Implemented by ACM
Sessions	Session to link roles to users, and users to rights and user to protected information	NA	Session controls are implemented
Entry Point	NA	Single access point from externals able to identify and to authenticate clients	Implemented by using a username/password combination for log in
Check Point	NA	Single access point from externals able to identify and to authenticate clients	Insufficiently implemented, as it is possible to use someone else's credentials to access the systems

the unauthorized access of information by authorized users. Although sharing the user credentials can be seen as a poor implementation of the technical solution as it is apparently possible to log on to the system without proper identification (such as by using biometric scans), it can be considered predominantly a non-technical problem of users not adhering to the rules of their organization. Therefore, we found that additional organizational arrangements are necessary to ensure information security in this case. Examples include training of employees working with citizen's information, and punishing unauthorized access of information.

The main issues for realizing information security identified from the case study are related to data access control. While measures taken to prevent the system from outside attacks were considered sufficient by the interviewees, unauthorized data access by employees was observed regularly. These issues are on the one hand the result of unauthorized access of information by employees, such as accessing personal information of celebrities, and on the other hand they are the result of organizations not collaborating properly. In the case study, the administrator role was not sufficiently fulfilled to the requirements of all the organizations making use of the applications, leading to insufficient support of the users' needs, and, thereby, to the

sharing of usernames/password combinations. Furthermore, as norms and interests differ across different organizations, security threats also emerge as a result of these differences, while individual employees are not seen to behave in an unauthorized manner. In order to improve data access control and realize information security, all three sources of security breaches need to be mitigated.

5 Discussion

Ensuring data access control for realizing information security is a recurring problem. In recent years, the need for measures to realize information security has arisen more strongly in the field of e-government. More collaboration between public agencies in networks in order to realize integrated service delivery and the increased sharing of citizens' information requires increased attention to information security. Information security in cross-organizational collaboration mainly focuses on the control of information access to be sure that only authorized people are able to read and modify information. As discussed in section 2, different security patterns exist that have been designed for data access control. We concluded, however, that these security patterns are currently only partly implemented in the case study. Furthermore, we found that additional organizational arrangements are necessary to ensure information security. And, finally, we also found that the inter-organizational nature of the collaboration requires these security patterns to be extended to cover threats that emerge as a result of the collaboration between different organizations. Therefore, in this section we discuss some recommendations for increasing information security in cross-organizational collaboration.

Firstly, the security patterns need to be implemented properly. For example, in the case study only simple roles are defined. Secondly, we found that additional organizational arrangements need to be in place besides the proper implementation of the security patterns. Security patterns are merely technical implementations that are not able to mitigate these threats to information security and legal arrangements are often only useful in case harm has already been done, although it can be argued that some level of prevention goes out from having laws against misuse of information in place. Examples of organizational arrangements include the training of employees in information security, and punishing unauthorized use by informing the managers of these employees, publishing unauthorized use in the in-house magazine of the organization, or even firing the employees in case of gross misuse. Further research should look into which arrangements – as well as combinations of technical and organizational solutions – are effective in specific circumstances.

Thirdly, security patterns may need to be extended to cover multiple organizations. Implementing security patterns across multiple organizations presents a challenge for the role of administrator. In the case study the administrator role is linked to one organization, as it is now possible to only assign employees of one organization to applications, or to add employees of different organizations to its HRM systems, which may be undesirable. Furthermore, the division of groups needs to be done according to the differentiation of tasks. In the case study, the employees of the different organizations that collaborate need to use the same information in different ways. The organization having the task to calculate the allowances for those in the

Netherlands that are retiring, do only need to have full information on individual citizens in case someone files a complaint, while the employees having the task of re-integration of the unemployed need to access the information on individuals real-time to be able to help them get a new job. This may lead to different requirements for security of the same application, which may require additional or extended security patterns to be in place.

We recommend that further research should be done to identify which elements are necessary for data access control for realizing information security in cross-organizational collaboration by using arrangements from both spheres. For example, a combination of technical solutions implemented through the use of security patterns and organizational arrangements such as training. Furthermore, to enhance research into information security in inter-organizational collaboration, developing a comprehensive framework comprising both technical and non-technical arrangements is likely to spur new insights. Currently, no frameworks exists for guiding the research analysis process in such a way that it is able to assert whether the analyzed system is sufficiently secure. Such a framework, comprising designed patterns, investigation methodologies, recovery procedures, legal requirements, behavior analysis and interview patterns, can be a next step in achieving a standardized information security level in cross-organizational collaboration.

6 Conclusion

In order to join up their services, government organizations need to exchange citizens' information. To ensure their privacy, data access control is central to realizing information security. Many pre-defined security patterns exist that represent specific solutions to realize security. This paper explores issues related to data access control in cross-organizational collaboration through the application of two of such security patterns: E-RBAC, and Single Access Point/Check Point. To explore their use in practice, we applied these patterns to a case study of public sector inter-organizational collaboration in the Netherlands. We compared the implementation of measures to ensure data access control for realizing information security from the case study with the two security patterns from literature.

We found data access control to be a main issue in realizing information security in the case study, and we also found that additional organizational measures are necessary to mitigate security threats, such as providing training, implementing shared data access norms and punishing unauthorized access of information. Furthermore, the inter-organizational nature of the collaboration requires extending existing security patterns. For example, it requires the role of the administrator to be filled in such a way that is able to fulfill this role for multiple organizations, instead of only one organization. Therefore, we recommend to look further into how organizational arrangements need to be combined with technical and legal arrangements in order to achieve information security. Finally, a related recommendation from this study is the development of a comprehensive designed framework for realizing security in inter-organization collaboration.

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Ambiguities in the Early Stages of Public Sector Enterprise Architecture Implementation: Outlining Complexities of Interoperability

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Abstract. In recent years the development of eGovernment has increasingly gone from service provision to striving for an interoperable public sector, with Enterprise Architectures being an increasingly popular approach. However, a central issue is the coordination of work, due to differing perceptions among involved actors. This paper provides a deepened understanding of this by addressing the question of how differing interpretations of interoperability benefits affect the coordination in the early stages of implementing a public sector Enterprise Architecture. As a case-study, the interoperability efforts in Swedish eHealth are examined by interviews with key-actors. The theoretical framework is a maturity model with five levels of interoperability issues and benefits. The findings highlight the need to clarify decision-making roles, ambiguities concerning jurisdictions between authorities and that differing perceptions of IT-infrastructure is connected to overall goals. The paper also suggests a re-conceptualization of eGovernment maturity by moving away from sequential models.

Keywords: eGovernment, Interoperability, Maturity models, Implementation, Coordination, Complexity.

1 Introduction

In recent years the development of eGovernment has increasingly gone from service provision to integration of back office systems and striving for an interoperable public sector [1]. It has been shown that eGovernment implementation projects tend to be overambitious and often fail, with more or less severe consequences. It has been suggested that this is partly due to that these projects focuses too much on IT (Information Technology), but are rather a part of an agenda of policy change [2, 3]. It has also been shown that IT policies in the public sector often rely on the underlying assumption that technology, by itself, will transform public organizations from stovepipes to integrated administrative systems focused on citizens' needs [4], and that emphasizing IT might lead to a waste of resources as organizational learning and collaboration is not prioritized [5]. Also, there is "overconfidence in the ultimate efficacy of interoperating" in eGovernment projects, meaning that ensuring

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technological interoperability does not necessarily lead to a functionally integrated public sector. This is due to a vast amount of organizational and legal issues [1]. In essence there are several issues related to over empathizing technology over social aspects, i.e. considering the whole Information System (IS), encompassing technology as well as human activities in relation to technology[6]. In trying to treat both social and technical aspects of interoperability different approaches have been taken, with Enterprise Architectures (EA) being increasingly popular [5, 7]. The purpose of EA is to work as a framework or method for aligning business processes and IT use, covering organizational as well as technical aspects [8]. However, previous research shows that EA in the public sector to a large extent is immature, and the IT-architecture and business architectures often are not sufficiently integrated [2], and might be treated separated from each other [7]. Hence the actual efforts to implement interoperability do not necessarily match the overall goals.

Another central implementation issue is the coordination of projects, and creating a shared vision of the future between them [9, 10]. Government IS projects are complex since different organizations or groups of actors might perceive goals differently. This might be problematic as goal convergence (and hence interoperability) might not be reached if different actors act upon incongruent perceptions of goals [11]. In designing an IS the architects are involved in a process of "anticipatory decision-making", which involves trying to predict future use, and sets the course for future actions [12]. However, the vision of the future use has some degree of interpretative flexibility and is "a contested object of social and material becoming" and not a point in time where change is bound to happen [13]. Thus, a central aspect is how different organizations and actors differing goals, practices and technologies relates to an overall plan and their interpretation of it [14]. An IS does thus not follow a predictable or neutral trajectory, but is rather dependent upon the specific setting in which it is implemented as different actors might question the intended purpose, and reinterpret it in order to suit local needs [15].

Case studies on the focuses, purposes (perceived benefits) and limitations (issues) to interoperation and integration in eGovernment projects has been suggested as relevant topics for further research [1]. Also, how eGovernment strategies influence interoperability work [5] as well as how motivations are aligned and what the expected outcomes are in large-scale eGovernment projects has been highlighted [16]. This paper addresses the question: *How does differing interpretations of interoperability benefits affect the coordination in the early stages of implementing a public Enterprise Architecture?* This issue is addressed by means of a case study on the Swedish strategy for eHealth which aims to implement a national EA in the healthcare sector. The case focuses on national and regional collaboration and coordination efforts. As a theoretical framework a maturity model for eGovernment interoperability is used.

2 Theoretical Framework

In order to categorize the findings there is a need to apply a theoretical framework to classify which kind of benefits and issues that is treated during implementation. The eGep (eGovernment Economics Project) model provides a framework for achieving a comprehensive theory-based measurement of eGovernment [17] and is used as it has

been proposed as being suitable for developing a deepened theoretical understanding of eGovernment [18]. The eGep has three value drivers; 1) Financial & organizational (cashable gains, employee empowerment, improved IT architecture) 2) Political (transparency, accountability, participation) and 3) Constituency (reduced administrative burden, inclusive services, user value) [17]. As the model has a strong emphasis on measurability (e.g. number of services, number of service users etc.) it risks losing in-depth understanding of complex issues [18]. Thus, in this paper only the value dimensions (and not the measurement tools) are used, as the paper focuses on understanding rather than measuring eGovernment. The model has also been criticized for potentially lacking the ability to determine actual progress [18]. Hence, there is a need to combine the model with another model which can assess progress. For this purpose Gottschalk's model for eGovernment interoperability maturity levels is used. It is suitable as it focuses on internal processes of interoperability, instead of more general stage-models that focus on service delivery and/or democracy which is a wider scope then would be useful in this paper. The framework consists of five interoperability levels; 1) Computer – semantic and technical issues, 2) Process – linking of work processes and information exchange, 3) Knowledge - IT-enabled knowledge sharing and cooperation among employees from different organizations, 4) Value – combining processes and knowledge sharing to create value by changing practice, and 5) Goal – Ensuring that no conflicting goals exist between the cooperating organizations. The framework is to be used as guidance for research as well as for organizations to be to be able to assess which level they are on and systematically plan development, as organizations reach higher interoperability levels over time. Gottschalk argues that the highest theoretical level of interoperability is not necessarily the most suitable for an organization, as transaction costs might be unnecessarily high if working to achieve a not needed level of interoperability. Gottschalk also argues that further research on variables to be included in the model, and suggests looking into the role of management, legal issues, organizational culture and benefits, as well as the role of technology at each stage [19]. Hence these five aspects are included in order to highlight different kinds of issues. The value drivers from the eGep model represent the perceived benefits.

3 Method

As the purpose of the study was to get a deepened understanding of EA implementation, an interpretative case study approach was suitable [20]. Interviews were chosen as the main method for data collection as the involved organizations in the case study are heterogeneous, hence flexibility and scoping was needed [21]. The data material consists of 21semi-structured interviews. The interviews were divided into two main parts; national actors and regional actors and were performed between August and December 2010. The first four interviewees were selected as they are key actors in the national level work with the EA for the healthcare sector, representing the major organizations involved in the EA-program; One project leader of a key-project, the head of the national Municipal Coordination Group (MCG), the head of the overall organization of eHealth work and one member of the architecture group in Center for eHealth in Sweden (CeHiS).These interviews were performed to gain a deeper understanding of the plans for implementation, getting access to informants at

the regional level, and refining the interview guide for the forthcoming interviews. Interviewees for the second stage were selected by recommendations from the national level actors. These were nine municipality coordinators (members of the MCG) and eight County Council actors. Their roles varied and the set included IT-professionals as well as CIOs. One of the County Council actors was also employed by the national architecture group. These interviews focused on how different actors worked with the strategy on a regional level, perceived benefits, issues and enablers as well as perceptions of future work with interoperability in healthcare.

All interviews were analyzed by identifying relevant statements concerning perceived benefits of interoperability or issues in coordination. Statements concerning similar issues or benefits were grouped into themes and placed in a matrix (Table 1 in the results section). The seven benefits and issues (found on the y-axis) are; The three values from the eGep model (Political-, Constituency- and Financial & Organizational benefits), which correspond to Gottschalk's suggestion to include benefits. The four issues are Gottschalks other suggested variables (found on the x-axis); Management issues, Organizational culture issues, Legal issues and Technology issues.

An example showing how analysis was done: One municipal coordinator stated that "the central project has decided that we shall use a specific type of eCards which are to be used for healthcare, but it is not suitable for us as we deal with more than just healthcare...". This was categorized as a relating to the computer level (concerning technology) and being a management issue of mapping out which architectural requirements and prerequisites that exist in the involved organizations.

When all themes had been mapped into the matrix an overview of the perceived benefits and issues in the case had been created. These were then analyzed in relation to each other, in order to determine which themes that were related. This led to the themes from the various levels of the model being integrated into three overall themes; Unclear structures and roles for decision-making concerning IT, Ambiguities concerning legal foundations and jurisdictions, and Problems and enablers with following a set path. These overall themes are used to discuss the findings in context, as the perceived benefits and issues reach across several levels of interoperability

4 Case Description - eHealth in Sweden

Swedish healthcare is distributed among several care providers. The 290 municipalities are responsible for social services and home care, but also for a vast amount of other services such as schools and waste disposal. Healthcare thus has limited resources and focus. The 20 County Councils are responsible for hospitals and medical care, and almost exclusively focus on healthcare. Healthcare is also handled by private care providers although to a lesser extent.

In 2006 the National strategy for eHealth was released, setting the ground for an EA program. The strategy aims to improve healthcare by means of interoperability, which is seen as a prerequisite for other quality drivers such as allowing patients a choice of provider and efficiency by allowing different providers to be able to hook up on standardized systems. The strategy initially focused on IT and hospital care, as it was mainly driven by an interest group for county councils. In 2010 a new Strategy was released, where the social services care (a municipal responsibility) was also included. A predominant change was also that the focus had now been turned towards

practice and benefits rather than IT. Since the launch of the initial strategy municipalities have taken a more active position in the program. The program is however funded by county councils and thus municipalities are included to a lesser extent in the development. Neither have all municipalities accepted the strategy, which all county councils have. Under the organization CeHiS there is the previously mentioned MCG which serves as a forum for representatives for all regions (of 10-40 municipalities) to come together and give CeHiS insight into municipal perspective, as well as bringing knowledge of the national situation back to the municipalities, in order to strive for a more holistic view of the entire program. Henceforth the reader should keep in mind that program refers to the EA program while project refers to smaller parts of it.

5 Results

In this section the results are analyzed using the matrix (Table 1) in order to highlight the perceived benefits and issues in achieving these in the implementation of the program. The overall themes (T1, T2 and T3) concern several interoperability levels as well as different types of benefits and issues, and are plotted out in Table 1. Theme 2 covers most of the benefits, while the other themes focus more on issues.

Table 1. The three themes of interoperability benefits and issues plotted out

	Computer	Process	Knowledge	Value creation	Goal
Political benefits					T2
Constituency benefits		T2	T2		T2
Financial & Organizational benefits	T3	T2	T2	T3	T1, T3
Management issues	T1, T2, T3			T2	T2, T3
Organizational culture issues	T1				T1, T3
Legal issues	T2	T2		T2	T2
Technical issues	T1,T3				T1, T3

5.1 Theme 1 – Unclear Structures and Roles for IT Decision-Making

The central issue in this theme concerns where decision making for IT-projects should take place. In the interviews three central questions were raised concerning municipal decision-making; mass, mandate and lack of IT-competence. First, as there are 290 municipalities it is not possible to "sit down in a room together" on a national level. This is also an issue raised by several actors on a regional level, as 10-40 municipalities are also hard to get together. Hence, it is problematic to *establish forums for discussion* (a computer level management issue), which is dealt with in different ways in different regions. Some regions have joint steering groups with municipal representatives and county council representatives where they discuss eHealth issues together, however not necessarily making decisions. Other regions have more informal cooperation, mainly focusing on informing each other on what is

going on. In these regions the issues are treated in different groupings with unclear boundaries regarding which issues that are treated where. In these situations the regional municipality coordinator has the task of trying to keep different groupings up to date as well as being informed about what is going on in these. This is experienced as a hard task due to lack of formalized structure for discussions on eHealth issues.

Concerning mandate there are issues regarding how decisions can be taken as well as who has the responsibility to take them. In some steering groups there are municipal representatives with the mandate to make decisions concerning eHealth for the region, by being appointed by other municipalities to do so. More often however the discussions in different groupings can only result in suggestions to the municipalities, leaving them with the option to just say no to decisions that does not suit them. This is raised by several actors. One states that it is about "finding a suitable level of cooperation", not making it too risky or costly for smaller municipalities to accept recommendations. Some of the county council and municipal actors note that decision-making in municipalities tend to be slow and has to run through different levels in order to be approved. Some argue that the slowness is partly due to a lack of IT-competence, especially in smaller municipalities.

Lack of competence on IT (a computer level organizational culture issue) might also result in ambiguities concerning decision-making as *IT-projects are traditionally perceived as belonging to IT-departments* (a goal level organizational culture issue). Often, municipal politicians do not want to take responsibility for issues concerning what they perceive to be an IT-project, arguing that it belongs to the civil servants in the IT-departments and social services. The problem is that in several of the municipalities it is not clear who should make a decision concerning eCards or *who has the competence to deal with requirements for the municipality as a whole* and not just for healthcare or by the IT-department (a computer level management issue). From several municipal coordinators' perspective decisions on technologies to procure should be taken with regards to the full responsibilities that municipalities have outside of healthcare, which in their perception needs clearer structures and political support. This conflict concerns *the perceived purpose of establishing an IT-infrastructure* (a goal level technology issue) which is connected to a financial benefit on the goal level, concerning *reduced costs for sharing IT-infrastructure*.

5.2 Theme 2 – Ambiguities Concerning Legal Foundations and Jurisdictions

The central issue of this theme concerns uncertainties of what was legal to do, and who actually had a say in this. One perceived benefit of working with interoperability is that patient safety will be improved (a value-level constituency benefit) by being able to access relevant information about patients who give their consent. A new law (the Patient Data Act) was introduced in 2008 in order to allow information sharing. However, at a later stage obstacles to this appeared. The (Swedish) Data Inspection Board (DIB) criticized how the law was put in practice as they argued that, during a test run of a key-project, the procedures to ensure patient privacy had not been sufficiently considered, with specific regards to patients who due to mental impairments could not give or deny consent. It was argued that there was no legal ground for medical staff to take part of information regarding these patients as it would be a breach of integrity. Thus, several actors perceive that a central value creation of using eHealth applications was inhibited for a large patient group as the

constituency benefits of *faster information provision* and *more reliable information* (on the process and knowledge level respectively, which also concerns financial benefits on the same levels) were lost due to legal obstacles. Hence, the overall perceived political benefit of *patient participation* (on the goal level) contained a conflict regarding the legal issues of *ensuring data privacy* and *ensuring patient safety* (which concern the process and value level respectively). As an effect of the unexpected interpretation of the law the DIB established itself as a central actor concerning interpretation of laws. In 2010 the DIB urged all organizations implementing the program to be cautious regarding privacy. In several interviews this statement was raised as a central concern for projects under the program, as the DIB does not provide legal advice beforehand. Hence, organizations wanting to implement new projects for which there is no template (such as several projects under the program) are told that they should implement and then the DIB will assess whether or not it lives up to legal requirements. This is experienced as an issue of *assuring legal foundations for decision-making* (on a computer level) as to avoid forcing local organizations to take high risk decisions.

Being able to do what is best for the patient is expressed as the central constituency benefits (on a goal level) in striving for interoperability. While the Patient Data Act opened up for the county councils sending patient information to municipalities it is not yet legal for municipalities to send such information to the county councils. Hence the program has started to implement an agenda which has *requirements that go outside the programs jurisdiction to change* (a goal level management issue). Some actors express a concern that it is "not even legal yet" to share information from municipality to county council. Others emphasize that although it is not yet legal laws will "probably be changed". Essentially these different beliefs are about *discussing what is thought to be achievable* (a value creation level management issue). Some actors argue that as the Patient Data Act has replaced the earlier law it might be possible to change other laws as well in order for the program to function as planned. However, due to the unexpected turn of events with the Patient Data Act, other actors remain skeptical to the possibility of changing other laws. This is a legal issue concerning a conflict between either *enabling cross-organizational data sharing by changing laws* or *adapting the program to existing laws* (both on the computer level).

Several of the actors raised issues concerning laws and procurement. The central point is that there is a lack of directives on how to handle joint procurement of services as well as whether different regional organizations could provide services to each other without having to go through a full procurement process. In several regions it was intended that the county councils, being more technically developed, would provide eCards to the municipalities. It was however unclear whether they could do this or not. These uncertainties concerning legal foundations of how to go about implementation costs a lot of time and effort in the regions. This is a problem as several municipalities do not have funding to set up the administrative apparatus for the technological solutions (such as eCards and staff registries) on their own. Thus, several municipalities wish to buy these services from the county council, although are not sure whether they are allowed to do this which is experienced as a legal issue concerning *barriers to cooperation in procurement* (on the computer level) and a *lack of national coordination* (a computer level management issue). Several actors experience problems concerning which authority they should listen to and wish for

greater coordination from a national level, with clearer guidelines to act upon. This is because different authorities might give contradictory statements. One municipal coordinator states that "we get different directives from different directions". For instance it is not clear to the regions under which authorities' jurisdiction certain questions lie, such as how procurement is allowed to be performed. Hence several actors highlighted the *need to resolve high-level differences in interpretations of laws* (a goal level legal issue). Similarly there is a perceived need to clarify the requirements for technologies in the program. Several actors empathize the perceived *need for clear directives* (a management issue on the computer level). CeHiS is currently trying to establish itself as a central actor in the Swedish eGovernment setting, which is experienced as problematic by CeHiS as well as among the regional actors. It is clearly problematic to negotiate with the multitude of other authorities that has a say in Swedish eGovernment and has different perceptions and interpretations, for instance regarding laws. Another example is that there are different opinions concerning standards for eCards, as some argue for the use of digital ID-cards that are handled by banks, while the eGovernment delegation argues for use of more open standards, allowing multiple solutions. This is experienced as problematic in relation to the specific standard for eCards that is already procured for eHealth, which is currently being implemented in several regions.

5.3 Theme 3 – Problems and Enablers with Following a Set Path

The central issue in this theme concerns difficulties with new perspectives emerging in the program. As municipalities only recently have started to be involved in the project on a national level and a central issue relates to *differing mission scopes of the organizations* (a goal level organizational culture issue). Since the initial strategy was mainly driven from a county council perspective the program is now faced with challenges of meeting up with municipal needs. For instance, staff registers and eCards have already been procured and planned into the program, and it thus becomes problematic that some municipalities are skeptical to whether these technologies are suitable for them. While some municipalities follow the lead of the county councils (as suggested by CeHis), others are skeptical towards adopting these technologies. Relating to the regional decision-making several municipalities perceive the eCards as a great challenge as it incorporates a strategic decision that goes outside of eHealth as it *involves wider architectural prerequisites for procurement* (a technology issue on the computer level). From their perspective the choice of eCards for municipalities should be useable for all sectors (such as for staff in schools). This is connected to that several of the municipalities perceive that *working with interoperability in eHealth can act as leverage to interoperability for other sectors as well* which conflicts with other actors perceptions of this (which is both a technology and a management issue on the goal level, as it concerns IT-infrastructure and implementation strategy).

As specific eCards and other technologies planned to be used in eHealth might not meet demands from other municipal sectors the skeptical municipalities are put in a problematic situation. Choosing this eCard might, in their perception, cause eHealth to work as a stovepipe as other practices or communication with other authorities, might not be able to use the same eCards as a means for login and identification. This is perceived as a problem for two main reasons; *practicality* and *cost* (which is

financial & organizational benefits on the value-creation level as well as on a goal level, concerning efficient use of tax-money). One ideal picture raised by some actors is that healthcare should avoid creating yet another system to log in to, but instead strive for single-sign-on. This is also the purpose of the specific eCard for eHealth, although some municipalities do not perceive that this would allow for single-sign-on for municipal users as they will have to communicate with other organizations then the county councils. It is seen as potentially risky and costly due to differing requirements from other authorities. These requirements are not experienced as technically compatible with the eCards for healthcare, which makes some municipalities hesitant towards adopting these solutions. Other municipalities do perceive the eCard as suitable for other municipal sectors as well, and has thus chosen to implement it, although still potentially requiring other cards for communication with other organizations. Another aspect in this is that several county councils and municipalities perceive the specific eCard as a requirement in the program, while others do not, which relates to the issue of *which authority that has the mandate in this question* (a goal level management issue). Several actors refer to the eGovernment delegations' statements concerning more open standards for eCards and eID, and are thus not willing to implement the specific eCards. The example of eCards is also a symbol for a wider criticism that municipalities prerequisites and requirements has not been sufficiently taken into consideration in the strategy. This issue is also experienced at a national level and concerns ambiguities of what the financial and organizational benefit of *better infrastructure* (on the computer level) means.

Some of the projects planned to make up the technical infrastructure for eHealth, such as a the specific types of eCards, one of the architects at CeHiS argue, are not in line with what is now considered to be needed for a proper architecture. This is partly due to that municipal needs have not been fully considered. However it is not considered feasible to change the rules during an ongoing game. The architectural group was created after the strategy was designed, and architectural demands are currently being outlined. This is hence done after several technologies have already been procured, started being implemented and are considered to be central to eHealth by several actors. The other architect interviewed (who was also employed by a county council) argues that several issues experienced at a regional level concerning differing architectural preconditions and needs cannot be treated in work on a national level. He states that "The problems experienced in my region are wider then what I am assigned to work with on a national level. [...] Locally we cooperate with municipalities while it is not a part of my assignment nationally". This is because the architectural unit at CeHiS is employed to work from a county council perspective, and not for municipalities. The overall perceived problem is about the *inability to adapt to newly discovered architectural prerequisites and needs* (a computer level management issue). At the time of writing CeHiS is in dialogue with other authorities, as well as internally, concerning standards and alternatives for infrastructure.

6 Conclusions

In this paper the question raised was how differing interpretations of interoperability benefits affect the coordination in the early stages public sector EA implementation.

An eGov maturity model was used as the theoretical framework, which clarified how several levels interact. The findings are summarized in four conclusions;

1. In local and regional EA implementation, interpretations of the purpose and scope of a program, and what implications it might have on other parts of eGovernment, can differ. This can lead to ambiguities concerning where decisions should be taken, making coordination hard. EA programs do not only need to acknowledge organizational issues as well as IT, but also needs to highlight the relation to programs in other parts of the public sector, which might overlap.
2. Conflicts are intrinsic to eGovernment programs and relations between national authorities need to be taken into consideration, as unclear jurisdictions might cause confusion among local and regional actors. Hence, being up-front about conflicts, and opening up for discussions on how to deal with them, is vital for coordination.
3. If new organizations get involved in a program, differing goals of implementing a program influence the requirements on IT-infrastructure. Hence, EA programs need to maintain enough flexibility so as to be able to adapt.
4. Using maturity models which perceives development of interoperability as sequential creates an over-simplified picture of implementation. This delimits scientific usefulness, as different "levels" do not follow sequentially. Instead a re-conceptualization of maturity models should be discussed. These models have also been criticized by others for being deterministic and simplified [22], which is strengthened by the findings in this paper, as each "stages" cannot be treated separately.

The paper contributes to previous research by providing a deepened understanding of how differing motivations and perceived purposes of interoperability makes alignment problematic. With this paper I hope to raise further discussions concerning these complexities. Further research can address eGovernment evolution with a longitudinal approach, as this case study only covers a limited period of time. Forthcoming research efforts can also elaborate on how to conceptualize eGovernment evolution in ways that incorporates complexity and ambiguities, and does not reduce evolution to something that is assumed to happen in a straight line or through specific stages.

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Integrity of Electronic Patient Records*

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Abstract. We discuss a reference model for security measures to preserve integrity of information. Unlike traditional approaches which focus on an defensive approach to preserving integrity, we also present offensive measures to stimulate integrity of information, by providing feedback from usage. The reference model is used to analyze the security measures proposed in the design of the Dutch national Electronic Patient Dossier (EPD), in particular the projected application for medication records. We conclude that much of the defensive measures were covered, but that some offensive measures are lacking, in particular measures related to trust. This may have harmed adoption.

Keywords: health care information systems, information security, integrity.

1 Introduction

Electronic Patient Records are information systems for storing and retrieving information about the medical treatment of a patient. In developing such systems, countries have come up with different solutions regarding the trade-offs between budget, usability, security and acceptance. This is far from easy [7]. Also in the Netherlands there has been much controversy surrounding the development of a national Electronic Patient Dossier (EPD). In April 2011 the Dutch First Chamber of Parliament voted against the obligatory use of the national EPD, ending a project that started in 2002 and cost about 300 million euro [27]. The main reasons for rejection were the continued controversy over the security of patient records, combined with the inability of the government to convince senators of the necessity of a system at this scale. It is expected that local EPD initiatives will continue to be developed, taking over parts of the national infrastructure

This controversy shows that information security is an important concern in the development of electronic patient records, because it relates to their acceptance by the public. Public opinion is mostly concerned about privacy: are the records well protected? Of the quality aspects of security (confidentiality, integrity and availability), confidentiality therefore receives most of the attention (e.g. [3],[2],[19]).

* The research in this paper was conducted as part of the graduate thesis project of Jan van der Jagt and Pieter Heijboer at the IT Auditing department of VU University, Amsterdam [12].

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Less is published about integrity of patient records: can the contents be relied upon? This is an omission, because information integrity is crucial for meeting the objectives of electronic patient records, namely to facilitate reliable exchange of information and thereby reduce the number of preventable medical errors [26]. Preventing medication errors will likely save lives and reduce health care spending [14]. Also in information security in general, there has been relatively little research on integrity, compared to confidentiality. This paper aims to address this omission.

We follow Boritz [4] and define integrity as representational faithfulness: does the information stored in a system correspond to reality? Integrity concerns both accuracy and completeness and therefore timeliness too, as well as validity with respect to regulations and procedures. Integrity is therefore closely related to the notion of reliability as used in accounting [15].

When security experts or auditors assess the security of an information system, they commonly test against a norm: the reference model. In this paper we report on our experiences in developing a reference model for assessing the integrity of electronic patient records [12]. Usually, reference models are developed on the basis of information security guidelines like ISO 27001, NIST 800-53 or COBIT 4.1. These guidelines do mention integrity, but we found them not specific enough. In particular, on the basis of Boritz's [4] characteristics, we selected all control objectives in the COBIT 4.1 guidelines which are relevant to integrity. We identified 48 of them [12]. However, it turned out that most of these control objectives address enabling conditions, such as base level security or auditability, but do not address integrity itself. This makes such control objectives impractical as a norm: difficult to test against. What is needed is an organizing principle to structure the reference model.

Guidelines for information security define information integrity as: "… guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity"[9]. This shows a rather defensive approach: once information is stored reliably it should be protected to keep it that way. The well known Clark and Wilson [8] model is an exponent of this view.

In this paper, we would like to argue that such a defensive view is necessary, but not sufficient. People are bound to make mistakes. Defensive measures do nothing to detect or correct errors once they have been made. Moreover, integrity may actually be served by transparency and openness. For example, the Wikipedia model of ensuring reliability of encyclopedia entries is based on openness and feedback. Therefore we propose to use offensive measures too, which aim to enhance integrity.

Summarizing, the research questions of the paper are as follows:

1. Can we develop a security reference model specifically addressing integrity, which includes measures to both maintain and improve information integrity?
2. Can the usefulness and adequacy of such a reference model be established in a case study, namely an infrastructure for exchanging electronic patient records?

The paper is structured as follows. We will first discuss the definitions (Section 2). Then we will develop a reference model containing both defensive and offensive measures (Section 3). We illustrate the usefulness and adequacy of the reference model by analyzing the security measures proposed in the design of the Dutch National Electronic Patient Dossier (EPD), focusing on medication data (Section 4).

2 Defining Integrity

What are the main characteristics of integrity? Accounting practice traditionally focuses on reliability, i.e. *correctness* (or accuracy): does the information correspond to reality, and *completeness:* are all relevant aspects of reality represented? [22][15]. These concerns have been taken over in information security. Thus the 'Code of Practice' regards integrity as "the property of safeguarding the accuracy and completeness of assets" [12]. Both correctness and completeness crucially depend on *timeliness*: failure to update when reality is changing leads to misrepresentation. Information is generated from raw data by processing steps like calculation, selection or aggregation. The more processing is needed, the harder it becomes to trace representational faithfulness. Therefore the *validity* of information, i.e. whether it has been generated according to authorized procedures, is crucial. Consider for example the exam results in a university administration. There is no reality outside university records, which is why there is an elaborate system of procedures for submitting exam results, and segregation of duties between lecturer, student and administration.

Maintaining absolute integrity is impossible. In consultation with stakeholders, tolerances must be set. For example, in a hospital, inaccuracy or incompleteness of medication data has more severe effects, than mistakes in the patient's name and address. A classification of the impact of errors leads to so called *integrity levels* [4]. A system should be designed in such a way that components with a lower integrity level cannot compromise high integrity components.

As we stated in the introduction, we distinguish two strategies. They can now be defined more precisely. The *defensive strategy* is aimed at keeping the current level of integrity. The *offensive strategy* aims to increase the current level of integrity.

3 Defensive Strategy

For any information system, the data definition and information structure should follow from the underlying semantics (meaning). The semantics determines which data types make sense, which data values are accepted, and specifies relational constraints between data entries (reconciliation). For example: a date of birth is always prior to the present date, or the total amount of travel expenses aggregated over projects must be equal the total amount of travel expenses aggregated over employees. Such conditions are called *integrity constraints*. Integrity constraints can be formalized and automatically maintained by a database management system [11]. Automated enforcement of integrity constraints requires that users may only access the data through the automated system. This principle of *encapsulation* prevents improper modification.

When an information system meets its integrity constraints, we say it is *internally consistent*. There are also constraints about the relation of the data with the external world. For instance, in a hospital there is a policy that no treatment may be started without first registering the patient's identification number. However, in this case, computer systems are unable to enforce that the number actually belongs to the patient (correctness), or that all actual treatments are being registered (completeness). When also such external demands are met, for instance by workflow procedures and verification, we obtain *external consistency* [22].

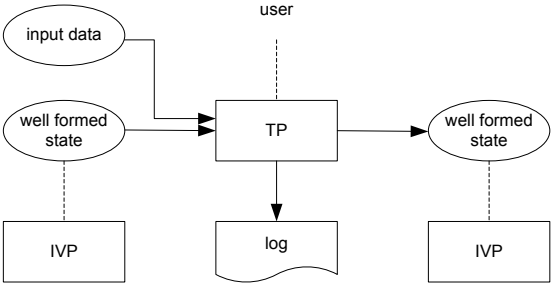

Fig. 1. Integrity policies according to Clark and Wilson [8]. Arrows depict information flow and dashed lines depict control.

The defensive strategy can be explained with reference to the influential model of Clark and Wilson [8]. An integrity policy consists of two kinds of procedures. An integrity verification procedure (IVP) verifies whether a data set is well formed, i.e., meets the applicable integrity constraints. A transformation procedure (TP) has two functions. First, for newly entered input data, it verifies whether the data meets the applicable integrity constraints. Second, for all transformations, it will guarantee that the data will remain well formed and integrity constraints are preserved (Figure 1).

The process is regulated by two kinds of rules: certification and enforcement rules. Certification is done by the user of the information: in practice the security officer, system owner or data owner. Enforcement is done automatically by the computer system (encapsulation). We follow the original numbering of the article, but for ease of explanation we use a different order of presentation.

(C1). IVPs are certified to verify the relevant *integrity constraints* for a given data set. If they do, the data set is called valid.
(C2). TPs are certified to be *valid*, i.e., each applicable TP must be shown to transform a valid data set into another valid data set. To this end, for all data sets a list of TPs which are certified for that data set is maintained.
(C5). TPs which deal with newly entered input data must make sure the data respect the relevant integrity constraints, or else reject the data.
(E1). The system enforces that users can't alter the data directly, but only through TPs which are certified to be valid for the relevant data set (*encapsulation*).

These rules can ensure internal consistency. To assure a certain level of external consistency, also the following control measures must be adopted by the organization.

(E2). The system maintains *authorization* tables to enforce that users can only carry out a TP on a data set for which they have been authorized.
(C3). Authorization tables are certified to conform to the principle of *segregation of duties*. The job descriptions, roles and the specification of the segregation of duties, which are used to generate the authorization tables, are validated beforehand and formally accepted by the responsible employee.
(C5'). Additional verification or reconciliation procedures are implemented to ensure external consistency when new data enter into the system, as part of C5.

These certification and enforcement rules only work under certain background assumptions about the audit environment, the computer system and the employees. Some of those assumptions are already made explicit by Clark and Wilson.

(E3). All users are uniquely *identified* and *authenticated* by the system.
(C4). All TPs must preserve an *audit trail* through logging.
(E4). The *maintenance* of the certification and enforcement rules themselves is subject to *segregation of duties*. In particular, only people authorized to certify TPs or IVPs may alter the list of data sets for which they are certified, and no person who is authorized to certify TPs may have executive rights for those TPs.

In subsequent research, more background assumptions have been added, see e.g. Adams et al [1]. We briefly list them here. (E5) Automated *DBMS facilities* should generate an audit trail and allow recovery of transformation procedures. (C6) *Change management* procedures (as in ITIL) should make sure that all changes to a computer system have been certified, and the risks addressed. (C7) Basic *security measures* like hardening are required. (C8) *Data definitions* must be *maintained* by the data owner. (C9) Integrity of data from an *external party* must be *validated* before being accepted. (C10) A person must be made *responsible* for data quality [9]. (E6) The system makes sure that an employee who is *authorized* by another employee, may only execute TPs on data sets for which the second employee is also authorized. (C11) A system should be *available* for authorized employees, when needed. This avoids a 'shadow registrations'. (C12) *Back-up* and *recovery* measures must ensure that after a calamity the system can be restored.

4 Offensive Strategy

Human errors are unavoidable. An error is defined as a situation in which a planned sequence of activities does not produce the intended result, where this failure cannot be attributed to external influence [21; p 9]. There are two types of errors. The first type is misunderstanding, resulting in the sequence of activities not being executed according to plan. The second type displays a wrong understanding, resulting in the creation of a plan which is incapable of achieving the intended results [21; p 17]. Both types of error undermine the defensive strategy. For instance, errors of the first type may lead to incorrect execution of procedures. Errors of the second type lead to incorrect specification of TPs. The defensive framework cannot prevent users from omitting data, or registering data which are not externally consistent. This also applies to the data needed to preserve the framework itself, such as authorization tables.

Generally, there are three ways in which humans address errors [21; p 148]. First, by exercising *self control*, such as the correction of typing mistakes (subconscious), or checking whether the right document is attached to an email (conscious). Second, by signals from the *environment* before the error has been made. We distinguish warnings from blocking functions. Blocking functions force one to perform in the right way. For instance, the wrong key won't open the door. Warnings only guarantee detection. A timely warning may allow for a recovery before any great harm is done. Third, by feedback from *another person*. Consider the 'four-eyes' verification procedure, in which

a colleague verifies some task before it is finalized. For instance, in pharmacies, a colleague must routinely verify whether the medication matches the prescription, before it is handed to the patient.

We have taken recommendations from the literature on information quality, such as Boritz [4; p 81-85] and English [9; p 337-339]: awareness, trust, simplicity, proactive measures and automated support tools. They will now be explained in full.

Awareness. Security policies should address integrity of data and rewarding schemes.

A1. Participants should understand what is meant by integrity, its impact on the organization, and how they can improve it (awareness). (Boritz 2004; p86).
A2. The primary recording of data should be given more status, reflected in rewards. Rewards to stimulate efficiency may negatively affect quality (Boritz 2004;p 80).

Trust and feedback. Many enterprises are nowadays organized as chains or networks of relatively independent organizations which need to cooperate. Business processes cut across these organizational boundaries, so they require frequent exchange of information. This requires trust. Trust is needed for cooperation [16]. Cooperation in turn implies that people are using each others' data, and help each other to correct or improve its quality. It is well known that feedback generated by actual usage is crucial for maintaining data quality [20].

In organizations, trust and feedback can be influenced, for instance as follows:

T1. Resolve borderline disputes and organizational barriers between departments, for instance by frequent meetings about interoperability issues [4; p 86].
T2. When specifying integrity constraints, take all known information needs into account, also those from beyond the own organization (English 1996; p 44). This avoids organizations setting up 'shadow administrations', which do not align.
T3. Initiate frequent meetings in which all stakeholders discuss data definitions, and the required integrity level. This promotes mutual trust in the information.
T4. Allow employees to participate in the design of systems and processes, to make systems easier to use and thereby make it easier to record data reliably.
T5. Stimulate feedback of employees on the actual usage of the information based on the data they have recorded [20].

Trust provides a basis for cooperation and thereby for improved integrity. However, there is also a risk of too much confidence. In our experience, people may accept poor quality data just to avoid conflicts. A healthy balance between trust and skepticism regarding the quality of data of other parties, will improve integrity of information.

Simplicity. Business process reengineering may contribute to the improvement of integrity. A simpler process will reduce the chance of making an error and will make it easier to correct detected errors. A process can be simplified by reducing the number of steps or by reducing the number of people involved.

S1. Stimulate that data are actually being used: "Use it or lose it!" [20]. Data which are not being used will not get feedback needed to improve accuracy.
S2. Record original data in one unique location, as close to the source as possible. Avoiding intermediate processing will avoid new errors [9; p 58].
S3. Deliver information immediately to the end-user from the system itself, to avoid information getting lost or being manipulated in between by others.

S4. Make sure that procedures and agreements regarding integrity are accessible and available. Make sure users can review the data definitions of the data they use.

Proactive measures. Maintaining integrity also requires proactive efforts to verify and correct errors.

P1. Make sure all entered or modified data is being verified. The lack of an explicit control in a routine procedure is a common cause of errors [21;p 59]. Verification can be achieved by the so called four-eyes principle, or by a party with an 'opposed interest': e.g. the client verifying the quality of a service, before paying. Controls must be integrated in the workflow.
P2. Instruct employees to take each contact with a customer or end-user as an opportunity to verify data. A time-stamp of the latest modification is crucial.
P3. Make sure that standards and agreements about data definitions are obeyed. Data pollution caused by not following standards is hard to clean up.
P4. Repeatedly verify whether routines, procedures, protocols or controls aiming to stimulate integrity are still effective.
P5. Carefully analyze all integrity related complaints, so root causes can be traced.
P6. Actively search for errors and defects on a regular basis. Use data mining and data analysis tools and knowledge of the semantics (reconciliation), to detect irregularities and patterns of usage which deviate from what is to be expected.

Information System Support. Information systems themselves can also play a role in the offensive strategy, by supporting users to follow procedures.

I1. Introduce additional records to a data collection to be able to determine integrity and repair data when needed. Examples are serial numbers, time stamps of the latest update, or the name of person who made the latest update.
I2. Introduce functionality to support users in assessing the current level of integrity. Examples are control totals, intuitively designed forms, or the use of colors to distinguish different risk categories. For example, in a pharmacy prescriptions for 'dangerous' drugs can be printed on pink rather than white paper.
I3. Implement opportunities for eliciting feedback in the information system, in order to relay errors to the source, and allow corrections to be made.
I4. Implement warnings or signals about the current status of the integrity into the information system.
I5. Record source documents (e.g. paper medicine prescriptions) electronically and make them available when access is necessary for validation.

These measures can be implemented in a Workflow Management System (WfMS).

In addition, there are many best practices regarding information systems management, such as incident management and problem management (ITIL).

I6. Set up the complaints department or the helpdesk in such a way that it gives insight in common causes of integrity related incidents (incident management).
I7. Set up technical departments in such a way that they analyze common underlying root causes of incidents, and give systematic solutions (problem management).

This concludes our overview of the measures to maintain and improve integrity. These measures can be used as a reference model in an information security assessment, focusing on integrity. In our case study we discuss one such audit.

5 Case Study: Dutch National Electronic Patient Dossier

In this section we discuss the information integrity measures proposed in the design of the Dutch national Electronic Patient Dossier (EPD), focusing specifically on the application for exchanging medication data, the Electronic Medication Dossier (EMD). Although the national EPD has been rejected by parliament, its design does remain a representative instance of a system for electronic patient records.

The purpose of this initial case study is to test the usefulness and adequacy of the reference model for assessing security measures specifically focusing on integrity, in particular the distinction between defensive and offensive measures. Proper validation would involve many more case studies, also in other domains, and should contain comparisons with other security reference models.

5.1 Research Approach

Data for the case study were collected by means of semi-structured interviews with representatives of the major stakeholders to analyze the decision making process around the Dutch national EPD, focusing on integrity aspects. We spoke with representatives of several patient organizations, physicians, pharmacies, project managers, health informatics experts and software providers. In addition, we studied the proposed architecture and security measures by means of publicly accessible data. On the basis of this we made an overview of the security measures taken or proposed in the infrastructure design. These security measures were compared with those suggested by the reference model, and compared with the concerns raised by stakeholders in the interviews. The results were validated with two security experts.

5.2 Case Description

The Dutch national EDP is being developed by NICTIZ, a subsidiary of the Dutch Ministry of Health. An *electronic patient dossier* (EPD) is defined in the context of this project as a collection of electronic data related to the medical treatment of a patient. An EPD is maintained by care providers for the benefit of other care providers. It differs from a Personal Health Record (PHR), which is maintained by the patient. The Dutch national EPD has two functionalities: (1) data exchange and communication between care providers related to the current joint treatment of a patient, and (2) retrieving historical patient data, recorded as a result of other current and prior treatments, to improve the current treatment of a patient .

This means that the Dutch national EPD is not unique. Many kinds of EPDs are already being used at local level, by general practitioners, pharmacies and in hospitals. The national solution was supposed to improve upon these local initiatives, because of improved scope, security, and privacy protection. Note however that these advantages are related to security, not usability or content. Content must be provided by the health professionals themselves. The main characteristics of the EPD are:

– *Virtual Dossier.* All patient data remain stored in the original source systems. At a central level only a reference index is being developed, which allows access to particular patient data upon request. The EPD only provides a virtual dossier.

- *Closed Network*. Access to the EPD is only possible through a closed network, the so called AORTA (see below). All messages are being encrypted and communication over the network takes place according the HL7 standard.
- *Identification and authentication*. Each care practitioner needs a special identification pass to log onto AORTA. This pass contains encryption keys for authentication and secure message exchange.
- *Unique patient identification*. Patient's records must be stored under the patient's unique citizen service number (BSN), which allows data about from different sources to be identified, and combined.

In principle, a national infrastructure set up along these lines could host several EPD services. Even at the end of the project, only two of those services were operational: the medication dossier, and the dossier for transfer of records among general practitioners, for instance after a stand-in or weekend service. In this paper we focus on the medication dossier.

The network infrastructure for information exchange between care providers is called AORTA. Each health care provider (general practitioner, pharmacy, hospital) can connect through the so called National Switchboard (LSP), mediated by so called Healthcare Information Brokers. A requirement is that the existing system has been classified as a "well maintained healthcare system" (GBZ). Connection of a well-maintained healthcare system to the national infrastructure is realized through data communication networks maintained by certified Healthcare-related Service Providers (ZSP). Hospitals typically provide their own ICT services.

Previous attempts to link medical data lacked a unique way of identifying patients. The existing social security number was 'upgraded' to citizen service number (BSN) and is now used as identification throughout the healthcare sector. The number appears on passports and identity cards, to allow authentication. The wide usage of the BSN greatly enhances integrity of the EPD: making a correct link between the patient and his or her dossier (external consistency) has become a lot easier.

Within each electronic patient dossier, NICTIZ distinguishes the following types of data, each with different requirements concerning privacy and storage period: personal data (name, address, residence), logistic data (appointments, reservations), medical data (diagnoses, lab results, x-ray images, medication), financial data (insurance, invoices) [17]. Clearly, these categories require different integrity levels.

The crucial data structure of the EPD is the *reference index.* This index keeps track of which data records about a patient are available at which source. The reference index is maintained through four basic functions: entering new data, modifying data, requesting data and protecting data. Protected data will not be exchanged over the national infrastructure. Data can be protected when a care practitioner has decided to not (yet) provide access on the basis of his or her professional secrecy, or when the patient has indicated that he does not want data to be published, for privacy reasons. Here we see the contradictory demands of integrity and confidentiality, because this feature will harm completeness of records, and hence integrity.

5.3 Application: Electronic Medication Records

We focus on the electronic medication dossier (EMD). The functionality of this dossier is to support the medication therapy process, in particular for care outside of

the hospital, shown in Figure 2. The process consists of five steps which are typically performed in a loop, until the patient has recovered. Note that although the physician is in charge and coordinates the process, all consecutive steps are performed by different actors. This may lead to problems of transfer of information and distribution of responsibilities. Only the patient is a constant factor in the process. This means that when the patient is less alert, communication problems may arise.

The first three steps involve a verification of medication safety; these steps could benefit from an EMD to reduce preventable errors. For instance, when a physician has an overview of all the drugs recently taken by a patient, she may be able to detect possibly harmful combinations. The system could also provide a warning in case of dangerous combinations, or in case of a dosage which differs from common usage. Similarly, the pharmacy could use a system like this to warn patients for medication interference, or simply refuse to provide the drugs in case of danger. As a matter of fact such warnings are already given on the basis of the local pharmacy sales data.

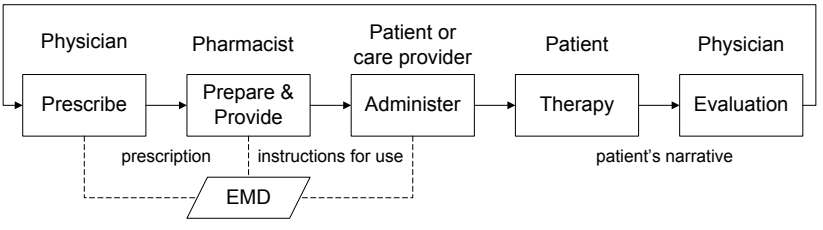

Fig. 2. Medication Therapy Process, with potential benefit of an EMD indicated

The main rationale behind the EMD functionality is a finding of the HARM study [14], which states that out of a total of 41.000 medication-related hospital admissions each year in the Netherlands, that is about 2.4 % of all admissions, about 19.000 are preventable. The objective of the EMD is to reduce the number of such medication related incidents. The study also identified three specific risk areas: (i) Elderly patients are more likely to face medication safety problems. (ii) Some particular types of medicine have an increased likelihood of problems. (iii) Therapy loyalty, the condition of the patient and cognition are important factors.

To deal with these risk areas, a full scale national EMD may not be necessary. Other more targeted measures may be just as effective. For example, for elderly patients a physician in the role of so called care orchestrator could help to make transfers between care providers more smoothly. In fact many medication errors are related to the transition of hospital to home. However, hospitals and hospital pharmacies are not involved in the current phase of the project. For those people using the specific risky types of medicine, a paper or plastic EMD with RFID carried by the patient him or herself may be more effective. Finally, therapy loyalty and the conditions of the patient remain the responsibility of patient and physician anyway.

The medication safety functionality of the EMD was not ready at the time of the research. Despite the efforts the developers, there will always be limitations to automated medication safety verification. We list a few. First, there are fundamental technical difficulties with aligning brand names with the chemicals actually provided.

A similar problem relates to communication of dosage. Currently there is no standard naming or dosing convention. Second, there are reasons the EMD may never be completely accurate or remain incomplete. Prescription and actual usage of a medication by the patient may not align, for example because the patient does not know how to administer the medicine well. The patient might have used medication which is available without prescription. Relevant data such as lab results are not provided. And finally, the medication history may be incomplete, because some EMD sources may have been temporarily unavailable, or the patient could have used his right to protect his data. For these reasons, an EMD could at best only support medication safety verification by a human (physician at prescription; pharmacist at provision; nurse or patient at administering) who must be trained to work with possible incomplete data.

5.4 Interview Results

Interviews with stakeholders revealed that there are diverging views on the EMD. Pharmacists generally welcome the initiative. Patient organizations do welcome the idea, but have doubts about protection of privacy. General practitioners generally do not trust the system, and are reluctant to use it. The main concern is that they have no control over the accuracy and completeness of the data being entered at another source. Part of this results from their training. Doctors are trained to trust only what they see in front of them. Doctors often do use local EMD initiatives, in which they are in a position to know the other participants (physicians, pharmacists), which would allow them to telephone and ask for clarification, when needed.

5.5 Testing against the Reference Model

The previous description highlights the design principles and main security measures proposed in the design of the national EPD. In a larger study, resembling an audit of the set-up of the security measures, these design principles were compared against the reference model. For details we refer to Van der Jagt and Heijboer [12].

Summarizing the outcomes, we could say that the Dutch National EPD does satisfy most of the defensive measures to preserve integrity. See also Van 't Noordende [19] who made a survey of the security measures. In particular we mention:

- the certification of information systems of care providers, before being allowed on the AORTA infrastructure. This is an example of authorization (E2),
- the obligatory use of a citizen service number for unique identification of patient and record. This measure helps to ensure external consistency (C5') ,
- personal identification for care practitioners (E3) to enforce authorizations (E3).

However, regarding the offensive measures, it appears the project has not done enough. Some user groups, in particular general practitioners, generally do not trust the reliability of the data in the system and are reluctant to use it (T3-T5). One reason is the limited functionality (S1). Moreover, electronic patient records will by nature always be incomplete and inaccurate, because patients do not always take the medicine being prescribed in the dosage being described. Physicians must therefore verify medication usage with their patients, reducing usability of the system (T2).

Another important issue is trust in the procedures of other care providers, to ensure reliability of data (T1). One of the reasons is that a natural feedback-loop concerning potential errors, as would exist in a local situation by telephone, is absent (T5). Moreover, due to privacy concerns, doctors or patients can block publication of some records. It is impossible to see that some data is missing. This harms the known completeness of data, and therefore the usefulness in practice (T2).

5.6 Usefulness and Adequacy of the Reference Model

A measurement instrument such as a reference model, is useful and adequate, when its distinctions help to bring out and explain aspects of a case which are also deemed relevant by stakeholders. Our interviews showed that stakeholders, in particular general practitioners, were concerned with trust and usability of the system. The reference model, especially the chapter on trust, did reveal these doubts as potential weaknesses of the design. Similar worries also motivated the rejection in parliament.

Concerning the distinction between defensive and offensive measures, we found that the defensive measures were relatively easy to assess, being specific and easily identifiable in the design specifications. The offensive measures were harder to locate. They are more about a design philosophy. This is in line with findings about assessing soft controls and organizational culture in the context of a security assessment [25].

6 Conclusions

Integrity of information is crucial, in particular in healthcare. In this paper we have developed an information security reference model specifically for integrity, and applied it to electronic patient records. We addressed two research questions.

1. Can we develop a security reference model specifically addressing integrity, which includes measures to both maintain and improve information integrity?
2. Can the usefulness and adequacy of such a reference model be established in a case study, namely an infrastructure for exchanging electronic patient records?

With regard to question (1), we have indeed developed a reference model, centering around the distinction between defensive measures, to preserve a given integrity level, and what we have called offensive measures, to create an environment and stimulate behavior which will increase the given integrity level.

We argue that defensive measures are necessary, but not sufficient. Humans are bound to make mistakes. Therefore one needs systematic ways of detecting and correcting errors. Feedback from the user will increase trust that errors will not go unnoticed. Especially in modern networked information systems, an important aspect of trust are the measures to ensure the integrity of data obtained from others.

With regard to question (2), our case study of the Dutch national EPD shows that most of the defensive measures have been covered in the design of the infrastructure. However, interviews show that key users do not trust the integrity of the data provided by the system, because they have no control over the provenance. They prefer local EPD initiatives in which they know participants and can trust their work. The case also highlights the trade-off between confidentiality and integrity: measures to withhold data for privacy reasons will harm completeness and reduce integrity.

This illustrates that the reference model, as developed by Van der Jagt and Heijboer [12], is useful and adequate for assessing integrity of patient records. Useful, because relevant stakeholder doubts about the design of the EPD were indeed brought out by the model (trust, provenance). As a matter of fact, these may have contributed to rejection of the national EPD by parliament, in addition to worries about privacy of patient records. Adequate, because the concepts in the model capture distinct aspects of reality. This is in particular true for the defensive measures concerning identification and authentication, but also for the offensive principle to capture data as close to the source as possible (S2), a key design feature of the EPD.

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Impose with Leeway: Combining an Engineering and Learning Approach in the Management of Public-Private Collaboration

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Abstract. The ongoing financial crisis is forcing governments to consider leaner (less resource intensive) forms of public service delivery. This is a difficult process, especially since recent private sector scandals demand that governments become more vigilant. Public-private collaboration (PPC) needs to address this 'lean yet vigilant' challenge. However, PPCs have proven to take a long time to establish and bring to fruition. Hurdles that delay the achievement of goals include the need to agree on standards in an environment with heterogeneous interests, changing laws and unclear revenue models. While literature on managing PPC hints towards the need for both compulsory measures (plan-driven, restrictive) and adaptive measures (learning-driven, leeway), case studies illustrating how these measures can be integrated in practice are scarce. Drawing on the Standard Business Reporting case in the Netherlands, this paper shows that both compulsory and adaptive measures are necessary to advance in multi-actor standardization processes. Our findings indicate that PPC managers need to impose with leeway by taking an engineering approach to architecture development yet providing leeway in the details.

Keywords: Public-private collaboration, engineering, policy making, standard business reporting.

1 Introduction

Following the global financial crisis, governments around the world face a thorny dilemma. On the one hand, they need to cut cost and become leaner. One way to achieve this goal is to reduce their compliance monitoring tasks and request fewer business reports from the private sector. On the other hand, private sector failures and scandals in various domains (e.g., financial reporting, food, oil) demand that government agencies become more vigilant. More vigilance is often associated with more regulations, more business reporting and information provision to various government agencies. In addition, more vigilance (e.g., regular inspections) often increases the compliance-monitoring burden for government agencies. This dilemma does not necessarily require government agencies to perform more tasks with fewer

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(human) resources. For instance, when it comes to regulation and monitoring tasks, government agencies can perform their tasks more efficiently depending on the agreements with the sector monitored. When developing architectures for public-private information exchange, a key step in addressing this dilemma is to collaborate with the public sector [1]. In order to come to such agreements, various forms of public-private collaboration (PPC) are discussed in literature [2]. Tan et al., [3] for instance report on a form of PPC in supply chains driven by the need to conduct more efficient and effective compliance monitoring. In such forms of PPC, trust and coordination are important drivers for collaboration. Kerschbaumer [4] reports on the rise of PPC in the health sector, primarily driven by the need standardize information flows, share resources and risks. In general, PPC is characterized by common objectives, as well as risks and rewards, as might be defined in a contract or manifested through a different arrangement, so as to effectively deliver a service or facility to the public [5]. The private sector partner may be responsible for all or some project operations, and financing can come from either the public or private sector partner or both.

In practice, several key types of PPCs can be found across various public sectors. Collaborating with the private sector carries the potential for meaningful benefits to be gained for the public partner and, in some cases the citizen. As such, PPCs are key in achieving a lean government, with reduced spending (e.g., eliminating large up-front investments of scarce public funds), greater efficiency (e.g., due to private partners' operational efficiency), and better management (e.g., of public services and infrastructure). In sectors which traditionally are subject to much regulation and compliance monitoring by government agencies, PPC can also be particularly valuable as a method of leveraging technical or management expertise (e.g., performance-based monitoring and incentives), and spurring technology transfer, all of which can lead to quality improvements. Nevertheless, studies show that managing the transition from traditional government regulation to PPC has proven to be difficult in practice [6]. Many PPCs crucially depend on information systems. Such systems need to be developed along with the collaboration. Information systems supporting PPCs involve complex inter-dependencies between processes, data and technology infrastructures. In many cases, the interest of the public and private stakeholders are divergent and sometimes even conflicting [5]. For instance, the interests of the public sector are related to legislation, regulations and authorities, political opinion and political influence, democratic decision-making processes, the minimization of risks and the realization of a social goal. One the other hand, the interests of the private sector, are related to revenues on the invested funds, daring to take business risks, having to anticipate market and competitive developments; realizing a corporate goal.

Top-down management approaches are hardly effective in these situations [7], mainly because they fail in facilitating the level of flexibility needed to deal with the wide range of varying stakeholder needs and project uncertainties. A more open approach, providing room to maneuver for stakeholders seems to be more appropriate. While contemporary literature on project management [e.g., 8] hints towards the integration of plan driven and adaptive learning measures, empirical contributions on how these measures were combined in practice and what kind of effects they had is scarce. This scarcity can be partly attributed to the fact that PPCs emerge in a relatively unstructured manner, often depending on the political agenda, making it

difficult to collect data. This paper elaborates on the integration of compulsory and adaptive measures that have proven to facilitate the steady advancement of a PPC program in the Netherlands. The case study is on Standard Business Reporting (SBR), a PPC based lean-government initiative aiming to reduce that regulation burden for companies, while at the same time reducing the compliance-monitoring burden for government agencies such as the tax-office and Chamber of Commerce. Section 3 presents more detail on the SBR case. Since SBR is a new form of PPC consisting of several projects, stakeholders needed a program management methodology that addresses the various complexities and uncertainties inherent to the standardization of data, processes and infrastructure for business-to-government information exchange. Note that we do not claim to have developed a new program management approach. Instead, the objective of this paper is to highlight the combination of compulsory and adaptive measures that were used in managing a PPC in practice. As part of the case study, we collected data through observation, document analysis and interviews with members of the SBR team in the Netherlands.

This paper proceeds as follows. Section 2 illuminates some of the typical uncertainties and progress inhibitors in PPC management found in literature. Section 3 presents some background on the introduction of SBR in the Netherlands. Section 4 discusses the findings and reflects on the combination of measures used in the SBR case study. This paper concludes with some avenues for further research.

2 Public-Private Collaboration Management: Marrying Two Extreme Management Styles

A well-known governance tool for complex projects is project management [9]. Typical of project management thinking is getting things done in a limited time frame with predefined quality standards and costs [7]. The main problem for a project manager is framed as controlling just these aspects: time, costs and quality. Project management is an example of an 'engineering approach' to management. An analyst (or an engineer) designs a system that is supposed to be optimal, which makes management an implementation issue. A well-known other example of such an engineering approach is Business Process Re-engineering (BPR) [10].

The growth of the use of project management as a form of governance is supported by a growing set of tools, aimed at predicting the design through system engineering, the tasks through a work-breakdown structure, the time to spend through network planning tools and the budget through various cost-estimation techniques [9, 11]. Project management adds instruments to ensure that the predicted outcome is actually the real outcome of the project. Project managers are responsible for fulfilling the strictly predefined tasks, which implies a top-down steering approach. Organizational change management, risk management and progress management are tools to command, control and secure that the prediction is realistic and realised. More and more, however, these project management tools are deemed inappropriate for the complexities and dynamics that come from multi-stakeholder networks. An important source of complexity is the need to invent context specific solutions by combining technologies, knowledge, and expertise - dispersed over various actors [12]. Consequently, these projects behave less predictably and as such, the predictions are

less accurate, and control focusing on realising that prediction is less apt. The alternative then is to shift towards adaptive forms of management that focus more on flexibility, cooperation, learning and trust. The underlying bodies of knowledge originate from outside de engineering world, such as public administration, institutional economy and sociology. These draw on literature on innovation, network governance, complexity and innovation, suggesting approaches such as adaptive planning [13], concurrent engineering [14] and process management [7, 15]. They underline the need for "bonding for internal cohesion" and flexibility. The idea is that surprises will inevitably occur in complex projects. In those situations, the project manager does not need team members, partners and contractors with neatly and narrowly described tasks but broad-thinking and committed collaborators with room to manoeuvre. The manager needs to prepare for surprises and commit everyone involved to dealing with them. Part of that preparation can be to use a broader, more functional description of requirements [16]. Along the way, lessons will be learnt by the client about what it wants and by other actors (e.g., regulators, accountancy firms, software providers, intermediaries) about what is possible and efficient. Learning requires bottom-up steering processes, room in terms of resources, time and budget, allowing for experimenting, the making, detecting and correcting of mistakes, and the exchanging of experiences. Working in a constantly learning and flexible environment demands suitable contracts that focus on realising a prescribed function rather than a prescribed system. Therefore, incentives and performance measurement are more output-based than work-task based. Furthermore, the project management requires leeway; administrators, politicians and stakeholders allowing it discretionary freedom.

Table 1. Two extreme management approaches

	An engineering approach	*A learning approach*
Assumptions	Systems are fully specifiable, predictable, and can be built through extensive planning	System components can be developed by small teams using the principles of continuous design improvement and testing based on rapid feedback and change
Management style	Command and control	Cooperation
Requirements	Blueprint	Functional
Task definition	Narrow for best control	Broad for best cooperation
Incentives	Work-task based	System-output based
Change	Limit as much as possible	Facilitate as much as needed
Steering	Top down	Bottom up
Information exchange	Limited	Open

The two approaches outlined in Table 1 are extreme representations of possible managerial approaches. It is doubtful whether such a pure form would be effective at all in any kind of project. The engineering approach – as drawn here – does not suit the complexities and dynamics of multi-actor system behavior. The adaptive approach is too open-ended to function in any environment that poses constraints, such as political environments imposing deadlines. A growing stream of literature on project

management and innovation suggests that an effective managerial is likely to meet the best of both worlds. It is meandering between the two extremes [17]. It is being strict about some aspects and lenient about others. De Bruijn and Ten Heuvelhof [5] have developed idea about how to combine both extremes. They suggest command and control by leeway. An engineering approach provides direction and incentives to actors to behave in an orchestrated manner. It, however, becomes vulnerable if main interests of actors are not addressed in the managerial approach. Resistance is problematic when the cooperation of actors is essential for the program or project. A different vulnerability is the fact that essential knowledge is dispersed over the actors involved and evolving over time. Providing room to actors may mitigate their resistance and provides an opportunity to distribute and use their knowledge. An example of combining command and control with providing room is output-based management: time, costs and/or quality standards are well defined and enforced strictly, but the way to meet these standards are open for discussion or decentralized decision-making.

This idea provides us a broadly defined normative framework for public management of compliance processes. It calls for some balance between two extreme management approaches, an intelligent mix profiting from the virtues of both. A balance might be found in using an engineering approach and the same time provide room to maneuver for the actors involved. However, this is still not a full-grown framework. Many 'how'- questions remain. Literature does not address complexities of specific PPC projects. Case studies are needed to show the validity of the framework and refine it. The next section presents a case study on the development of an architecture for standard business reporting in the Netherlands.

3 Case Study: Introducing Standard Business Reporting in the Netherlands

This section contains an illustration of the compulsory and adaptive techniques and practices used in the implementation of Standard Business Reporting (SBR) in the Netherlands. SBR concerns the implementation of the set of agreements and information systems used for the exchange of reporting information between companies and pubic organizations. SBR implementation combines both restrictive and adaptive measures such as the ones discussed earlier. The management approach that has been used in the SBR program has two partitioning principles. Firstly, development proceeds iteratively in phases with clear deadlines and deliverables: analysis and design, implementation, execution and monitoring. This provides a temporal partitioning. Secondly, there is a separation between the different layers of a projected solution: process layer, data layer, technological infrastructure, and governance aspects.

3.1 Background

In the Netherlands, the Standard Business Reporting Program (SBR Program) is a set of projects in the area of business to government information exchange. In the SBR Program, several government agencies and industry partners collaborate to simplify

and standardize (financial) reporting [18]. This collaboration is encapsulated in an agreement (covenant) that was signed by over eighty parties, both public and private.

The program started in 2004 as Netherlands Taxonomy Project (NTP). In 2006, a generic infrastructure project was carried out drawing up requirements for a new process infrastructure for financial reporting based on the Extensible Business Reporting Language (XBRL). XBRL is an XML based computer language for reporting business information enabling data to be tagged and reused [19]. In 2007, the first versions of the technical infrastructure developed for exchanging the data were ready. Stakeholders decided that the government should maintain the infrastructure IT maintenance agency Logius. In 2009, the taxonomy project was handed over to Logius altogether and a steering group consisting of senior representatives of all Ministries involved was appointed. As of 2009, NTP continues under the international name Standard Business Reporting (SBR). Similar approaches have been adopted by Australia, and later also New Zealand, China and Singapore.

Reporting streams in SBR include company (or its intermediary) to the CBS (production statistics, investment statistics and short-term statistics, i.e. revenue per period), Chambers of Commerce (possibility to file the annual financial report) and Tax Office (revenue taxes, corporate taxes, income taxes, intra-EU performance (ICP), and short versions of corporate and income taxes. The business information supply chain starts with companies possibly reporting via an intermediary (accountant, bookkeeping, tax consultant etc.), who are both supported by software providers. In the middle, we find the various taxonomy variants chosen for the different reporting streams, and the gateways. Institutions demanding reports are shown on the right. Information flows follow a 'store once, report to many' principle. According to this principle, the data definitions and the infrastructure may be re-used over different reporting chains, while the actual act of reporting remains specifically addressed to one agency. Based on current legislation, the one-stop-shop scenario [20] or the single window based continuous monitoring scenario [3] would be too far reaching for three reasons. Firstly, it is legally not allowed to re-use data collected for one purpose, for different purposes. Secondly, because reports may have different legal functions and they have different contents. Thirdly, because data for different report may have a different quality level, aggregation level, precision or source.

3.2 Development Phases

In the SBR case, a development schedule with pre-defined development phases is enforced quite strictly. Figure 2 shows a development schedule as it has been used in several rollout projects in the SBR domain. There are two go/no go decision making moments. The first one is after the analysis and design phase, when commitment is needed that the project will go ahead as specified in the blueprint. Note that analysis and design are merged. This does not mean that a requirements specification (analysis) and a design (blueprint) should not be separate deliverables, but rather that determining requirements and developing ideas about what is feasible should be intertwined. Another reason is that these phases involve similarly skilled people: visionaries and architects, with an eye for unforeseen possibilities. By contrast, the implementation phase needs project managers who get the job done. In the third phase, the implemented process and technology components are deployed in practice.

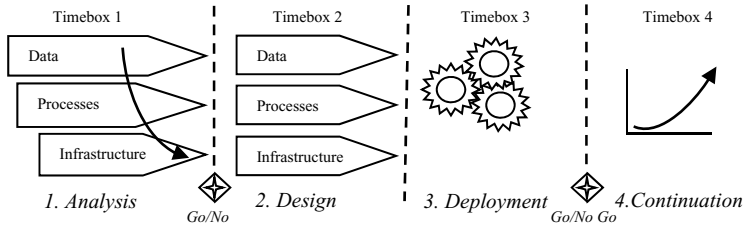

Fig. 1. SBR implementation approach

Initially this is done in a smaller application area. Only after evaluation and acceptance of the working solution, and with an enriched business case, a roadmap can be drawn up to scale up deployment in other application areas. This also involves a marketing plan to make sure external parties (e.g., companies, intermediaries) will adopt the new way of reporting.

Figure 1 outlines the main phases in the deployment of SBR in the Netherlands. Stakeholders have recognized that the implementation of SBR will be a cyclical program, consisting of four recurring activities: analysis, design, deployment and continuation. There are two go/no-go moments built into this cycle, during which stakeholders decide on the progression to the next phase depending on the quality of the deliverables. The following sections discuss the combination of compulsory and adaptive measures regarding the data, processes, infrastructure and governance in the SBR case.

3.3 Process Layer

One of the major dilemmas for compliance management was gaining agreement on process definitions across the chain of stakeholders. To model reporting processes Business Process Modeling Notation (BPMN) was proposed as standard. As an recognized standard for business process modeling [21], BPMN makes it possible for everyone involved in the reporting process a clear picture and description of the process steps that are in a reporting chain. Accordingly, BPMN modeling provides the basis for implementing the process steps. While the use of BPMN is compulsory, compliance managers soon found out that these standards were not sufficient to capture the complexity and context specificity of the entire reporting process. As such, the use of additional process definitions (e.g., in text) was allowed. When we consider the process of reporting, an interesting dilemma was choosing the type of gateway for facilitating the reporting streams. At first, a one stop shop [20] was envisioned, referring to a single point of access from a customer of public administration's point of view. This type of infrastructure requires a high level of integration and standardization across the information systems of the requesting agencies. Moreover, the one-stop-shop infrastructure would be too far reaching. First, current legislation does not permit the re-use of data collected for one purpose to be used for a different purpose. Secondly, because reports may have a different function and may therefore have different contents. For example, in a tax report, the company

will try to report as little revenue as possible. In a year-end financial statement meant for shareholders, a company will try to report as much revenue as possible, to appear as a solid investment opportunity. As an intermediate solutions, the program managers opted for a 'store once, report to many'-infrastructure. This means that although the data definitions and the infrastructure may be re-used over different reporting chains, the actual act of reporting remains specifically addressed to one agency. Hence, the gateway will operate much like a post office, simply moving electronic messages from businesses' system to the right agency, and returning an electronic receipt. This provides leeway for the requesting agencies in organizing their internal processes.

3.4 Data Layer

Concerning the data layer, we discuss the dilemma of allowing extensions, versus uniformity of a standard (Section 3.4). As was explained above, the general policy in the SBR program is to prefer the national XBRL taxonomy, but to also allow other open standard data formats for specific domains (alternatives of XML, for instance for human resource management). In the case of the banks, an intermediate solution is chosen. Banks use their own extension of the taxonomy, but in the release schedule they follow updates of the national XBRL taxonomy. Therefore, users can still expect to re-use the common data part. Another issue concerns the possibility of XBRL to generate different reports from the same data, by using presentation formats. This leads to a legal problem. By law, an accountant verifies whether the annual accounts present a 'fair image' of commercial reality. When the metaphor of an image is taken too literally, this means that the accountant can only sign for the actual presentation chosen; not for the underlying data elements. After all, not only accuracy but also completeness is testified. This issue still needs to be settled by experts of the Dutch accountants association.

3.5 Technical Infrastructure Layer

In the SBR program, Digipoort functions as the main gateway for information exchange between the private sector and government agencies. SBR uses open technology standards were possible. As compulsory measure, companies have to connect to Digipoort (using free coupling specifications) which is the exclusive gateway for system-to-system reporting in XBRL. Leeway is provided in the way companies (or their intermediaries) connect their business data systems to Digipoort. Companies are free in deciding which of their systems (e.g., financial, accounting, ERP) they connect to Digipoort and to what extend XBRL is embedded in their business transactions (i.e., bolt on, build in or embedded).

3.6 Governance

A strict release schedule is maintained for different stakeholders. In this way, partners can test and use the taxonomy – so possible defects are – found before troubling market parties. As we mentioned, according to the Weill and Ross model we need to determine three things. First, SBR is governed by a council, in which all major stakeholders have a say. User groups are represented in the SBR platform. They can

give feedback on the way the program develops. The platform is supported by three expert groups, one for data, one for processes and technology and one for marketing and communications. Expert groups are meant to initiate, discuss and solve current issues. This structure ensures that all major stakeholders have a say, while also guaranteeing enough expertise to reach workable solutions. Second, we need to ensure alignment among stakeholders. The actors in the SBR domain form a network, which together provide a service: an information processing chain. Therefore there are frequent meetings (e.g. platform meetings; expert group meetings) to make sure parties know of reported issues and scheduled changes. Regarding adoption by end users, a professional marketing and communications plan is maintained. Third, formal communication procedures must be followed. For example, before releasing a new version of the taxonomy, it must be tested by all stakeholders. Now suppose one party did not perform the test and the release has to be postponed. This needs to be communicated in a uniform way. Table 2 summarizes the compulsory and adaptive measures found in the SBR case study.

Table 2. Summary of compulsory and adaptive measures in the SBR program

	Compulsory measure	**Adaptive measure**
Process	Requesting agencies have to use BPMN for communicating their processes with Logius	Requesting agencies are free in organizing their own internal processes for handling business reports
Data	Use of a single national XBRL taxonomy with predefined definitions of data elements	Extensions to the taxonomy are allowed when the requesting agencies demand additional information
Technical Infrastructure	Companies have to connect to Digipoort (using free coupling specifications) which is the exclusive gateway for system to system reporting in XBRL	Companies are free in deciding which of their systems will connect to Digipoort and to what extend XBRL is embedded in their business transactions (Bolt-on, build in or embedded)
Governance	Fixed release schedule for the taxonomy and Digipoort components (e.g., certificates)	Flexible requirements and maturity levels for the consecutive versions

As outlined in Table 2, the PPC included both compulsory and adaptive measures related to the data, processes, technology and governance aspects of SBR. Both type of measures were required for different purposes. One the one hand, the compulsory measures were needed to mobilize the stakeholders set the standards for SBR. On the other hand, adaptive measures were needed to cater in the heterogeneous stakeholder requirements and maintain their commitment to the SBR program. The combination of measures listed in Table 2 is specific for the SBR case. Section 4 proceeds with a discussion on what types of combinations can be abstracted from the case study.

4 Discussion

SBR is a PPC based lean government initiative seeking to reduce the administrative burden for companies and the compliance-monitoring burden for government agencies. The SBR case study illustrates a combination of elements from an

engineering approach and a learning approach. In the short term, the form of PPC in the SBR case can be characterized as an engineering approach with top-down steering and extensive planning. These elements were necessary in order to mobilize the stakeholders. Varieties of compulsory measures support this engineering approach. Process and data standards are made compulsory, so there seems no room for experimenting. Time is found an important constraint managed by strict deadlines, so no room seems to exist for lessons learned after the deadlines. The technical infrastructure allows for just a single gateway, so there seems no room for redundancy. And yet, on the long run, some elements of the learning approach such as cooperation and bottom up steering were also apparent. These elements were necessary in order to maintain the commitment to the standards (i.e., data, processes and technology) selected by the stakeholders. The learning approach was combined with the engineering approach in at least three ways:

1. *Engineering the broad picture, leeway in the details.* The simplest combination is engineering the framework, while providing room to maneuver in managing the details. This is highly visible in the compulsory use of the national XBRL- taxonomy, and the possibility for the use of different extensions at the same time. This provides flexibility and learning possibilities for users, while still using (and accounting for) one standard.
2. *Implementing a flexible design by an engineering approach.* Leeway can also be apparent in the design itself. The more flexible the design, the more room there is for actors to cope with it, the more legitimate an engineering approach may be. An example is the choice for the relatively flexible 'store once report many' design. A one-stop-shop design would demand a lot more change from a lot more actors. In that case a pure engineering approach would be likely to fail, while for a flexible design more elements of this approach are likely to be accepted.
3. *Leeway within restrictive procedural rules about decision making.* A version of 'command and control by providing leeway' is the top down implementation of decision making procedures. Although the outcomes of the decisions remain open, the procedures (terms, participation) are well defined, so that participants have little room later to reject the decisions on the ground that they had no influence on the outcome. Examples are procedures for agencies to provide existing process models in non-standard formats. Another example is the governance model, in which collective go-no go moments are required in a strict time frame. These combinations provide possibilities for learning by doing within an engineering frame.

The case suggests that a combination between the approaches has been found, by using an engineering approach and providing leeway at the same time. As suggested by theory, this 'management by paradox' could very well be an important success factor of the SBR-case. While there is no set of hard or quantifiable metrics for evaluating the success of this methodology, the prospect of the nationwide requirement to deliver official reports in the XBRL format indicates that the stakeholders have made significant progress in establishing the necessary infrastructure for SBR. In the case of SBR, the combination of such compulsory and adaptive measures has proven to be able to sustain progression in achieving the minimally required program milestones. Considering the results of the SBR program, the Dutch Government has announced that Digipoort will be the exclusive channel for exchanging financial reports with government agencies starting 2013.

5 Conclusions and Further Research

Managing public-private collaboration projects is a difficult process, subject to different interests, heterogeneous processes and changing political priorities. Since public and private agencies often have various interests, measures are needed to mobilize their resources on the short run and to sustain their commitment on the long term. Finding this balance is a delicate process. This paper illustrates the need for, and the use of, an adaptive program management methodology, which includes both compulsory and adaptive elements. As such, the case study shows that both compulsory and adaptive measure are necessary as command and control is needed to deliver milestones and standards, while maneuvering space or leeway is needed to mobilize stakeholders and profit from learning effects. In this way, program managers plan for and continue with the most crystalized project outcomes, while at the same time plan for a higher maturity level in future releases.

One of the questions rising from this research is under which conditions a combination of compulsory and adaptive measures would succeed. In retrospect, the case study has four specific conditions that need to be highlighted, since they provide a basis for PPC. Firstly, there is a sufficient level of political consensus on the need for SBR in the Netherlands. Secondly, the technology and data representation standards used (XBRL) and the infrastructure needed (government gateway) are based on accepted open standards and use proven building blocks. Thirdly, the introduction of SBR does not demand any immediate changes in the current laws on business-to-government reporting. This is highlighted by the slogan 'store once, report to many'. We argue that when legal changes would have been required, the implementation would have progressed slower. Finally, an important condition in the SBR case is that it entails a clear business case for the participating stakeholders. Further research may consider other cases in which these conditions are not in place. Careful evaluation of the conditions for success and sustainability is required on a case-by-case basis in order to assess the costs and benefits and the likelihood of success of such an approach. Such cases would allow further specification and testing the type of compulsory and adaptive measures needed for public sector reengineering.

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Challenges in Information Systems Procurement in the Norwegian Public Sector

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Abstract. Public procurement of information systems (IS) and IS services provides several challenges to the stakeholders involved in the procurement processes. This paper reports initial results from a Delphi study, which involved 46 experienced procurement managers, chief information officers, and vendor representatives in the Norwegian public sector. The participants identified altogether 98 challenges related to IS procurement, divided further into 13 categories: requirements specification, change management, cooperation among stakeholders, competence, competition, contracting, inter-municipal cooperation, governmental management, procurement process, rules and regulations, technology and infrastructure, vendors, and IT governance. The results contribute by supporting a few previous findings from conceptual and case-based studies, and by suggesting additional issues which deserve both further research and managerial and governmental attention. As such, the results provide altogether a rich overview of the IS procurement challenges in the Norwegian public context.

Keywords: Public procurement, procurement of information systems, Delphi study.

1 Introduction

Public procurement, i.e. "the acquisition (through buying or purchasing) of goods and services by government or public organizations" [1], of information systems (IS) involves significant investments, where costs are covered by the taxpayers. For example, in Norway, a country of roughly 5 million inhabitants, the central government, municipalities and county governments used 6.6 billion NOK (825 million Euros) for purchasing hardware and software alone, in 2006 [2]. Procurement of IS consulting has been simultaneously increasing [3] due to a broader view of how IT is deployed in organizations.

Procurement of IS from the market is challenging, if compared to acquisition of more standardized goods and services. The systems often need to be customized to the needs of the public sector [4]. Moreover, procurement decisions are made early in the process, when requirements are still uncertain [5]. The buyer may face challenges to evaluate the bids against requirement specifications and to compare between potentially competing, complex system options. By information systems we limit

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ourselves here to software and systems implemented for specific organizational purposes, such as enterprise resource planning and e-services tailored for the buyer's needs. We thus exclude acquisition of off-the-shelf software, such as standard text processing, e-mail, and other generic applications, from this study. In IS procurement, the procurer also often needs to weigh between alternative IS implementation strategies (e.g. [6]), such as in-house development, tailoring from proprietary software, or adhering to open-source software ecosystems. Procurement of related IS consulting services can also involve complexity, including difficulties in specifying requirements, risks of incurring costs, and problems inherent in outsourcing confidential knowledge to external consultants [7].

The public sector may face procurement challenges slightly different from the private business community. It is often bound by strict regulations concerning procurement and public tendering. For example, most European countries are required to publicly announce their call for tenders for all procurements above a certain threshold value; this applies to member states in EU, and in the EEA area. In addition, public projects are often large, both in terms of scope and of volume, which makes them risky. There are several incidents of significant overruns in time and costs, such as the Golf project for the Norwegian defense [8] or the NHS Programme for IT in England [9]. The above-mentioned issues make the field of public IS procurement a relevant, but challenging, area of research.

Our research question is: What challenges and dilemmas are typically faced in the procurement of information systems and related services in the public sector?

The paper reports results from two initial phases of a Delphi study among three expert panels related to IS procurement in the Norwegian public sector (procurement managers, CIOs, and vendor representatives). The experts identified a list of 98 challenges in public IS procurement projects, which were further divided into 13 categories. Based on the initial list, the experts and researchers came up with a narrowed-down list of 19 major challenges. A discussion of the major challenges contributes to the previous literature by confirming a few (mainly conceptual and case-based) findings and suggesting additional issues which deserve managerial and governmental attention for improving public IS procurement.

The rest of the article is structured as follows. Section 2 summarize previous challenges of IS procurement identified in the public sector, as a basis for discussion of the results. Section 3 describes the research process and section 4 summarizes the results. Section 5 discusses the results in light of the previous research and section 6 concludes with suggestions for further research.

2 Previous Work

A considerable body of research on procurement in the IS field has focused on on-line procurement or e-procurement, both in the public and in the private sectors [10-13]. E-procurement appears most beneficial when the purchased items have explicit requirements or are manufactured according to common quality standards, and when there is a large pool of suppliers [12]. Hence this line of research seems to offer little insight into public procurement of more complex information systems and IS services. There is also a stream of research covering procurement policies in general. This line of research questions whether and how procurement can be used as an

instrument for specific policies (such as stimulating innovations or development of green products). Other researchers cover how procurement of technology can be carried out, whereas a few has focused on the procurement process of IS itself.

The findings from previous research on public IS procurements and associated challenges can be summed up in a limited number of different issues or research topics (Table 1). These issues are discussed in more detail below.

Table 1. Summary of the findings from previous research

Challenge	Reference
Various stakeholders	[15], [16], [17]
Opportunism, from consultants	[7]
Limited interest from vendors, due to payment model and standard government contracts	[18], [19]
Balance between different socio-economic objectives, e.g. between partnership and fair competition	[20], [21], [22]
Specifying requirements before announcing tender	[19]
Focusing on life cycle cost and not just initial procurement costs	[23]

2.1 Stakeholders

A large body of general-level procurement literature addresses how the process itself is or should be carried out. Organizational buying involves multiple participants [14] and represents a decision process where many purchasing decisions are influenced by various members of the buying centre [15]. The public sector also involves the complexity of satisfying different needs of different stakeholders. The main conventional distinction between public and private organizations resides in ownership; whereas a limited group of entrepreneurs or shareholders owns private businesses, public agencies are owned collectively by members of political communities [16]. Organizations subject to political rather than economic controls are likely to face multiple and potentially conflicting sources of authority [16]. In general, public IS acquisitions involve several stakeholders with the challenges of balancing among their goals, which gives a starting point for this research.

2.2 Opportunism

Dawson et al. [7] discuss information asymmetry when clients procure services from IS consultants. They use the agency theory to identify possible manifestations of opportunism, and how this can be constrained. Whereas their work is highly conceptual, it introduces the challenge of opportunism between clients and consultants. Pan [17] uses a stakeholder analysis in a case study to analyse how a procurement process of an e-procurement system was abandoned. He claims the study provides useful insight for practitioners on how to manage stakeholders in IS development projects.

2.3. Contract issues

Research on policy for public acquisitions has focused on issues related to both competition and contract types. These issues are expected to apply to public

procurement of IS as well. A large study of the choice of contracts in Indian software industry find that reputation matters in terms of whether fixed price or cost-plus contracts is used [24]. Bajari and Tadelis [25] develop a model inspired by data from the private-sector construction industry and show that cost-plus contracts are preferred when buyer and contractor share uncertainty about many important design changes that occur after the contract is signed and production begins. These findings should be relevant for procurement of information systems in instances when requirements are incomplete.

However, findings from the public sector indicate that the regulations and contract arrangements are protective of the government customer, through particular payment models [26] and the use of standard government contracts [19]. This is suggested to limit the vendors' interest to participate in public tenders [19].

2.4 Balance between Socio-Economic Objectives

One line of previous work has focused on challenges or conflicting goals in public procurement. Thai states that public procurement must deal with a broad range of issues [20], such as:

- Balancing the dynamic tension between a) competing socioeconomic objectives, and b) national economic interests and global competition as required by regional and international trade agreements;
- Satisfying the requirements of fairness, equity and transparency;
- Maintaining an overarching focus on maximizing competition; and
- Utilizing new technology to enhance procurement efficiency, including e-procurement and purchase cards.

However, Thai [20] provides little empirical evidence, and others have questioned the traditional way of doing procurement and suggest moving towards public procurement partnerships. Complexity of procuring information technology, software and IT-services is one of the reasons for such a move [21]. In a recent paper Loader [22] finds through a survey of 105 authorities in UK that 63% of local authorities have to some extent partnership with some suppliers, two thirds of the respondents recognizing partnership as being more likely to produce best value, rather than switching supplier through a tendering process. However the term partnership was not defined to the respondents, and we do not know to what extent they do practice partnership.

In spite of the goal of transparency and fair competition, there may be further reasons to believe that the process is not altogether transparent, and that not all competing vendors have equal opportunities. A qualitative study of IT procurement processes in private companies in four European countries [27] shows that the choice of vendors may be based on limited information. The findings indicate that the search for supplier is usually initiated either through contacting a known supplier or one that has been recommended, and on average a rather small amount of suppliers were actually contacted in this study.

As the public sector is large, the effect of public sector procurement may be big. The European Union (EU) policymakers have increasingly encouraged "public procurement of innovative products and services" as a policy instrument for raising

private sector R&D investment in member states [1]. The documented outcomes indicate that public procurement has significant positive effects on innovation [28]. It is less clear if and how this normative recommendation is operationalized in IS procurements. Research has been carried out through surveys with large samples (in Germany, on effects on innovation).

2.5 Specifying Requirements

The findings from Moe et al. [19] indicate tensions or dilemmas concerning creating requirement specification up front and doing the system specification as an integral part of the procurement process, and other dilemmas related to negotiations and fixed price contracts. The paper reports two case studies on procurement of fairly complex information systems in a Norwegian municipality. Whereas the general-level IS procurement literature recommends the in-house development strategy in case of unclear requirements [5], it may not be a realistic option for those public organizations with minimal internal IS development resources.

2.6 Focus on Initial Procurement Costs

Tyssedal [23] finds that even though the Norwegian ministry of Defense has stated that the lowest life cycle cost should be preferred, still procurement in some projects are reviewed on the basis of initial procurement costs alone. Tyssedal [23] uses agency theory to explain this phenomenon, and suggest that agents may be more risk-averse than the principal. He finds only limited support for information symmetry between principal and agent affecting the use of life cycle cost for decision making.

The literature thus identifies a number of potential challenges of IS procurement, while giving a limited account of empirical data to validate the conceptual and normative recommendations. Moreover, there exists little systematic research on what other challenges there may be, or which of the challenges would be most prominent. One of the challenges that is referred to, is the issue of different stakeholders, and this may be more important in the public sector, but there is limited research on how this issue adds to the other challenges.

3 Research Method, Data Collection

As the contemporary literature on the IS procurement challenges in the public sector remains without largely established theoretical or empirical grounds, we chose a research approach which orientates towards mapping the state-of-the-art expert opinions in the field. Hence, we chose the Delphi study method, which is often used in the field of information systems in order to find key issues and to explore an emerging topic [29], with three expert panels: municipal and regional procurement managers, chief information officers (CIOs) and representatives of vendors providing their systems and services to the public sector. This paper presents the preliminary results of the two first steps of the study. In general, we follow the process steps recommended for Delphi studies by Schmidt [30] and Okoli & Pawlowski [29].

The first activity was to select the experts for the study. We limited ourselves to inviting experts that are practitioners, representing the three different stakeholder

groups mentioned above. We selected practitioners from different types of public entities of a reasonable size (municipalities, government run entities such as hospitals and entities in central government), where they possess a recognizably good level of experience. Likewise we selected experts from different categories of vendors with a considerable portion of the market for the public sector, including consultants, software houses offering systems targeted to public sector (e.g. systems for social services) and general software houses (e.g. offering ERP systems or systems for accounting and HRM). Experts were identified partly through suggestions from other experts, and partly through contacting the major vendors and municipalities.

In order to qualify as an expert, we set a minimum level of at least 3 years of experience in the current position or in a similar position with responsibility for either procurement or, on the vendor's side, selling. We chose to include procurement managers and CIO`s, as both these groups should in general have expertise on IS procurement. We decided not to include user representatives as it turned out to be hard to find expert participants from this group. We set a requirement of having taken part in minimum 3 procurement processes of information systems or services. The procurement manager panel included 18, the CIO panel 17, and the vendor panel 11 participants. However we lost one procurement manager before the study was completed; hence there were 45 participants in total. Most of the CIO`s and procurers are from municipalities (28), the rest (7) being employed in either health care organizations, counties (fylker) or state government.

The first phase of the actual Delphi study with the selected panels was the brainstorming of issues related to the research question. In this phase, we treated the experts as individuals. Each expert was asked to list at least 6 challenges or dilemmas of public IS procurement. Each issue has a shorter "name", definition, and a brief reasoning why this is important according to the expert in question. That is, what are the consequences of the challenge, if it is not managed, and what causes it? The experts e-mailed their lists to the researchers, thus remaining anonymous to each other. After gathering the challenges from the participants, the researchers unified the list, removed exact duplicates and unified terminology. The consolidated list of 96 identified challenges was sent back to experts who gave feedback to validate that the researchers had not dropped out any in this phase and that the researchers had not misinterpreted or changed meanings. The feedback resulted in the list which was added with 2 challenges. Some of these fit perhaps less within a text book definition of the procurement phase, e.g. "Change of work processes and benefit realization", or "Management of problems after delivery". However all challenges in the consolidated list were identified by experienced procurers and we thus decided to include them, instead of relying on our own interpretations or prejudices about the relevant challenges within the procurement theme.

The second round narrowed down the brainstormed list to a manageable number of the most important issues, to be ranked within each panel. Now, we divided the experts into the three panels described above. In each panel, the experts defined around 20 issues that they considered as "most important". The presentation order of these 98 factors was randomized to the varying panel members to avoid bias related e.g. towards choosing factors from the top of the list. This study reports these preliminary results.

The third phase of the Delphi study will aim at a consensual ranking of the relative importance of the issues identified as most important in the narrowing-down phase. Despite the fact that the Delphi research was in process while writing this paper, proceeding towards the panels ranking the issues, the collection of the top issues already provide us with food for discussion and theory creation.

4 Results

The consolidated list from the brainstorming phase consisted of 98 challenges and dilemmas. The challenges are divided further into 13 higher-level categories, which help to organize and to get an overview of the results. Whereas no readily theorized category structure for the theme of procurement existed, the researchers grouped the challenges in this phase according to more common themes which they interpreted to emerge from the brainstorming data. The categorization has a purely pragmatic role for the further process, and it should thus not be considered as a "theorizing" effort as such. The narrowing-down-phase included altogether 19 issues (table 1), which were selected as follows. Firstly, we selected a "top ten" list based on the votes in total. This resulted in a selection of 12 issues (the 10th place was shared by three issues).

Then we had to find out whether there were large differences between the groups. Kendall's tau values, which measure the agreement between the panels [30], from this phase showed some positive and significant correlations between the panel-wise selections for the narrowed-down lists:

- procurement managers – CIOs: 0,474, sig 0,000;
- procurement managers – vendors: 0,205, sig 0,006; and
- CIOs – vendors: 0,234, sig 0,004.

However, as all the Kendall's tau values between the panels were less than 0,5 (values above 0,5 would have indicated strong inter-panel agreement) we decided to form a narrowed-down list, which would include the most important issues identified in each panel, in addition to those issues identified important across the panels. Hence, we decided to include the panel-wise challenges chosen by more than 50% [30] of members in each panel (Table 2).

The differences between the three groups did result in some challenges being included due to one group only finding them among the most important. For example, "Vendors oversell" is an issue, which none of the participants from the vendor side found worth listing, whereas "The vendor is not given an opportunity to show its qualities" was listed by more than half the vendor participants but by none of the others. "Sober requirements" is another example along the same vein.

This heuristic resulted in additional six challenges to be included in further analysis. In this phase, we also realized that two challenges (1.10 and 5.2) were so close to each other that they could be merged to one issue of "Finding good criteria for vendor evaluation. Then, we calculated individual votes altogether for this merged criteria – and it was, indeed, making itself as an additional (13th) criterion to be included among the "top 10".

Table 2. Major challenges. The list shows the 19 challenges that were selected after the narrowing-down phase. The numbers in brackets show how many from the different groups that selected this challenge as one of the more important ones.

#	Total votes, N=45	Procurement managers, N=17	CIOs, N=17	Vendors, N=11
1	2.1 Change of work processes and benefits realization (30)	4.1 Procurement competence (13)	2.1 Change of work processes and benefits realization (12)	1.3 Sober requirements (7)
2	9.1 Lack of coordination and standardization (of the procurement process) (24)	2.1 Change of work processes and benefits realization (12)	10.1 Complex regulations (12)	10.5 Tendering obligation may conflict with long-term planning (switching costs) (7)
3	4.1 Procurement competence (23)	1.1 Clear requirements (10)	9.1 Lack of coordination and standardization (of processes / services) (11)	5.6 The vendor is not given an opportunity to show its qualities (7)
4	10.1 Complex regulations (22)	1.2 Complete requirements (9)	11.2 Integration, compatibility (11)	13.9 Too much focus on costs (7)
5	11.2 Integration, compatibility (20)	11.2 Integration, compatibility (9)	6.6 Framework contracts (9)	2.1 Change of work processes and benefits realization (6)
5	3.3 Co-operation between different stakeholders (20)	12.2. Vendors “oversell” (9)		9.1 Lack of coordination and standardization (of processes/services) (6)
5	5.3 Weighing / Prioritization between vendor evaluation criteria (20)	5.5 Monopoly-resembling vendor conditions (9)		3.3 Co-operation between different stakeholders (6)
8	1.1 Clear requirements (19)			5.3 Weighing / prioritization between vendor criteria (6)
9	10.5 Tendering obligation may conflict with long-term planning (switching costs) (18)			10.3 Partnership and innovation is hindered (6)
10	7.1 Municipal cooperation is challenging (17)			
10	12.2. Vendors “oversell” (17)			
10	10.3 Partnership and innovation is hindered (17)			
10	1.10 & 5.2 Finding good criteria for vendor evaluation (17)			

In general, the narrowed-down list involves all but one (governmental management) of the 13 categories identified in the first phase. That is, the major challenges relate to many issues, and require holistic attention among the stakeholders. Three of the categories had more than one issue among the top 19: ensuring competition, requirements specification, and rules and regulations. However, the number of issues per category does not necessarily indicate the relative importance of the category. The experts highlight also significant challenges related to change management, cooperation among different stakeholders of procurement, competence, contracting, inter-municipal co-operation, the procurement process, technology and infrastructure, vendors, and organizational IT governance in general.

Table 3. The narrowed-down list of 19 major challenges divided into the 13 categories

#	Category	Top 19 Challenges and Dilemmas
1.	Requirements specification	1.1 Clear requirements 1.2 Complete requirements 1.3 Sober requirements
2.	Change management	2.1 Change of work processes and benefits realization
3.	Different stakeholders, cooperation	3.3 Co-operation between different stakeholders
4.	Competence	4.1 Procurement competence
5.	Competition	5.2 (& 1.10) Finding good criteria for vendor evaluation. 5.3 Weighing/prioritization of vendor evaluation criteria 5.5 Monopoly-resembling vendor conditions 5.6 The vendor is not given an opportunity to show its qualities
6.	Contracting issues	6.6 Framework contracts
7.	Cooperation between municipalities	7.1 Municipal cooperation is challenging
8.	Governmental management	
9.	Procurement process	9.1 Lack of coordination and standardization (of the work processes / services)
10.	Rules and regulations	10.1 Complex regulations 10.3 Partnership and innovation is hindered 10.5 Tendering obligation may conflict with long-term planning (switching cost to change vendor)
11.	Technology and infrastructure	11.2 Integration, compatibility
12.	Vendors	12.2. Vendors “oversell”
13.	Governance of IT and the organization	13.9 Too much focus on costs

Among the five issues with most overall votes from all experts across the panels, the most voted one was change management of work processes and benefits realization, which thus should be considered already during the procurement. The next issue was lack of coordination and standardization of the procurement process, being especially in the top agenda of CIOs and vendors. The third issue, procurement competence, was especially highlighted by the procurement managers. Complexity of regulations was also among the top five of CIOs, whereas the fifth issue concerning technological integration and compatibility challenges of the purchased systems was in the agenda of both CIOs and procurement managers.

In addition to the above-mentioned issues, the procurement managers especially highlighted the challenges of getting clear and complete requirements for the procurement process. They also mentioned two challenges related to vendors. That is, the procurement managers experience that in some areas particular vendors may have a monopoly-like position, whereas sometimes the customers also experience the vendors "overselling" and thus creating exaggerated expectations.

The CIO panel lifted up the challenges related to the framework contracts in general, such as decreased flexibility to choose the best partners and systems for particular needs. The vendor panel seems to have a slightly differing view on the challenges, highlighting sober and realistic requirements from their customers, problems with the need for opening new projects for tendering instead of longer-term co-operations, problems with foci of requirements hindering the vendors from showing their qualities, and the overall focus on costs only among the public sector procurers.

Co-operation challenges exist between different stakeholders within the public sector customers but also between the municipalities; sometimes networks of municipalities pursue joint acquisitions of systems. In addition, rules and regulations are regarded to hinder longer-term vendor-customer partnerships, when new projects need to be opened for public requests of bids. Finally, solid vendor evaluation criteria are hard to find and prioritize.

5 Discussion

The results, i.e. the major 19 challenges identified in public sector procurement of IS, confirm a few previous findings (see table 1), but also reveal a group of new challenges, which have not been discussed in detail in previous research. There was also one previously identified issue, which was not directly among the challenges of this study.

The issue of the vendors "overselling" their ability to deliver products and services denotes potential for opportunistic vendor behaviour, confirming the ideas of Dawson et al. [7]. Alongside with the overall differences among the panel prioritizations, our study thus supports their suggestions for improving stakeholder management in public IS procurements. The previously identified challenge of focusing too much on initial procurement costs in a case study from the Norwegian ministry of Defence [23] is also present in our list.

The issues of finding good vendor evaluation criteria and to balance among different objectives (such as fair competition and partnership) [20-22] were also well visible in our list of major challenges. Transparency for ensuring fair competition between the potential vendors is clearly a public-sector-specific challenge, whereas the private firms can be more pragmatic on these issues. The classic challenge of coordinating between various stakeholders in procurement in general [15] and in the public sector IS investments [17] was also one of the major challenges. Our results thus support the previous calls for more focus on managing these challenges in public procurement practices and processes. In addition, municipal cooperation is found to be one of the major challenges, and some of the participants are from municipalities that are highly involved in networks with neighbour municipalities where they try to use procurement as an instrument to negotiate better prizes, and to move to a more shared portfolio of systems.

The experts highlight importance on clear, complete, and sober requirements specifications, which has been perhaps less recognized as an issue for public sector procurement, if compared to the field of systems development in general. However, increased focus on requirements specifications may be especially important for the public sector, as procurement regulations specify tendering as the default instrument for enhancing fair competition and requirements must often be clarified up-front before talking to vendors [19]. This regulation-initiated challenge may be controversial to the observations made in the software engineering and information systems literature since the end of 1970s, which have recognized the difficulties for defining "complete" and "clear" ex-ante requirements and the fact that requirements tend to change during development (e.g. [31]). Varying IS procurement strategies for coping with "standard" requirements versus complex projects with uncertain requirements has also been suggested for some time [5]. However, many public-sector organizations can rarely develop systems internally, despite such a strategy for procurement being recommended for projects with unclear requirements [5]. Our data thus confirms that this dilemma of ex-ante requirements definitions for IS procurement largely remains to be solved in the Norwegian public sector.

To our slight surprise, the issue of facilitating change in work processes and benefits realization was regarded as an important challenge that relates to procurement as well. We regard this as a new finding in the field of public IS procurement. As such, this finding supports the benefits realization literature, which highlights the importance of planning for the expected benefits from IS investments from early on (e.g. [32]). This issue has not been identified in the previous literature of the public IS procurement. However, the challenge of establishing benefits realization practices from IT investments in the Norwegian public sector has been recently identified in other studies [33, 34]. Our results thus motivate further research, development and education initiatives on public benefits realization practices, linking them also to the procurement process of IS investments.

A need for coordination and standardization of IS procurement processes (among organizations) is probably specific to the public sector. In the public sector, among the altogether 430 municipalities plus other public sector organizations in Norway, such coordination may be possible in the first place. However, procurement standardization would probably represent a big public project in itself, to be coordinated by the state-level government. The issue of procurement competence was also highly ranked, which has surely some implications for both governmental and educational institutions. This is not surprising as IS procurement is a complex field due to the risk associated with large IS projects and due to the complex regulations.

The three issues related to rules and regulations (complex rules, hindering partnerships and long-term planning) for public IS procurement has also got less attention in the previous literature. This issue surely relates both to the dilemma of ex-ante requirement definitions and the call for increased competence. Interestingly, increased competence comes out top on the list from procurement personnel whereas complex rules comes out near the top from CIO`s, it may well be that procurement personnel sees the need for increased competence due to the complex rules, whereas CIO`s are more challenged by the rules themselves. Framework contracts, on the other hand, may hinder flexibility to adopt new ideas from the non-included vendors. However, these issues may also give food for thought for the policy-makers and the

framework-contractors, in order to make the current rules better suited for information systems projects. These challenges may be present also in parts of the private sector; rules and regulations may be just as complex in larger corporations.

The challenge of considering technological integration and compatibility of the systems highlights the importance to involve the IT and operations experts of the customer organization in the procurement process. In Norway, which is a small country, some vendors may have also reached a "monopoly-like" position in some niche areas specific to the public sector. On the other hand, due the regulations and strong focus on ex-ante requirements defined by the customer, some vendors may have few opportunities to show their specific qualities, if the customers cannot ask for that. The challenge of inter-municipal co-operation may be also a case characteristic to the Norwegian context, where the municipalities have been so far rather independent with regard to their IT/IS implementations. Whereas 2/3 of CIOs and procurement managers in our panels were employed in the municipal sector, but not all municipalities participate in inter-municipal procurement networks, this issue may appear a bit contextual for particular organizational settings.

Interestingly enough, the challenge of "uninterested vendors" due to complex regulations and practices in the public sector, identified in the previous research [19], was not present among the 98 identified challenges *per se*. This might have something to do with our selection of panels – i.e., by involving only vendors which already are active with the public sector. On the other hand, the issue of "monopoly-resembling vendor conditions", identified by the customer organization representatives, likely relates to this issue, taken that the scarcity of the vendor selection would be a consequence of such disinterest to overcome the public bureaucracy threshold.

6 Conclusions and Further Work

This Delphi study revealed typical challenges of IS procurement in the Norwegian public sector. Three expert panels, involving procurement managers, CIOs, and vendors, defined altogether 98 challenges and dilemmas, divided into 13 categories: requirements specification, change management, co-operation among stakeholders, competence, competition, contracting, inter-municipal co-operation, governmental management, procurement process, rules and regulations, technology and infrastructure, vendors, and IT governance. The results provide a rich overview on the challenges and complement the previous, largely conceptual and case-based, literature on public IS procurement challenges. The study supports the previously identified challenges related to stakeholders, vendor opportunism, standard government contracts, balancing between objectives, requirement specification for tendering, and plain focus on costs. In addition, the study revealed previously less discussed challenges of public IS procurement, such as aligning benefits realization to procurement, coordinating and standardizing public procurement processes, procurement competence, complex and constraining regulations, rigid framework contracts, issues of technological integration and compatibility, monopolistic vendor positions, unawareness of particular vendor qualities, and inter-municipal co-operation. In general, the identified major issues provide food for thought for Norwegian researchers, policy-makers, and practitioners in the field.

Our further research efforts will focus on finalizing the Delphi study with panel-wise prioritizations of the issues in order to see whether the experts would reach further consensus about the definitely most important issues, and whether the stakeholder prioritizations vary. We plan also to conduct in-depth studies to form theories of causes and effects related to the most important issues. Whereas the Delphi analysis alone reveals little or no relationships between the issues, our further work will focus on creation of cause-effect relations between the most commonly observed issues through qualitative analyses of the brainstorming data and additional field work. Another natural avenue for further work resides in cross-country studies, which might reveal more information about generalizability of these results beyond the Norwegian context.

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eGovernment and Organizational Changes: Towards an Extended Governance Model

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Abstract. Over the last decade the diffusion of Information Technologies has represented one of the main drivers of government reform. The adoption process of such technologies has posed significant challenges for public organizations. The aim of this paper is thus to look into the process of organizational change that public agencies have undergone, in order to single out its most salient characteristics, such as understanding changes in the adoption of technologies, in organizational choices, in skill needs and in customer-public administrations relationship. On the one hand, organizations are gradually opening up their institutional boundaries in order to proactively answer to environmental changes. On the other hand, citizens play an increasing role in the context of e-Government, since their suggestions and contributions may considerably influence decisions taken by public administrations. Specifically, we attempt to answer this research question: What are e-Government organizational implications in the back office and in the interaction with citizens due to Information Technologies diffusion? Using data from a survey on 1,206 Italian public administrations, we show how organizational changes are emerging, based on the overcoming of traditional bureaucratic organizational forms. The implications of these findings are also discussed.

Keywords: E-Government, extended government, back-office, organizational theory, public administrations, citizens.

1 Introduction

The process of Government reform is highly intertwined with the evolution of paradigms in technology usage. This has often led to a technology centric view of innovation in the public sector, promoting an underestimation of its organizational implications [1]. As a net result, the first waves of public investments in ICTs produced very limited value for final users. Expectations for technology usage in Public Administrations (PAs) are very high, but will the value be ever delivered? We are convinced that much will depend upon the ability of public organizations to understand and adapt to the changes that the use of Information Technology (IT) applications will require. It is thus paramount to clearly single out what are the practical challenges that public managers will have to face in terms of work

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organization, coordination and skill acquisition in order to effectively leverage IT applications in the innovation of their internal processes [2]. Therefore, challenged in the back office of the PAs have to be analyzed with an organizational lens.

One of the main challenges for e-government consists in the realization of organizational changes in order to exploit the whole potential of IT for enhancing operations [3, 4]. On the one hand, public agencies need to reshape their back office procedures and their organizational structure since they necessitate to shift from hierarchical organizations to network centric organizations [5]. On the other hand, the necessity of communicating with citizens in order to understand their requirements and meet their requests is compulsory if a PA wants to achieve an efficient level of performance. This is the reason why public administrations would increasingly make use of new tools, such as blogs, wikis and online community for interacting with their final customer, the citizen. Indeed, in an online community people share common interests, they are highly involved in the discussion topic and they are able to provide useful benefits for PAs in the definition of new interventions and policies [6].

This paper, exploratory in nature, has the aim of understanding e-government changes in the back office, given the more and more IT usage in PAs. Specifically, we use an organizational perspective. Grounding on the aspects mentioned above, the practical research question that this article intends to address is: What are e-government organizational implications in the back office and in the interaction with citizens due to the IT diffusion?

We structure the reminder of this paper as follows. Section 2 provides definitions of the e-Government. Section 3 presents the theoretical background about organizational theories, while section 4 contains the discussion of the main findings. Finally, section five contains some concluding remarks and an indication for possible future research directions.

2 E-Government

PAs are lagging behind enterprises in the usage of ICTs for conducting their back-office activities. Only a small number of PAs are incorporating the Information and Communication Technologies (ICTs) for automating their activities. To tackle this diffusion delay, especially in the last years, several initiatives have been launched to increase the e-Government phenomena [7, 8, 9]. Given that in this paper we are dealing with e-Government and there is some confusion in the e-Government definition, we try to explain the meaning of this concept. Indeed, in literature there are different definitions of e-Government. To better understand this concept, we provide in table 1 a set of definitions used by researchers.

As can be seen analyzing definitions contained in table 1, the common theme behind these definitions is that e-government takes into account the automation or computerization of existing paper-based procedures that will prompt new institutional and operational features, new managerial skills, new abilities of defining adequate policies, new capabilities of planning activities to conduct, new aptitudes to increase the citizens' involvement in public activities. Indeed, with the availabilities of new ICTs, combined with the organizational changes and the new competences creation, PAs have to overcome operational, institutional, managerial and strategic barriers.

Table 1. E-government definitions

Source	Definition
European Commission	E-Government: is defined as the use of information and communication technologies in public administrations combined with organizational change and new skills in order to improve public services and democratic processes and strengthen support to public policies.
Baum and Di Maio, 2000	The e-government is the continuous optimization of service delivery, constituency participation and governance by transforming internal and external relationships through technology, the Internet and new media.
Nawar, 2005	E-Government refers to the use by the general government (including the public sector) of electronic technology (such as Internet, intranet, extranet, databases, decision support systems, surveillance systems and wireless computing) that have the ability to transform relations within the general government (bodies) and between the general government and citizens and businesses so as to better deliver its services and improve its efficiency.
OECD, 2001	The term "e-government" focuses on the use of new information and communication technologies (ICTs) by governments as applied to the full range of government functions. In particular, the networking potential offered by the Internet and related technologies has the potential to transform the structures and operation of government.
Baharul , K.M., 2002	The use of information technology to free movement of information to overcome the physical bounds of traditional paper and physical based systems.
Deloitte and Touche, 2003	The use of technology to enhance the access to and delivery of government services to benefit citizens, business partners and employees.

Moreover, PAs have to be aware of the existence of barriers that have to overcome when they decide to abandon the traditional activities for activities that require the usage of ICTs. A list of possible barriers that PAs have to consider when decide to shift from the traditional “government” to the “e-government” is provided in table 2.

As can be seen in the table 2, barriers to e-government can be grouped in three main categories: the institutional/operational, the managerial and the policy planning. The first one, the institutional/organizational category, considers all barriers related to the infrastructure features and the internal competencies in order to support operations. Indeed, it considers barriers related to costs in changes technology and infrastructure, the necessity of disposing resources to support internal operations, the suggestion of innovative solutions in order to innovate the “traditional” PAs and also the necessity of policy guidelines, which usually lack in the PAs. The second one, the

managerial category, refers to managerial competences in order to manage the shift between the government and the e-government. In fact, in order to enable this shift, managerial competences for managing large-scale IT projects are required and also managerial competences in order to coordinate all managerial levels: from top to middle managers. Furthermore, managerial competences are important in order to manage the relationship not only with internal workers but also with possible external oppositions. Finally, managerial competences are important for enabling the share of information and data among departments. The third one, the policy/planning category, refers to the fact that today PAs lack in coordination among departments and in strategic planning, given that they do not follow a medium/long term horizon planning. Furthermore, public administrations lack in continuity of policy and programs and any policy guideline is absent. Finally, the PAs underestimate the contribution that the citizens could start to provide in the policy and programs definitions. Indeed, people were traditionally considered as consumers of contents instead of producer of contents, but nowadays they are becoming active producers of contents abandoning the role of passive Internet users. Thus, in case a PA would start to use more frequently the IT and would be active also online, it could beneficiate from the people comments, information and suggestions.

Table 2. Barriers to e-government (Source: United Nations, DPEPA, ASPA)

Institutional/Operational	Managerial	Policy/Planning
Technology and infrastructure costs/factors	Lack of capacity to manage large-scale IT projects	Lack of coordination and/or strategic planning
Lack of resources to support operations	Lack of conviction of top or middle managers	Opposition by professional or union interests
Lack of innovative incentives in public sector	Management expectations vs. management realities	Absence of policy guidelines
Organizational/cultural dichotomies	Doubts and resistance by leadership	Organizational/cultural dichotomies
Lack of institutional support	Opposition by professional or union interests	Local governments and municipalities if left far behind become bottlenecks
Information mismanagement, reluctance among departments, misuse of sensitive data	Information management, reluctance to share among departments, misuse of data	Lack of comprehensiveness continuity of policies and programs
Absence of policy guidelines	Obsolete legal framework to innovate and incorporate	Lack of comprehensiveness and continuity of policies/programs

The previous barriers are faced by all public administrations nowadays. Nevertheless, they are trying to overcome these barriers, even if it is difficult given cultural, technological and organizational settings. In order to understand how the

organization has to change, in the following section we propose the framework provided by Hurst (1995) [10] and following reviewed by Daft (2004) [11], which shows what types of changes are necessary in order to leave the traditional organizational schemes. It is applied to the enterprise context, but we believe that it can be also applied to the public context.

3 Organizational Theories

The ability of managing IT in an information society, not only in the private sector, but also in the public sector, is becoming increasingly important. We are going through a period where organizations that adopt a network approach are always more frequent [12]. Effectively, public agencies have the necessity to adopt a network approach in order to reach high levels of collaboration, commitment and participation. Traditionally, the back office of an organization was organized as bureaucracies: the environment was perceived as predictable, stable and the role of the manager was of marginal importance [13]. The concept of bureaucracy included several concepts such as standardization of labour, hierarchy and strict rules [14]. In such a context, for allowing a shift from the bureaucracy to the network-oriented organization, from a close to an open system and from institutions to communities, organizational structure has to be changed [15].

IT plays an important role in the organizational redefinition, since it is considered a key factor, even though it is not the only important factor to take into account when the organizational evaluation is performed [16, 17]. Indeed, numerous factors influence the structure of an organization. Daft (2004) [11] distinguishes two types of factors that may influence the organizational efficiency: the structural factors and the contextual factors. The former indicates the internal features of an organization and provides a measure for comparing different organizations. It includes formalization, specialization, hierarchy of authority, centralization and professionalism. Whilst the latter characterizes the whole organization also beyond the physical organizational boundaries, including organizational size, the technology, the environment, organizational goals and organizational structure. It is worthwhile to remind that managers of a PA have to monitor all these factors in the supporting of the e-government. However, they are not enough. Specifically, managers have to consider the rise of new organizational design approaches, in order to cope with the shift from a bureaucratic organization to a network organization where learning approach, communication, participation and coordination are the main aspects that distinguish the e-government implementation.

Searching the organizational features that characterize a network-oriented organization, the framework provided by Hurst (1995) [10] and following reviewed by Daft (2004) [11] seems the most appropriate. It contains the main distinctive elements useful to promote communication and collaboration in order to increase organizational capabilities. In particular, it shows the main elements that characterize the shift between the mechanical system design to the natural system design, called network-oriented organization, in a private organization (Figure 1). We expect that the same will happen in the public sector. Specifically, changes are following described.

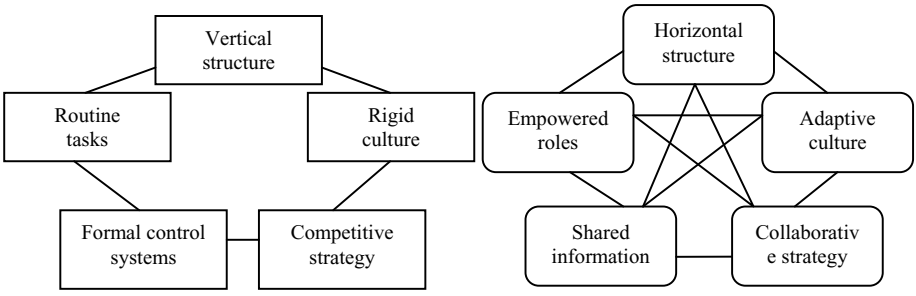

Fig. 1. Organizational design approaches [10, 11]

From vertical to horizontal structure. Traditionally, the most common way to organize activities consisted in grouping them together according to their similarities, from the bottom to the top. Commonly there were no collaboration among departments and vertical hierarchy was the main coordination mechanism. Nevertheless, this structure is effective only in a stable environment. Since the PAs are experiencing a period of continuous changes and the environment in which they operate is turbulent and dynamic, a shift from a vertical structure to an horizontal structure, where boundaries of departments are not so strict as before and where collaboration is widespread, is needed.

From routine tasks to empowered roles. Traditional organizations were characterized by employees with specialized tasks, while in the dynamic social system people have roles redefined and adjusted. In fact, employees are encourage to share their knowledge and collaborate together in order to achieve a common goal. Also, in the natural system design, people employed in the PAs have to work and listen customers' needs and requests, going beyond the physical organizational barriers.

From formal control systems to shared information. In a mechanical system design, large and complex organizations were characterized by a big distance between top leaders and workers in the technical core. Formal systems usually are implemented in order to manage the growth of the information amount that has to be processed. Conversely, in network oriented organizations information provides a different purpose. Ideas and information are shared throughout the organization and also there are open lines of communication with citizens through the Web 2.0 tools, as forums, blogs and online communities [18].

From competitive to collaborative strategy. In traditional organizations the strategy was formulated by top managers and was imposed on the organization and on all people that operated in the organization. On the contrary, in network oriented organization, informed and empowered workforce contribute to the development of the strategy, since they identify needs and solutions given their linkage with citizens ideas and suggestions [19].

From rigid to adaptive culture. A rigid organization is characterized by fixed cultural values, ideas and practices which could be detrimental in case a rapid change in the environment occurs. This situation is very common in a society that is increasingly dependent on the IT development speed. Indeed, the network oriented communities stand for openness, continuous adaptation and changes. People in the

organization have to be aware that their contribution is not enough for the success of the organization itself, so that they need to interact with actors beyond organizational boundaries. In addition, public managers have to face with work reorganization, promotion of coordination and skill acquisition in order to effectively leverage web 2.0 applications in the organizational management [20].

By looking to these two organizational design approaches and even if the literature contains several studies that analyze how the IT influence the organizational structure, there are questionable findings about the organizational implications in the back office of a public organization and in the relationship with citizens, given that the widely IT diffusion and the Web 2.0 applications are gaining increasingly popularity in the interaction with people.

4 The Organizational Change Inside Public Administrations: Evidence from an Italian Survey

The analysis of organizational changes in the PAs was conducted through a survey that we send to Italian PAs every year. In this research study we have considered data of 2007, 2008 and 2009. The data used for this study are the output of a survey carried out every year on a population of around 1206 PAs located in Piedmont, a north-west region of Italy. The survey is part of the policy intelligence activities carried out by the ICT Observatory of the Piedmont Region. In the following sub-sections we provide two analysis attempting to provide a link between the organizational theories explained in section 3 and data we gathered. First, we look at the back-office organizational changes. Second, we look at changes in the relationship between the PAs and the citizens, allowed by the availability of new ICTs.

In paragraph 4.1 we investigate changes in the back office by looking at four main variables: the existence of an Information and Telecommunication (IT) office; the existence of an IT manager; the existence of an IT manager or and IT office; the percentage of disperser workers. Whereas in paragraph 4.2 we investigate the relationship between citizens and public administrations by analyzing the existence of a web site in the public administrations, and the newsletter, surveys and RSS tools used by public administrations in order to interact with citizens.

First of all, we decided to investigate on the existence of an Information and Telecommunication (IT) office, of an IT manager or at least one of them given that we believe that these indicators provide an explanation of the IT adoption levels that the PAs have reached, showing how the PAs have an adaptive culture and tend to become horizontal organizations by integrating all functions together through the IT usage. This aspect is also underlined by the percentage of disperser workers that are employed in PAs, since they provide a clear indication of how the organization does not limit its activities inside its physical boundaries. Then, we asked to PAs about the existence of a web site in order to understand the level of openness of PAs themselves and to monitor the shift between the formal control system to the shared information system followed. Finally, the existence of tools that enable a relationship and an opinion exchange between citizens and PAs are investigated in order to figure out how organizations follow collaborative strategies instead of competitive strategies, how adopt a model based on shared information instead of control system and how

pursue an adaptive culture instead of a rigid culture. Nevertheless we were not able to measure the shift from the routine tasks to empowered roles.

Specifically, table 3 reports the linkage between the variable measured and the organizational change associated. All variables were operationalized by a dummy variable.

Table 3. Variable used and organizational changes associated

Variable	From vertical to horizontal	From routine tasks to empowered roles	From control systems to shared information	From competitive strategy to collaborative strategy	From rigid culture to adaptive culture
IT office					X
IT manager					X
IT manager of IT office					X
% disperser workers	X				X
Website			X		X
Newsletters			X	X	X
Surveys			X	X	X
RSS			X	X	X

4.1 Changes in the Back Office

Few studies have analyzed the organizational changes in the PAs and how they are evolving in a period when the ICT are widely adopted and the Web 2.0 is increasing its diffusion. In back office functions, the roles are undergoing a transformation and new IT capabilities are required, given that the capability of IT to automate the aspects related to the supervision of work has radically changed the allocation of power (Scott Morton, 1991) [121]. Technological and organizational changes are necessary to cope with the diffusion of the ICT and its increasing usage. PAs will be able to manage this trend only by implementing significant changes. Something has been done, but with limited results. This is the reason why we are exploring how PAs are managing these changes and what organizational and technological changes are applying in their internal processes and in the interaction with citizens. More skilled human capital is required in order to manage the wide usage of the ICT and new organizational models are needed if the shift between the "traditional government" and the e-Government has to occur. Specifically, looking at the internal organization of the PAs interviewed, we have chosen 4 indicators. We believe that these indicators well represent the changes that the PAs have to start to apply in order to manage the transaction between the traditional government and the e-Government. In particular, the four indicators (figure 2) are: 1) The existence of an IT office; 2) The existence of an IT manager; 3) The existence of an IT manager or IT office; 4)The percentage of disperser workers.

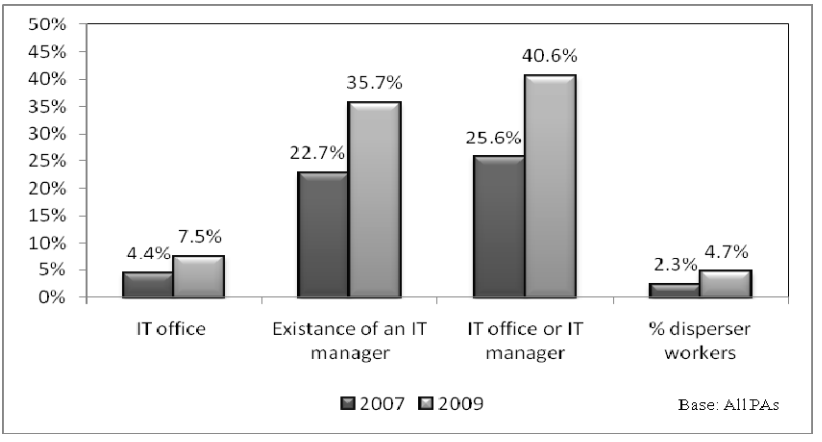

Fig. 2. Back-office organization (Source: ICT Observatory of Piedmont)

These four indicators give evidence of a general process of restructuring the back-office which is strictly connected with investments in new IT systems, in the definition of an IT manager and in changes of the workforce management. We decided to show only data of 2007 and 2009, given that it is a growing trend between these two periods. By looking at data, the percentage of PAs that have an IT office is increased between the 2007 and the 2009from the 4.4% to the 7.5%. Furthermore, the management capabilities are becoming strongly important, given that the existence of a formal figure, such as the IT manager, given an indication of how the back office functions has been going through a redefinition. Indeed, in 2009 the 35.7% of the PAs has an IT manager, in contrast with the 22.7% in 2007. Finally, as explained in the previous paragraph, given that empowered roles are needed, an adaptive culture is required and a collaborative strategy is necessary, organizational changes occur also in the workforce management. Particularly, as shown in figure 2, the dispersed workers are also rising (2.3% in 2007 and 4.7% in 2009), underling two main facts: first, a restructure of the workers management is occurring; second, the IT has been used more heavily, given that the disperser workers have to interact with the people that work inside the boundaries of the PAs.

However, it is still not clear how fast these technological and organizational changes will occur in the near future.

4.2 Changes in the Relationship Citizen-Public Administrations

Individuals do not live in isolation, but belong to groups. Thanks to Web 2.0 tools the size and the geographical dispersion of social groups is increasing. Nevertheless, not only the relationships between individuals are changing, but also new forms of management are gradually moving from a logic of command and control to another one of connection and collaboration, both internal and external to the public sector organization (Friedman, 2007) [14], the collaboration between people is increasing and Web 2.0 is emerging as primal aspect of human nature in the use of the World Wide Web. Related to this, new virtual areas where people can meet and

communicate are emerging - blogs, wikis, social networks, online communities – and the need to manage and control the information flow is becoming recently a central issue (Osimo, 2008) [1]. Indeed, the process of knowledge development and communication on the web is strongly influenced by the level of collaboration, participation and interaction among people, which is principally obtained through their interpersonal communication (Wenger et al., 2002) [23]. Thus, the increased engagement of citizens and the wider use of ICT tools result in four main potential of innovation in the interaction of citizens with the government: 1) broader value added to government from citizens thanks to data mining of social networking sites; 2) re-engagement of younger citizens in policy making processes as they are more likely to use social networking sites to express opinions; 3) increased numbers of citizen viewpoints represented in policy formation through use of social networking site analysis; 4) increased levels of interaction between citizens and government in policymaking.

The conducted research shows how PAs provide new services to citizens in order to increase their participation to the public activities. First of all, the presence of a search engine on the web site of PAs is increasing during the years. In 2007, the 27% of the PAs had a search engine, in 2008 it reached the 38%, and finally it was 45% in the 2009 (figure 3). This means that not only PAs are using more widely the ICT, but also the citizens are appreciated these new instruments.

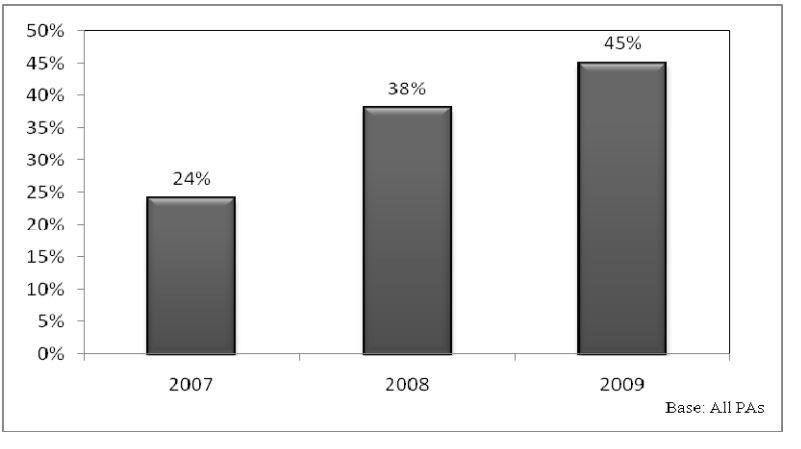

Fig. 3. Search engine existence on the web site (Source: ICT Observatory of Piedmont)

By looking to data gathered, it emerges how the new tools offered by the PAs for the interaction with the citizens are becoming more diffused. Specifically, we have investigate the diffusion of the newsletter, surveys and RSS (most commonly expanded as Really Simple Syndication) (figure 4).

Three main finding emerge: 1) the diffusion of the newsletters, a regularly distributed publication generally about one main topic that is of interest of public administrations, is increasing; 2) the surveys' delivery, usually used by public administrations in order to analyze the citizens' position about initiatives and decisions of the public administrations, is more frequent than in the past; 3) RSS, a

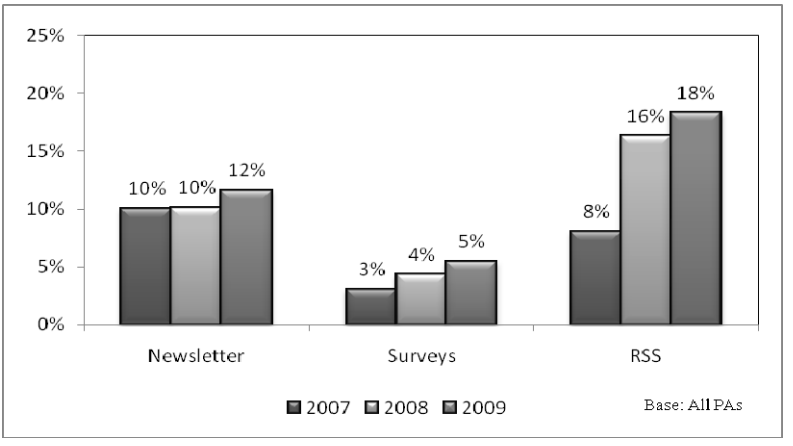

Fig. 4. Tools for the interaction between the citizens and the public administrations (Source: ICT Observatory of Piedmont)

family of web feed formats used to publish frequently updated works - such as blog entries, news headlines, audio, and video - in a standardized format (Wikipedia, 2010) [24], was used only by the 10% of PAs in 2007, and it has reached the 18% in 2009. Even though the adoption of these tools is enhanced in the last three years, the percentages are still low (only the 12% have a newsletter, the 5% conduct analysis survey and the 18% has a RSS). Nevertheless, we believe that the rising of the adoption trends of these tools indicate how the PAs are changing, are using more widely the ICT and are becoming to be aware about the important of the interaction with the citizens.

5 The Organizational Change Inside Public Administrations: Evidence from an Italian Survey

The transition from the "traditional government" to the e-Government has been recently investigated, but without considering both the usage of the ICT and the organizational transforms that are needed in public administrations in order to manage the changes that are occurring in such a context. As mentioned in the introduction, the first waves of public investments in ICTs produced very limited value for final users. Nevertheless, expectations on technology usage in the PAs are still very high.

Specifically, in this paper we have analyzed the evolution of organizational models in PAs and the increased interaction between citizens and PAs. By data analysis, we have found two main findings. First, evidence of a general process of restructuring in the back-office of public administrations is shown. New IT systems are adopted and changes in the workforce management emerge. Moreover, new forms of management are gradually moving from a logic of command and control to another one of connection and collaboration, both internally and externally to the public sector's organizations. Second, the PAs are favouring the usage of new ICT tools in order to

involve citizens in policy making processes, increase numbers of citizen viewpoints represented in policy formation and increase levels of interaction between citizens and government in policymaking. The combined effect of such changes may represent a first hint of a paradigm shift towards the creation of an extended governance model where institutional boundaries are blurring and new management styles are emerging [25]. Such shift, of course, need to be further investigated in order to be better framed and understood in all its facets.

From a policy viewpoint, policy makers could further enhance the engagement of citizens in policy making processes and they would encourage radical changes in the organizational models. Indeed, a major awareness about the organizational changes that would occur in PAs is needed and a cultural change is compulsory if improvements in activities conducted by PAs are expected.

This study contains two main limitations that will be investigate in future research studies. First, the next survey will be constructed by analyzing more in depth the organizational changes that are occurring in public administrations. Second, other variables will be used for analyzing the adoption level of technologies reached by public administrations, such as the usage of social networks for interacting with the citizens and the intranet usage to securely share any part of an organization's information or network operating system within the organization.

Concluding, this paper shows how the Internet and the ICTs are more widely adopted by PAs than in the past, organizational changes are emerging, the transition from the "traditional government" to the e-Government starts to occur, even though these changes and the adoption rates are still in an infancy stage given that public administrations have to learn how to answer timely to the external inputs.

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eGovernment Service Quality Assessed through the Public Value Lens

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Abstract. This paper assesses the role of e-government service quality in the creation of public value from the citizen perspective. By assessing the added value of e-government services through a public value lens we aim to explore more deeply how e-government service quality impacts on public value creation. We propose a conceptual framework based on the theoretical perspectives of public value and e-service quality to support the examination of e-government service quality from the citizens' viewpoint. An exploration of the literature on public value, e-service quality, and e-government indicates that the creation of public value is highly dependent on the level of quality of a service delivered by a public organization. The framework draws together the elements of public value as determined by Moore [1] and Kelly [2], and quality dimensions from the updated IS success model by DeLone and McLean [3].

Keywords: E-government, Service Quality, Public Value, Public Organization.

1 Introduction

Governments take resources from citizens and transform them into products and services to create public value [1]. Public value includes the quality of citizens' experiences of public services [2], and it can be created and improved by improving public services quality [2, 4]. Since the emergence of electronic government (e-government) in 1997 [5], the significance of providing quality services online to citizens has been recognized by many government sectors [6]. Public sectors adopt e-government to enhance their service provision quality and boost public management organizations' efficiency. E-government guarantees the ability to obtain government services from the home or workplace and cut down costs with (24/7) availability and greater ease of access [7]. E-government also supports several significant features such as e-democracy, transparency and government reform which save money and close the distance between government and citizens [8]. Thus, it has become clear that what is delivered to the public through e-government is much more than just an online service added to the rest of government services. E-government has a public value itself since the government can provide various important quality services to the public.

The majority of the latest reports available show that the level of government spending on information technology (IT) projects, including e-government initiatives, has grown exponentially [9]. For example, IDC estimated that e-government spending

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in the Asia-Pacific region will exceed US$31 billion by end of 2010 [10]. With this volume of spending governments might face serious political backlash if they cannot provide evidence of the return value of the money they invest in e-government; also they may be accused of wasting taxpayers' money on needless initiatives. While many governments have invested heavily in e-government projects in the last decade, relatively little is known about the return value of these investments from the public value perspective. Thus, government administrators need external and objective feedback on their e-government efforts and effects [11] to have a better understanding of the benefits and return on their investments. Therefore, the public value of e-government should be considered and understood in particular to help decision-makers when implementing new policies or initiatives. Wimmer [12], recommend assessing the value of government IT investments as an important research area, arguing that the potential benefits of e-government initiatives can no longer be assumed, but must be demonstrated. They argue that 'a clear understanding of the value of egovernment, and value for whom, is needed' [12, p. 6]. Furthermore, Maxwell [9, p. 37] stressed that: 'The value of a government's investment in IT should be assessed from the point of view of the public it serves.'

Providing citizens with high quality services is one of the main sources of public value [2, 4]. In the area of the quality of e-government most of the studies concentrate only on evaluating the overall customer (citizen) satisfaction and the quality of the e-government websites [13]. Additionally, such studies do not assess the performance and quality of e-government initiatives from a public value perspective. However, this paper develops the concept of public value of e-government services quality from a "citizen's eye" perspective. We examine the added value of e-government to citizens in a public value context and thus explore the relationship and the influence of factors of e-government service quality on public value creation. This directs us to form the research question as follows - How do service quality factors impact on public value creation, and how does e-government service quality contribute towards public value? This paper aims to investigate the contribution of e-government service quality towards public value creation, proposing a conceptual framework based on theoretical perspectives of public value and e-service quality.

The paper is organized as follows. In the first section we define and discuss the concept of public value from different perspectives, focusing on features which are relevant to e-government service quality. In the second section we examine the relevancy between public value and service quality in general and with e-government in particular. This is followed by a discussion of evaluation approaches related to e-government services quality. In the fourth section the identified constructs are brought together to build a conceptual framework that could facilitate research into the public value arising from e-government initiatives. Finally, we will draw some conclusions and highlight some future directions for research.

2 Public Value

In the 1980s countries such as the UK, US, Australia, New Zealand and many other OECD countries adopted the strategy of New Public Management (NPM) to modernise and reform the public sector [14]. NPM always stressed cost-efficiency over any other criteria arising from the tendency to focus on those things that can be

evaluated easily and turned into objectives, whilst those that are difficult to evaluate are disused. A common problem of NPM is that it evaluates public service efficiency based on the average cost of processing a given output, rather than examining the potential outcomes that are valued by citizens [15]. For example, Raus [15] stresses that 'measuring how cost-effective a government website provides quantity of information rather than the usefulness and relevance of the information to the citizen' [15p. 124]. This example indicates that in this narrow sense, efficiency improvements do not contribute to the enhancement of public value. In view of the fact that NPM strategy focuses more on outputs rather than on outcomes, public managers often cannot see the bigger picture beyond the service they provide leading to weak coherence in the public services sector [16]. As a consequence the idea of public value has been developed to give a clearer view of government performance and to overcome the disadvantages of NPM.

Public value was first articulated by Mark Moore from Harvard's Kennedy School of Government as a new way of thinking about public management that might help public managers. Moore [1] describes public value as the value that a government generates for its people. Moore suggests that public managers should focus on creating public value by satisfying individual and collective desires instead of basing their work on traditional NPM strategy which was seen as best practice in the 1980s and 1990s. Furthermore, Moore [1] questions NPM quantitative measures arguing that they often fail to address the fundamental intangible issues of public service quality.

For Moore [1], public organization strategy should be about three main concepts; (1) Creating public value (2) Being legitimately and politically sustainable and (3) being operationally and administratively feasible. Creating public value is about the value that the public organization wants to create for its citizens (for example the organization aims and objectives). Legitimacy and political sustainability is the foundation of authority and sustainable resources that public organizations depend on to offer services. Operational and administrative feasibility refers to the operational capacity of the public organization including their employees (e.g. financial and technological resources). Moore [1] illustrates public value strategy in 'the strategic triangle' (Fig. 1a), and stresses that creating public value should be central to the

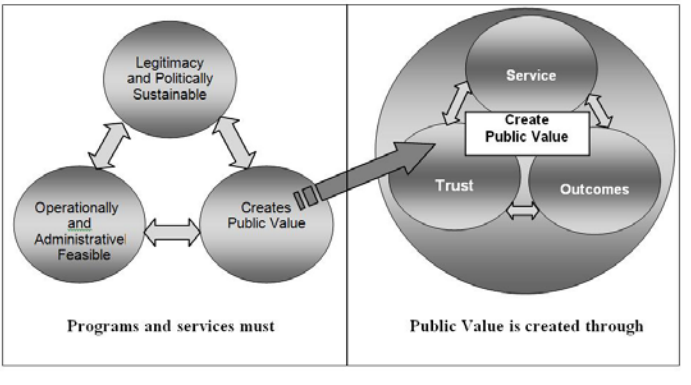

Fig. 1a. The strategic triangle Sources: Moore (1995)

Fig. 1b. Public value main sources Sources: Kelly (2002)

activities of public managers. As Moore explains, private companies create value by offering consumer products and services and creating economic value for stakeholders. For public organizations, their clients are the citizens who profit from their services and their goal is to create public value for them, and their stakeholders are the politicians/legislators who offer resources and empower them to manage.

The concept of public value is gaining considerable attention from many academics and experts [4, 15]. Moore's public value management model demonstrates a new way of thinking which moves away from the NPM era approaches that were centralized on quantitative measurable outputs [17].

Public value attempts to capture the difference between outputs and outcomes [18] and it exists at both individual and collective levels [19]. Based on the Competing Values Framework (CVF) there is no singular public value but rather multiple public values [20]. Public and governmental interaction continuously defines and redefines public value, thus public value is not fixed and it should be continually explored [21] and the multiple values addressed through either aggregation and/or choice [20]. For example, to identify public values Jorgensen and Bozeman [22] offer an inventory of seven main "value constellations" with seventy-two categories of public values. Constellation seven in the inventory refers to the relationship between public administration and the citizens and contains four groups of values: (1) Legality, Protection of rights of the individual, equal treatment, Rule of law and Justice. (2) Equity, Reasonableness, Fairness, Professionalism. (3) Dialogue, Responsiveness, User democracy, Citizen Involvement and Citizen's self-development. (4) User orientation, Timeliness and Friendliness.

Kelly [2, p. 4] however, focuses on the practical implications of public value strategy by identifying the sources of public value. They build on Moore's[1] work beginning with defining public value as 'the value created by government through services, laws, regulation and other actions'. The authors argue that public organizations can generate value that will be genuinely valued by citizens in many ways, for instance, by improving the quality of public services. However, they identified three main sources of public value: outcome, trust (including legitimacy and confidence), and services (see figure1b). The value that is created through outcome is highly connected to the following: security, poverty reduction, reduced social exclusion, advancing levels of public health and education, equity and reduced levels of homelessness. Trust, legitimacy and confidence in government are at the core of the relationship between citizens and government and are crucial for public value creation. The value created by government through services is highly dependent on the level of service quality delivered by public administration. The quality of services provided is driven by a series of factors such as: service availability, satisfaction levels with services, importance of services offered, fairness of service provision, and cost [2].

E-government is linked to the improvement of public service quality [2, 4] and this paper explores the relationship between the e-government service quality and public value creation. The next section addresses the interaction between e-government service quality and public value.

3 E-Government Service Quality and Public Value

Prins[23] defines e-government as 'the delivery of online government services, which provides the opportunity to increase citizen access to government, reduce government bureaucracy, increase citizen participation in democracy and enhance agency responsiveness to citizens needs'. The emphasis of delivering government services online relates to the definition of e-service as given by Hoffman[24]. E-service is a service conducted through the Internet that completes tasks, solves problems, or conducts transactions [24]. Providing citizens with quality e-government services can create public value, which can be augmented by citizens' positive experiences of public services [2, 4]. Given that modern public managers view the public as customers, who pay rates and taxes and should receive value in return, they should aim to satisfy citizens' demand for high quality e-services[25].

Although Kelly[2] recognizes that the provision of goods and services generate public value, there must be a trade off 'between perceived quality and perceived sacrifice' [26]. However, from the perspective of public value, both Moore[1] and Kelly[2] questioned the NPM quantitative measures. They argue that a NPM strategy often fails to address the fundamental intangible issues of public service quality[27] and state that satisfaction is generally the regular and natural subjective measure of service experience and outcome. Kearns [28] adapted the main public value concepts of Kelly[2] for the context of e-government. He argues that the success level of e-government initiatives from a public value perspective should be evaluated based on the following set of key criteria:

- The provision of services that are widely used.
- Increased levels of user satisfaction with services.
- Increased information and choice available to service users.
- Greater focus on the services that the public believes to be most important.
- Increased focus of new and innovative services towards those most in need.
- Reduced costs of service provision.
- Improved delivery of outcomes.
- A contribution to improve levels of trust between citizens and public institutions.

4 Electronic Service Quality and Information Systems Success

Zeithaml [29,p. 363] define Electronic Service Quality (e-SQ) as 'the extent to which a website facilitates efficient and effective shopping, purchasing and delivery of products and services'. E-SQ has a significant influence on consumer perceived value of the products, services and online satisfaction [30-32]. Many researchers have developed numerous measures of e-SQ in general and in the e-government field in particular. E-government systems often differ because they include broader political and social strategic goals such as trust in government, social inclusion, community regeneration, community well-being and sustainability which distinguish them from commercial information systems [27].

Issues of service quality are incorporated into DeLone and McLean's[33] commonly cited model for Information Systems (IS) success. DeLone and McLean [33] try to understand and explain the use (intention to use), perceived usefulness, and impact on individuals and organizations depending on system and information quality. Because of the dramatic changes in the information systems role in 1990s, DeLone and McLean [3] believed that the impacts (net benefits) of IS have evolved beyond the immediate users with many other impacts including societal impacts. Thus, they enhanced their original model, and propose an updated IS success model by adding a "Service Quality" dimension as a separate variable to their original success model. Furthermore, they grouped all the impact measures into a single impact or benefit category called "net benefit" [3]. The updated DeLone and McLean IS success model illustrates the relationship between system quality, information quality, service quality, use, user satisfaction, and net benefit.

Wang and Liao[34] adapt the model of DeLone and McLean for IS success to an e-government context. They state that 'e-government service process fits nicely into the DeLone and McLean updated IS success model and its six success dimensions'. In accordance with the updated IS success model [3], Wang and Liao[34] propose an e-government systems success model, shown in figure 2, including six success variables: information quality, system quality, service quality, use, user satisfaction, and perceived net benefit.

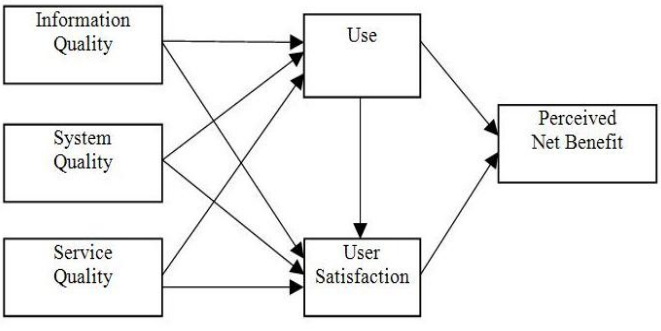

Fig. 2. Wang and Liao e-government systems success model source: Wang and Liao[34]

Wang and Liao's[34] model does not take a public value perspective of e-government into considerations. Public value approaches have become a new tool to evaluate the level of public services success as seen in the UK, Australia and some other countries. For instance, the BBC and Scottish Government have used public value to evaluate police forces, local authorities, public sports and arts [20]. Measuring quality is a highly complex exercise and subject to many interpretations. DeLone & McLean's three quality constructs of service quality, system quality, and information quality have some relevance to e-government [34] and provide a base to begin the exploration into e-government service quality. However, there is a need for a public value perspective as provided by Kearns[28]. Kearns' criteria for evaluating the success of e-Government initiatives from a public value perspective are therefore discussed together with Wang and Liao[34] and Kelly [2] in the development of the framework.

5 Conceptual Framework

The framework developed from the literature, as depicted in figure 3, illustrates the theoretical relationship between e-government service quality and e-government public value. The framework draws together the elements of public value as determined by Moore[1] and Kelly [2] and quality dimensions from the updated IS success model by DeLone and McLean [3]. Kelly [2] and O'Flynn [4] found a direct relationship between service quality and public value creation. Service quality in an e-government context is shown to be inextricably linked to information quality and system quality [13, 34]. In constructing the framework we are using the original DeLone and McLean's [3] model to re-examine Wang and Liao's [34] adaptation to fit with the broader context of public value within e-government.

Our study focuses on the direct impact that the three quality constructs (service quality, information quality, and system quality) have on public value as depicted by the DeLone and McLean's[3] concept of net benefit. In considering Kearns'[28] e-government success key criteria we find a fit between certain of the key criteria that refers to service quality as developed by DeLone and McLean [3]. These include the availability of e-government services, citizens' satisfaction on e-services, availability of choice and information, importance of the e-government services, fairness of service delivery, and cost reduction. Although these criteria can be linked to service quality the illustrated framework is deemed to include them in DeLone and McLean's factors of the three quality dimensions. Kearns' remaining key criteria of improved delivery of outcomes and a contribution to improve levels of trust between citizens and public institutions directly relate to Kelly's [2] main sources of public value, namely outcomes and trust. However these are not the focus of this study and are not further included.

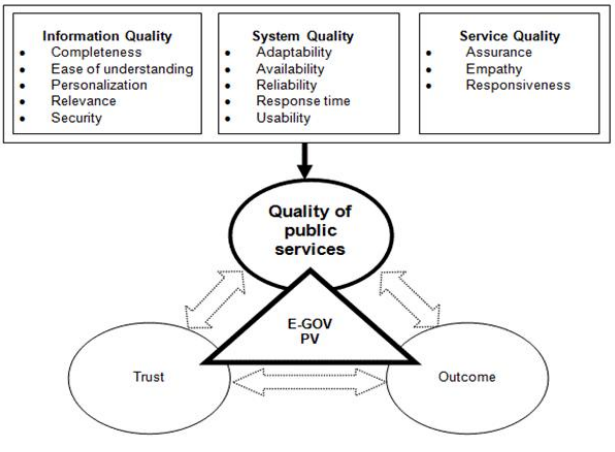

Fig. 3. The framework for evaluating the public value of e-government services

6 Conclusions and Future Research

The framework we propose in figure 3 results from a broad literature review into public value, e-service quality, and e-government. The literature suggests that providing citizens with services is one of the main sources of public value, and this value is highly dependent on the level of quality of service delivered by a public organization. The literature supports our contention that in the e-government context the quality constructs (service quality, system quality and information quality) are interlinked and provide a base to begin the exploration into e-government service quality's contribution towards public value.

Our framework represents a starting point for understanding the public value phenomena from the point of view of the citizens, and for assessing how they perceive and evaluate the e-government services. The framework is developed based on theoretical perspectives of public value and e-service quality including; the elements of public value as determined by Moore [1] and Kelly [2] and quality dimensions from the updated IS success model by DeLone and McLean [3]. We aim to empirically examine the framework to investigate its validity for evaluating the public value perceived by citizens through service quality based on the success level of e-government initiatives key criteria of Kearns [28]. A qualitative research approach using semi-structured interviews as the main method will be used for assessing the public value perceived by citizens through service quality. The framework will be used as a basis for the data collection and analysis.

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Exploring the Future of Public-Private eGovernment Service Delivery

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Abstract. Intermediary service providers are important users and actors of eGovernment. This paper explores future longer-term collaborative models and partnerships between the public sector and divers new intermediaries. Four distinguished and logical scenarios of public-private cooperation around 2015 have been developed. Each 'extrema' presents a plausible future and specific implications and effects regarding the future role and position of the intermediary (e-)service providers. Whereas the current state-of-the-art shows a wide variety of intermediate roles, each of the future scenarios tends to stress one specific role. Being prepared for these futures is a major competitive advantage. The scenarios present the framework for assessing the impact of societal trends and present a test bed for the design of future-proof eGovernment strategies.

Keywords: eGovernment, Intermediary Service Providers, Scenario Building.

1 Introduction

Intermediary service providers are important users and actors of eGovernment. Personal income tax filing for instance is being supported by social intermediaries like unions or elderly organizations. Especially small and medium sized businesses (SME's) decide to outsource administrative, secondary processes. Shipping agencies for example take care of customs declarations, book-keepers fill in and send business tax notices of assessment and salary service organizations calculate and pay social security contributions and report to the statistical department [1]. In many countries nowadays these intermediary service providers have become part of a broader eGovernment multi channel service delivery strategy [2], [3].

The role of intermediaries in eGovernment service delivery and governance has been addressed as a key area of eGovernment-specific socio-economic research challenges. Thus addressing the need to better understand and consider the needs of these intermediaries as both users and actors of eGovernment [4]. Numerous contemporary policy discussions and technological developments will influence intermediary service providers' future position and role with respect to eGovernment services delivery.

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Outcomes of the *policy* debate regarding the capacity of the state and the development of alternative mechanisms for exerting control over society might effect current trade offs within public-private arrangements. At the extreme for example it has been argued that 'governance without government' will become the dominant pattern of management for advanced industrial democracies [5].

Implementation of structural legal and *administrative reforms* will effect the intermediary's business case. It has been argued that currently an 'intermediary paradox' is preventing individual businesses to profit directly from the reduction of administrative burdens [6].

The Internet and different ICT's enable direct contact between organizations and their clients and *lower transactions cost*. Growing competition and innovation within the administrative services industry itself may result in the removal of the intermediary role in the services delivery channel [7].

Caused by low adoption rates of eGovernment services a growing number of countries chose *mandatory implementation strategies* for e-taxation and e-invoicing services [8]. Analysis of the Dutch legal obligation of e-taxation for businesses indicates as a result a strengthening of the intermediary's position [1].

What might be the result of these discussions and technological developments over time, and towards what kind of public-private partnerships might this evolve? This paper explores these possible longer-term collaborative models and partnerships between the public sector and divers new intermediaries, which could help governments and private parties to respond to changing technologies and opportunities [9]. Scenario building has been used as a methodology to address future issues and to incorporate both private and public stakeholders in the research process.

The article proceeds as follows. First, the current state-of-the-art is analysed in the next paragraph. Then, the scenario building research methodology and its application to the specific case is illustrated briefly. The resulting four future scenarios are then introduced. Each scenario presents a possible future of the position of intermediary organizations with respect to the delivery of eGovernment services to businesses in the Netherlands. The time horizon was set at about the year 2015. Finally, this paper sketches the most manifest policy implications for the development of public-private cooperation.

2 State-of-the-Art

On the one hand private sector intermediaries have been introduced by governments within delivery processes of public services. These *government commissioned intermediaries* [10] deliver services on behalf of governmental organizations. Post offices for example may facilitate the issuing of drivers licences whereas notaries transfer cadastral data. ICT has enabled the outsourcing of a number of functions traditionally performed by the public bureaucracy to private sector companies.

On the other hand citizens and businesses decide to outsource activities to commercial intermediary service providers. These *customer commissioned intermediaries* [10] provide a broad range of administrative and advisory services, which in most cases includes the inherent data reporting relationship with governmental organizations. This study has been focussed on the role of customer commissioned intermediaries providing eGovernment services to businesses.

Intermediaries provide many functions and roles that cannot be easily replaced, substituted or internalized through direct interactions. Four roles of intermediaries can be defined [1], [11], [12], [13]:

- *matching demand and supply*: bridging the gap between the service requestor's wishes and requirements and the service provider's offers;
- *information processing*: acquiring, aggregating and distributing data;
- *providing trust:* ensuring the accountability of decisions;
- *providing interoperability:* managing an institutional infrastructure used by multiple organizations.

Within the administrative data processing context of eGovernment these roles often overlap. For those who are not online for example, an intermediary can conduct eGovernment on their behalf. Thus bridging the gap between the demand and supply on the one hand and providing interoperability on the other hand [10].

Matching demand and supply. Individual businesses have the choice either to implement direct electronic relationships with governmental organizations or to outsource these interactions to intermediary service providers. The UK Office of the e-Envoy [10] states that due to their existing relationships with customers and insight into their needs, intermediaries are well placed to deliver effective eGovernment services in a customer-centric way. Agulnik [14] illustrates that intermediaries are more likely to get people to claim online, because they provide more customer-focused services and are better placed to reach the digitally excluded. "The US Government believes a partnership with private industry will provide taxpayers with higher quality services by using the existing expertise of the private sector; maximize consumer choice; promote competition within the marketplace; and meet objectives in the least costly manner to taxpayers". Researcher hypothesise that the introduction of ICT will influence the market of intermediary e-services causing a disintermediation process as result of which traditional intermediary organizations will sooner or later disappear [15], [16]. These disintermediation arguments are mainly based on reducing the cost of services transactions [17], [7]. On the other hand researchers expect new intermediaries to enter these markets, taking advantage of new market characteristics and delivering new added value services, resulting in (re-)intermediation [18], [19].

Information processing. The majority of the administrative business-to-government services originate from legal information obligations. Businesses are enforced to report data regarding their personnel, turnover, production processes, etcetera. These reporting costs are an administrative burden to many businesses. Allers [20], defines this administrative burden as "compliance cost: private sector costs of complying with regulations". Many European countries, amongst which the Netherlands, position eGovernment as a way to reduce this administrative burden of businesses [21]. Caused by the complexity, scale and diversity of these information obligations many SME's chose however to outsource this data reporting to governmental organizations. Contrary to most individual SME's, many of these intermediary service providers are able to gain efficiency benefits from electronic data reporting relationships with governmental organizations. A professional (ICT-) organization enables them to profit from economies of scale and to benefit from the so called electronic integration effect [15].

Providing trust. Sarkar et al. [22] point to the fact that trust may enforce the intermediary's position; users are likely to perceive intermediaries to be on their side. Intermediaries can enhance trust by reducing the risk of failures within the transaction process chain and are able to assure that transactions between commercial partners have been completed [11]. An intermediary as a 'trusted third party', may provide legal cont(r)acts between parties, providing the authentication and integrity of the communication needed within inter-organizational relationships. The notary is an example of such a legally institutionalised trusted third party.

Providing interoperability. Interoperability is defined as "the ability of ICT systems and supported business processes to exchange data and by that to share information and knowledge" [23]. C*ommunication services providers* primarily focus on the logistics part of electronic message interchange, as for instance the routing, archiving and tracking and tracing of data [6]. These hubs provide network services like availability, security and capacity. Those intermediaries can play a major role in the adoption and diffusion process by helping to standardise the technologies that are used to deliver e-services [24]. Next to that, not everyone will have access to electronic public services, particularly in rural areas [4] and developing countries; intermediaries can "bridge the gap between e-government implementation and social reality … and play an important role in the diffusion of e-services in relation to improving the availability, accessibility and enhancing privacy and security in a developing country" [25]. The *business services providers'* added value lies in the decoupling of business processes and message handling of organizations involved. This group of service providers consists amongst others of traditional book-keepers and advisors to which administrative task are being outsourced. New types of business service providers arise, like the application service providers (ASP's) which in general provide business functions via the Internet.

In what way might future developments influence trade-off's between these four functions and roles? Will one role prevail over the others? Unexpected cooperation between different types of intermediary service providers, hard- and software suppliers for instance will influence the future market of governmental e-services delivery [6]. The next paragraphs explore what the future *may* look like.

3 Research Method

In this study we applied *the method of explorative scenario thinking*. This structured approach does not try to eliminate uncertainty or tries to predict what is merely unpredictable, but on the contrary underlines uncertainties and ambiguity of the future. This relates to the fact that strategic decision making takes place within a context of uncertainty about the future.

Scenario building is a widely used future research method and a not uncommon method in eGovernment research [26]. In general there are different approaches of constructing and using scenarios. Some scenarios are an extrapolation of current trends (extrapolative approach), usually resulting in three scenarios: a positive, middle and negative option. Other types of scenarios present a desirable future (normative scenarios) or are the result of desk research or trend watching.

The scenario building method used in our research strongly differs from forecasting. While forecasting predicts the near future based on the extrapolation of past and current developments, scenario building cuts off the past and requires us to look solely into the future. It helps to gain more insight into possible future developments. The scenarios are neutral: they are neither good nor bad futures [27].

Scenario development process

The explorative scenarios have been developed according to the following process:

1. Identifying (un)certainties. The process starts with the identification of the most important trends and developments (driving forces) within the social, economic, institutional and organizational domain. Next, these driving forces are ordered according to their impact on the organization under consideration (i.c. the intermediary services channel) as well as according to their relative uncertainty.

2. Identifying scenario axes: Based on a 'trial and error process' the two most important uncertainties are determined. That is, the two most uncertain driving forces which are assessed to have the highest impact on the organization. These driving forces need to be independent of each other and when crossed, result in four clearly distinguished scenarios.

The result of these first two steps are presented in paragraph 4.

3. Developing the story lines. The third process step starts with the description of the end positions of the four scenarios. This means that four distinguished, plausible and logical coherent stories of the relevant environment in 2015 are created. Next, these stories are linked to the present by hypothetical events that need to take place in order for the end states to be developed. In this way each scenario has a beginning (the present), a middle and an end.

4. Wind-tunneling the scenarios. During this process step the scenarios are being used as a test bed of the future. In this case implications and effects of each scenario on the future role and position of the intermediary service providers have been analyzed.

The result of the third and fourth process steps are presented in paragraph 5.

5. Strategy development. During the last step different strategic options are generated for each scenario answering the question: "What would we want to do if this was how the real world would be developing?". In the final phase the options are then analyzed across all scenarios in order to improve them towards a robust strategy applicable in all four scenarios. Results of this final step are discussed in paragraphs 6 and 7.

Workshops and participants

Creativity and conflicting subjective opinions by (possibly biased) humans are important ingredients of scenario building methods. The scenarios in this study have been developed during four separate workshop sessions. The actual scenario building has been executed by business and governmental professionals and scientists *familiar with public-private eGovernment service delivery*. During the research project 25 experts participated, residing from: several accountancy organizations, commercial communication service providers within the agricultural and the logistics domain, e-commerce and ICT standardisation organizations, the Tax and Customs Administration, the Social Security Agency, the Ministry's of Finance and Economical Affairs and Dutch universities.

The individual workshop sessions were organised by a small project group and were facilitated by scenario building experts who assured the methodological quality of the process. The project group prepared and finalized the workshop documents. As a starting point of the brainstorms during the first workshops a long list of trends and driving forces has been produced based on desk research. The raw workshop results were captured and summarized into formal workshop documents.

During each workshop one or two process steps have been executed. Groups of five to six participants, moderated by a coach, produced results that were validated and/or enriched by other expert groups thus ensuring and stimulating a creative and goal oriented process. This iterative engineering process and the contribution of independent, multi-disciplinary experts support the validity of the workshop results. Next to that, as part of the final plenary strategic session, a new group of experts assessed the content validity and logical consistency of the scenario's.

4 Results: Key Uncertainties and Scenario-Axes

The first two steps of the scenario development process resulted in the two most uncertain driving forces which are assessed to have the highest impact on the organization under consideration (i.c. the intermediary services channel). These two most uncertain driving forces result in contradictory and alternative futures and thus feed into four clearly distinguished scenarios. This opposite to 'certain' societal developments relevant in every scenario, like the altering demographic characteristics of the Netherlands and the ongoing digitalisation. With respect to this research objective, the exploration of possible longer-term collaborative models and partnerships between the public sector and divers new intermediaries, the two key uncertainties are:

- *Trust in government (high or low).* The extent to which society (citizens and businesses) have confidence in politics, municipalities, provinces, benefit agencies, etc. In case of high trust, people perceive government acts honestly, driven by high moral standards. In case of low trust people doubt governments intentions.
- *The organization of society (limited versus unlimited).* This aspect addresses the way private persons, businesses and/or organizations/communities live and work together. In the 'limited society' uniformity and cost efficiency prevails. The 'one size fits all' mentality is based on rational economic motives which set boundaries to the freedom of choice. On the contrary, in the 'infinite, unlimited society', rational-economic drivers are less dominant. Personal motives and the desires to distinguish oneself fuel social processes.

These two key uncertainties define the four scenarios of public-private collaborative models. *Trust in government* on the vertical axis and *Organization of society* on the horizontal axis result into the four quadrants presented in figure 1.

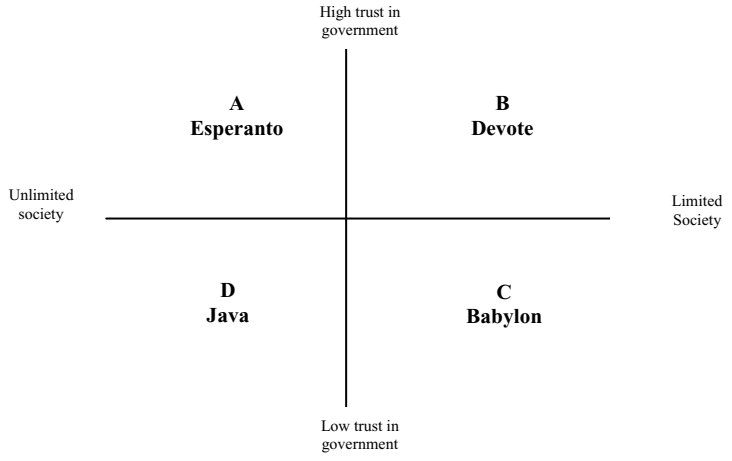

Fig. 1. The Uncertainties and Scenarios

We chose to name the scenarios after linguistic phenomena; stressing the importance of the aspect of communication and cooperation in each of the scenarios. These titles should help to grasp the meaning of each of the scenarios and to distinguish it from the others.

Esperanto, one language bridging differences, opposite to *Babylon*, referring to 'a perfect Babel' where no one understands the other.

Devote referring to be set apart and strongly affected to dedicate by a solemn act; (in the Netherlands also referring to a software company specialized in custom made software), opposite to *Java*, a public license, cross platform, software language.

5 Results: The Four Scenarios

This paragraph presents in sum the four distinguished, plausible and logical scenarios of public-private cooperation around 2015. The scenarios are presented as 'extrema' in order to contrast with each other. Each description starts with a short coherent storyline of the relevant environment, characterized in terms of political, social, and/or economical themes. Next, implications and effects of each scenario regarding the future role and position of the intermediary (e-)service providers are being highlighted.

Scenario Esperanto

The scenario Esperanto presents a safe and *high trust society*. Security is a political top priority surpassing privacy. Persons and organizations focus on cooperation within *changing collaborative models*. Both citizens and businesses are compliant and prefer high trust relationships with government. They are however very *demanding* regarding the quality, flexibility and speed of governmental e-service delivery. People prefer to work for themselves or within private companies in stead of being a civil servant. Confronted with many employees retiring, most governmental organizations face *human resource shortages*. Sustainable innovation is a top priority of many non

governmental organizations. Cooperation between European member states is close. This and the continuing globalisation empowers the Dutch open economy. Pushed by a growing spread of Internet applications services, ICT has become an integrated part of daily life. Esperanto pictures a world *connected by open standards* facilitating common understanding.

Implications and effects. Intermediaries *intensify their relationships* with governmental organizations. On the one hand forced by growing direct high trust relationships between individual businesses and government, on the other hand stimulated by growing governmental personnel shortages. These intermediaries become *co-producers of electronic governmental services* realizing substantial cost savings in the complete life cycle of governmental e-services. Using their former information and network position intermediaries are able to deliver custom-made, *highly personalized services*. To be able to cope with the growing number of (often project based) cooperative models, intermediaries try to *specialize*. They organize into groups of similar business partners in search for market influence or dominance.

Scenario Devote

The scenario Devote presents a society focused on *self interest*. Citizens more often feel unsafe and ask for more police and strict law enforcement. Citizens perceive high trust in government and its civil servants. By consequence, governmental organizations are in the position to formulate and execute policies regarding a broad range of societal issues. On the contrary, people have *lost their faith* in commercial organizations. The financial and economical crisis has undermined their legitimacy. Empowered by the application of new sustainable technologies governmental institutions have become *well organised, efficient organizations*. They do not experience any problems in finding new and qualified personnel. These organizations are now the driving force behind large innovative, former commercial, projects like for instance the establishment of wind energy parks in the North Sea. Stimulated by the European Commission specific national digitalisation programs are being implemented, focussing on efficient and *uniform local e-service delivery*.

Implications and effects. Within this scenario the intermediary's network position worsens very rapidly. A lack of trust *undermines their independent commercial market position* towards individual customers. On the other hand governmental organizations are able and capable to standardize e-service delivery. Thus resulting in as 'one size fits all'- quality of service accepted by citizens and businesses. On the operational level intermediary organizations will provide *'neutral' data processing capacity*, labeled as extensions of government. Groups of intermediaries negotiate *strategic alliances* together with groups of governmental organizations. This high level cooperation aims at knowledge transfer and agenda setting in order to regain trust and define and develop new business.

Scenario Babylon

The scenario Babylon presents a *society of communities*. Citizens are pretty much self-reliant, have a low confidence in government and offer resistance to governmental interventions. Citizens prevail *'small scale' and 'home town'*, primarily

focusing on national regions rather than on global or European cooperation. Protectionist trade barriers slow down innovation and globalization. As a result the open Dutch economy is in recession. *Group identity empowers* its members. Elderly people for instance organize into communities, protecting their own interests and creating their own services organization. Consensus is no longer the obvious political strategy, but each group strives for the realization of specific interests. Society is less interested and less in need of generic governmental service delivery. *Governmental influence diminishes* towards law enforcement issues and free market regulation. Government regulates the bargaining space between the different *societal 'blocks'* (groups of citizens and businesses) and defends transcending national interests.

Implications and effects. Within this scattered society intermediary service providers will become the *glue* between different societal groups. These groups are niche markets to commercial service providers. Some intermediary organizations have become the group's sole representative and *data gateway* in connection to other groups. Providing interoperability is their core competence. Towards government, these intermediaries represent the group and provide *specific eGovernment services* towards individual group members, citizens and businesses. A small number of *strategic alliances dominates the market* of intermediary e-services and defines and regulates the 'glue infrastructure'. This group of alliances is the negotiating party towards government and other industry groups.

Scenario Java

The scenario Java describes a *scattered society* in which citizens and businesses have a low level of trust in government. Citizens have to be self-reliant and focus on personal interests. *Personal motives* and the desires to distinguish oneself fuel social processes. As a result of increased international mobility, foreign employees have now become a familiar phenomenon in Dutch society. Numerous ICT applications enable businesses and citizens to interact and organize in different ways. *e-Communities* are the new pillars of society. Service delivery and production are increasingly organized in a project based manner. Within these projects and communities people and organizations *temporarily unite private interest* to realize common objectives. Government concentrates on a few basic policy domains like security and defense. If possible other governmental tasks are being outsourced to private companies.

Implications and effects. Within this scattered society trust provision is scarce but vital. Neither government nor societal groups are trustworthy or stable enough. Independent intermediary organizations will become the *dominant societal trust providers*. Their service delivery may even be extended towards other domains of common interest like insurance, finance, and social security. In that way intermediary service providers will become *the dominant communication and service channel* towards individual citizens and businesses. However, the perceived quality of intermediate service delivery heavily depends on the providers ability to customize and personalize transactions. Volatile e-communities ask for an agile organization of service delivery, and demanding individuals can only be satisfied by means of customer intimacy.

6 Conclusions

This paper's objective is to present possible future, innovative and longer-term, collaborative models and partnerships between the public sector and divers new intermediaries, which could help governments and private parties to respond to changing technologies and opportunities. Table 1 summarized the four scenarios developed in this study, from an intermediary's viewpoint.

Table 1. Scenarios for Future Public-Private Collaboration

Scenario:	**Esperanto**	**Devote**	**Babylon**	**Java**
Trust in government	High	High	Low	Low
Openness society	No frontiers	Limited	Limited	No frontiers
Intermediary relation to government	Co-producer of eGovernment services	Strategic, high level partnerships on sector level	Distant business representative	Communication channel towards businesses
Relation to customers	Distant	Distant	eGovernment services provider	High trust provider
Added value	Cost saving for government	Low, primarily data processing	Specific niche services	Risk management and trust provision
Intermediary business model	Specialization	Strategic alliances	Strategic alliances	Customer intimacy and services
Dominant role and function.	Demand-supply	Neutral information processing	Interoperability between power centers	Trust provider, operational interoperability

Each of the four scenarios presents a different modus of public-private cooperation; some of which are potentially threatening to commercial service providers, others tempting and full of commercial opportunities. Some scenarios present omni present and well appreciated eGovernment services, in others eGovernment in hidden behind commercial intermediaries. The most provoking conclusion is perhaps the fact that *each scenario presents a plausible, possible future*. Independent of our personal or organizational interests and plans, future society might develop in one of these (neither 'good', nor 'bad') directions.

One of the most interesting findings concerns the intermediary's future role and function. Whereas the current state-of-the-art shows a wide variety of intermediate role's, each of the future scenarios tends to stress one specific role. The same holds for the dominant type of e-service delivery; varying from servicing private e-communities to the co-production of eGovernment services.

Being prepared for these futures is a major competitive advantage. These scenarios present the framework for assessing the impact of societal trends and present a test bed for the design of future-proof eGovernment strategies.

An important critical success factor has been the role of the independent facilitators who assured the result's objectivity and plausibility. Whereas each participant in the research project had its own perception of a desired future, based on personal feelings and organizational interests, the method of scenario building inspired the group to look frankly into the future.

7 Discussion

What would we want to do if this was how the real world would be developing?" This question is the starting point from which organizations can begin with the assessment of their current eGovernment strategy. Each scenario presents a different view on the role of open standards, multi channel strategies, the quality of service and strategic partnerships.

Regardless of which scenario will deploy at the end, two organizational aspects are crucial in each transition process: agility and the ability to establish strategic alliances. These two organizational characteristic are critical success factors for the future 'survival of the fittest'. Each scenario presents a change in activities, responsibilities and inter-organizational relationships.

The process of change starts with the awareness that each organization is part of the changing network towards one of the possible scenarios presented in this paper.

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Technology as the Key Driver of Organizational Transformation in the eGovernment Period: Towards a New Formal Framework

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Abstract. Relationship between technology and organisational changes in public sector has become the subject of increasingly intensive research within the last decade. Studies dealing such relationship could be divided in two major groups - first group regards ICT in the e-government period as the key factor of organizational transformation and the second group regards ICT as an equal and co-dependent element in relation to other organizational factors. These two groups of studies could be further classified within two organizational theories - *Technological Determinism* and *Socio-Technical Theory*. The aim of this paper is to critically analyse those theories in the sense of formal theoretical framework to explain relationship between ICT and other organisational factors through the lens of Leavitt`s diamond. On the basis of critical analysis and synthesis of available literature the draft of a new conceptual model for explaining such relationship will be proposed.

Keywords: Technological determinism, Socio-technical theory, Leavitt`s diamond, Model representing the role of ICT in e-government period.

1 Introduction

For at least four decades, technology has gradually penetrated and influenced the operation of public sector organisations by changing and increasing its role with every new technological cycle. In the early stages, the influence was primarily visible in regard to the execution of administrative and technical as well as simpler professional tasks. During the later stages of intensive computerisation in particular during the e-government period the influence of technologies upon the execution of processes rapidly increased, thereby causing them to become more standardised, formalised and more effective. The internet and related technologies caused a major leap forward in all spheres of operation of public sector organisations, namely in internal and external operations.

In parallel, to development of e-government the relationship between technology and organisational changes in the public sector has became the subject of increasingly intensive research and study. On the one hand a number of authors claim that information communication technologies (hereinafter referred to as ICT) in the e-government period have the potential to create radical organisational changes

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(e.g. [3], [4], [13], [30], [32]). However, on the other hand there are also the authors who believe that ICT is only one of the elements within an organisation, which is reciprocally related to other elements within as well as outside of the organisation, and only appropriate connection between them enables optimum exploitation of the potentials of new technologies (e.g. [10], [22], [27], [38]).

Technology, as a factor in the development of organisations in the broadest sense has for almost a century been the subject of interest to numerous social sciences (political and organisational sciences in particular). In studying its influences upon various social systems, numerous "theories" have also been developed, which are used to formalise this relationship. For our further analysis we selected just the two of them: the *Technological Determinism Theory* on the one side and the *Socio-Technical Theory* on the other.[1]

Our initial assumption in this study has been that the development of e-government and its influence upon the organisational changes of government cannot sufficiently be placed into either of the above mentioned theories and models. On one side ICT is seen as the key factor of transformation of public sector organisations, however on the other side its influence more than ever depends upon other factors within an organisation.

The purpose of this paper is to follow the following three goals:

1. Critically analyse the above mentioned theories, particularly from the perspective of their applicability in the formal theoretical framework for explaining relationships between the increasingly intensive use of ICT in the government and technology related organisational changes.
2. Develop and introduce the draft of a new conceptual model for explaining the role and relationship between ICT and other key factors in an organisation for the successful development of e-government.
3. Examine the proposed model through analysis of the findings and statements of other authors, and define in more detail its features.

Chapter 2 introduces theoretical aspects regarding the role of technologies in changing organisations, analyses selected conceptual models and theories and examines their applicability towards explaining relationships between the development of e-government and related organizational transformations. Chapter 3 introduces the draft of a new conceptual model, a more detailed definition of its features and its evaluation. That is followed by the concluding chapter.

2 Theoretical Aspects Regarding the Role of Technologies in Changing Public Sector Organisations

As a theoretical starting point for understanding the role of technologies in changing organisations, Leavitt's definition of organisation will be used, which is best illustrated by the well known Leavitt's Diamond [23]. For an in-depth analysis of the relationship between technology and the changes to fundamental institutional

[1] However, one of the theories that would be worth mentioned at that point is also Structuration Theory proposed by Orlikowski; however this paper focused on first two theories.

structures, we selected and examined two known theories appropriate for our discussion - *Technological Determinism Theory* and the *Socio-Technical Theory.*

2.1 Leavitt's Extended Model

One of the rather old and most recognised conceptual views regarding organisations is represented by Leavitt's Diamond (1964), which illustrates an organisation as a system of four entities – people, structure, tasks, and technology – and is frequently used as the basis for analysing the influence of technologies upon changes in organisations (e.g. [8], [26]). Later, the model was extended by other authors (e.g. [18]) and a fifth entity was added: organisational culture (Fig 1). These key elements of organisation are interdependent, which means that changes in one of them cause changes in the other.

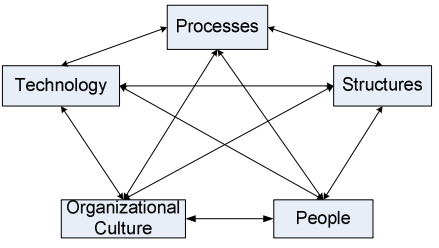

Fig. 1. Leavitt`s Extended Model (Source: Kovačič et al., 2004, p. 66)

2.2 Technological Determinism

Technological determinism is a reductionist theory that presumes that the technological process defines the social progress. Technological determinism regards technology as the basis of society in the past, present and future. New technologies transform society on all levels: institutional, social and on the individual level [6]. However, such a definition contains the view, which assumes that technology is more or less independent from social matters. Here we speak of so-called hard determinism. On the other side, soft determinism appeared as a response to the strict principles of hard determinism, and it emphasises the increased roles of inclusion and selection by an individual. According to this softer view, technology is placed within complex social, economic, political and cultural networks [20]. Even within soft determinism, technology is still the leading factor of social development, but it allows for an individual to adopt a decision regarding the predicted outcomes of a specific situation. It is interesting that within social science research dealing with modern technologies such as the internet, we are witnessing the appearance of tendencies towards explaining the relationship between technology and society in a relatively deterministic manner (see [7]). If we place technological determinism within the context of the organisation, the technology in an organisation is the factor that directs the transformation of organisations and their elements.

2.3 Socio-Technical Theory

Socio-Technical Theory developed in the mid 20th century when researchers examining the impact of technologies on business efficacy and productivity came across some cases where employees resisted the introduction of new technologies through not achieving expected results and so on. Therefore, supported by sociological, psychological and anthropological sciences, the researchers established that the solution to such problems lies in combining the technological and sociological system.

Socio-Technical Theory regards an organisation as a socio-technical system built from two correlated systems – social and technical. The technical system is composed of the processes, tasks and technologies needed to transform input into output, whereas the social system is composed of people (their believes, skills, values, knowledge, needs), the relationships between them, remuneration systems and authority structures [5]. Every (trans)formation of an organisation as a system must consider these two sub-systems. A return to the classic socio-technical principles provides an environment for successful organisational changes following the implementation of new technologies [2], [5]. As can be seen from Fig 1, Leavitt's view of organisation and Socio-Technical Theory is heavily intertwined, which makes Leavitt one of the founders of this theory.

2.4 Critical Analysis of Technological Determinism

In accordance with technological determinism, technology directs the transformation of public sector organisations, which means that technology or its potential cause changes in processes, structure, people and organisational culture. These elements are separate and all they allow is a free choice regarding the use of potentials, which are enabled by modern ICT. In this case, technology is an independent variable, whereas processes, structures, people and culture are dependent variables (Fig 2). In that sense, ICT in e-government period is seen as a tool for the reform of bureaucracy. Jain e.g. [15] analyses e-government from two perspectives using the objective of Weber's bureaucratic model; first, as a tool for the "reform" of bureaucracy and second, that unsuccessful implementation of e-government is a result of bureaucracy. E-government as a tool of bureaucracy is also defined by the OECD [31], which claims that e-government is a key factor in the reform of government and that ICTs support this reform in many areas. Bellamy and Taylor [4] also justify such perspective by claiming that government can be transformed on the basis of technology, because information technology enables a new flow of information that endangers old norms and abilities.

However, some highly cited authors strongly oppose these "optimistic" perspectives regarding the reform potential of technology (e.g. [19]) and support their scepticism through numerous studies and empirical research that was conducted in 1980s and 1990s in the US. Furthermore, within the last decade, there emerge authors who establish that the transformational function of technology is not deterministic, because in practice equal inputs often give completely different results in various environments within the development of e-government (e. g. [36]). It can be said that the Theory of Technological Determinism is too one-dimensional and one-sided and

does not provide enough formal framework for examining the influence of e-government regarding organisational changes.

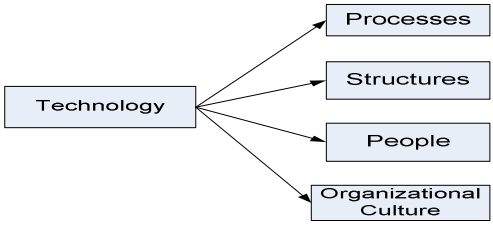

Fig. 2. Adjusted Leavitt`s Model Following Technological Determinism

2.5 Leavitt's Model in the Context of Socio-Technical Theory

Leavitt's model within the sphere of Socio-Technical Theory (see Fig 1) has already been introduced in the introduction to this chapter, because Leavitt [23] is one of the authors of this theory. In accordance with the Socio-Technical Theory, public sector organisations are systems of correlated elements that are interdependent, and changes in one of them cause changes in the other. In this case, technology is only one of the components of the socio-technical system, and as long as processes, people, cultures and structures remain at the level of bureaucracy, the potentials of modern technologies cannot be exploited. Van Wert [38] believes that the success of implementation of e-government is questionable, because officials want to own information and not share it and want their organisation to "shine" as opposed to others. On the basis of examining the implementation of e-public procurement in the local governments of Great Britain, Maniatopoulos [27] warns of the importance of organisational, political and economic factors, which influence the development and use of the technologies of e-government such as e-procurement. Another advocates of the socio-technical perspective is Fountain [10], who claims that ICT and organisational/institutional factors are reciprocally connected, that each of them may be a dependent and an independent variable, as each of them causes the other one.

3 Towards Development of the New Formal Model

ICT in e-government period is regarded by some authors as a tool for the radical transformation of public sector organisations and by others as merely one of the elements within an organisation that is equivalent to all of the other ones. Both author`s groups arguments could be agree to some extent but not completely. The superficial overview of I(C)T's role during various periods of the public sector's modernisation, as provided in the introduction, already leads to the establishment that its most powerful role has been played during the e-government period, constituting the greatest potential for transforming public sector organisations. This exact period of time is however facing the biggest challenge so far. No matter how high ICT's potential may be, no organisation can be transformed by it alone if it is not prepared,

if it refuses to denounce the traditional, rigid sector and to form links within the organisation itself and among organisations, if it does not possess sufficient technical, system and process knowledge, if its managers refuse to take responsibility for change.

ICT's powerful role during the e-government period and its strong dependence on other elements within the organisation is precisely the reason which prevents both the social-technical and classical technological determinism theories from providing a satisfactory description and definition related to the transformation of organisations during the e-government period. That leads to the conclusion that a new model is needed that enables ICT to be placed into the centre of the socio-technical system as the key driver of organisational transformation. ICT as a central actor in such a model, however, cannot operate independently. An optimum potential utilisation is strongly co-dependent on the other elements of the model. This leads to the creation in some ways of a new conceptual model, which would provide the best description of the interdependent relationships among the key factors in the e-government period (Fig 3).

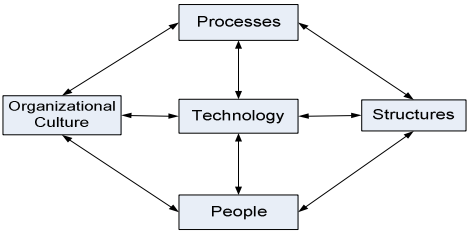

Fig. 3. Conceptual Model Representing the Role of ICT in the E-Government Period

3.1 Primary Characteristics of the New Model

Being recognized ICT is a key factor during the e-government period and holds great potential for transforming public sector organisations. New technologies enable horizontal and vertical process integration [21], simplified and significantly accelerated process execution, improved information management, more complex transactions, decreased staff burdening [14], [16] and improved public services [14], [17], [24]. They hold the potential for changing cultures, values and thinking [1].

These are only but a few of the potentials that new ICTs undoubtedly have and which impose their central role during the e-government period. They are, however, integrated into organisations that throughout the 20th century were dominated by Weber's bureaucracy model, based upon a strict top-down hierarchy. Modern ICT can be thus confronted with a whole array of factors which prevent organizations from fully benefiting from its potential. This raises the question of which changes should occur in the other elements of the organisation that those potentials could be exploited to the optimum level. Based on the review of existing studies in this field, where those changes have already been detected or highlighted, the extension of necessary changes in every given element of our proposed model is provided in Table 1.

Table 1. Necessary changes to individual elements, which provide the most comprehensive utilisation of ICT's potential

Element	Extent of changes	Authors
Processes	- changes to the entire process - significantly accelerated process execution; process can be executed 24/7 - horizontal and vertical process executions - changes to the rules, which determine the process (trust, safety, maintenance and integrity)	Layne & Lee (2001), Scholl (2003), Kim et al. (2007), Klievink & Janssen (2009), Politt (2010)
People	- employees have to gain new and complex skills (e.g. self-organisation, confrontation with unexpected tasks) and knowledge - leaders must be able to combine their ICT knowledge and skills with their understanding of the process dimension - leaders must be able to develop a strategic vision and comprehensive human resource management, project management and user-orientation strategies	Layne & Lee (2001), Ho (2002), O`Donnell et al. (2003), Griffin et al. (2004), Leitner & Kreuzeder (2005), Indihar Štemberger & Jaklič (2007)
Culture	- transition to a service-oriented culture - the employees must overcome departmentalisation thinking - employees must be encouraged to perform more challenging tasks, to be willing to take responsibility - inter-departmental and inter-organisational cooperation and trust must be strengthened - the leaders' way of thinking must be radically changed	Ho (2002), O`Donnell et al. (2003), Schedler & Schmidt (2004), Leitner & Kreuzeder (2005), Kim et al. (2007)
Structure	- on one hand, due to the horizontal and vertical integration, tasks are undergoing a de-specialisation process, while on the other hand, a new task-structuring is required - Data digitalisation must be standardised, procedures being standardised for several departments or organisations simultaneously - as procedures are simplified and informatised, the level of formalisation is decreased, while, on the other hand, a new procedure execution method requires new record safety, trust, maintenance and integrity rules - decisions on the introduction of e-government is transferred to e-leaders, which appear both on the top and the middle level, which leads to a decentralised decision-making process - the hierarchical structure is transformed into a network one	Layne & Lee (2001), O`Donnell et al. (2003), Scholl (2003), Griffin et al. (2004), Leitner & Kreuzeder (2005), Maniatopoulos (2005), Kim et al. (2007), Klievink & Janssen (2009), van Veenstra et al. (2010)

The text below provides an assessment of the suggested model's individual elements with illustrative examples from existing studies.

3.2 Model Evaluation

In order to examine our assumptions regarding ICT's role and its great co-dependence with other key institutional elements and to support our proposed model some illustrative e-government examples will be presented below.

ICT as the key factor

According to OECD's report [30], the internet and related technologies hold great potential for transforming the structure and processes in administration. Vintar [39] links the application of electronic documents, e-business and internet in internal and external administration operations with the introduction of new systemic and organisational solutions as well as new management models. ICT introduction positively affects the development of public sector organisations by decreasing the number of hierarchical levels [29], [37], transforming a hierarchical structure into a network one, decentralising activities and developing new horizontally integrated and strategically independent agencies [29]. Procedure standardisation would promote the creation of a network structure [37] and enable release of control [25].

ICT and processes

The processes themselves are most subjected to ICT's influences and potential. A rather significant number of authors reports about an increased process efficiency during the e-government period, mainly in terms of shortening the required time for executing a process [16], [28], [33], standardizing procedures [27], [33], [37] and facilitating and improving information management and exchange [14], but problems occur when a horizontal (integration among functions and services) and vertical (integration among organisations) process execution is required. In his analysis of U.S. municipal administrations, Moon [28] finds that most administrations have reached Level 1 or 2 in service development (one- or two-way interaction), but none have been able to reach Level 4, which requires vertical and horizontal integration. Groznik and Trkman [12] link the unsuccessful completion of the e-public procurement process in Slovenia to an inadequate regeneration of business processes for reasons of insufficient horizontal integration. Klievink and Janssen [17], in their analysis of progress towards joined-up government, which requires the integration among several organisations and departments, find that most Dutch public sector organisations have reached Level 2 – integrated organizations, but still have a lot of work to do until reaching Level 4 or 5 (inter-organisational integration and joined-up government).

ICT and structures

Non-utilisation of the potential for vertical and horizontal process execution is thus linked to the existing public sector organisation structure. Laynee and Lee [21], whose four-stage model of e-government transformation is based upon vertical and horizontal integration, highlighted that a management structure, based on specialisation, cannot be efficient during the e-government period. The tasks must be re-structured [35]. Based upon his analysis of the introduction of e-public procurements into the British local administration, Maniatopoulos [27] finds that the structural arrangement of local administrations is the main challenge of an e-

procurement system implementation. Semi-autonomous units are based upon specialised services and are run by higher managers, intense rivalry and lack of cooperation. The change process is thus strongly affected by traditional structures. Li [25] finds that, despite large investments into technology, at the point of introducing e-government into the Chinese public administration, its structure remained essentially bureaucratic. The main challenge is thus how to apply this technology for achieving changes of the organisational structure towards an improved de-centralisation and decreased formalisation.

ICT and people

Closed and inflexible structures can certainly be subscribed to a great extent to the organisation's management, which is held responsible by many authors for the non-utilisation of ICT's potential. Elnaghi et al. [9] place emphasis upon the role of leading figures in an organisation as the key actors for a successful e-government implementation; they point out that lack of authority is the main obstacle towards the development of e-government, which is regarded by leaders as a technological mission and not as a strategic vision. A lack of project management is one of the main reasons for the rather unsuccessful implementation of e-procurement in Slovenia [12]. Similarly, Klievink and Janssen [17], through analysing the progress toward a joined-up Dutch government, where most organisations can be found on the starting levels, found that project management and leaders play an ever-increasing role in achieving higher levels. A successful introduction of e-government requires interdisciplinary approaches and leaders who are able to combine their ICT knowledge with their understanding of the process dimension [11].

Inadequate staff competences also greatly hinder the utilisation of ICT's potential. The employee must be conscious of the fact that he/she is becoming the supervisor of the entire process and that he/she is not merely the person performing a task [21]. Moon [28] suggests that the biggest obstacle in the process of introducing e-government initiatives into US municipal administrations is the lack of staff technical knowledge and the lack of technical staff members.

ICT and organisational culture

The staff is also closely linked to the organisational culture, which is regarded by some as the main culprit for poor utilisation of ICT. Maniatopoulos [27] thinks that the greatest challenge in introducing new technologies is the dominant organisational culture, which requires a different way of thinking. He reports that introducing XML standards into e-procurement procedures, organisations did not show great enthusiasm for the introduction of such structures and that employee still tend to execute the procedure manually. Also Klievink and Janssen [17] saw changes in culture as one of the conditions for successful transition to higher levels of joined-up government.

The illustrative examples presented above show rather clearly that ICT on one hand holds the potential for radical transformation of public sector organisations, while on the other hand show that the utilisation of its potential is more than ever dependent upon the willingness of other organizational elements to accept it. The examples also clearly show that authors, who analyse the non-utilisation of ICT's potentials, find obstacles for that not only from one but from more factors. That indicates a great level of co-dependence among those factors as well as that an

optimal introduction and utilisation of ICT's potentials requires a comprehensive multi-dimensional approach.

4 Conclusion

By confronting two recognised theories in the field of social sciences – technological determinism and socio-technical theory and by defining a new model – this paper attempts to introduce a new perspective regarding the discussed problem and to contribute to further examination and a stronger integration of the relationship between ICT and organisational changes during the e-government period. As some research have already shown, ICT plays a more important role during the e-government period than ever before, while at the same time its inter-dependence upon other elements in the organisations must form stronger links than ever before in order to provide for the maximum realization of the ICT's potentials. New relationships and dependencies among the main factors of successful e-government development, attempted to be formalised through the suggested model, are on the verge of being developed. A successful implementation of the model in practice requires a strategic approach towards the development and transformation of public sector organisations.

At the same time, there must be acknowledged the limits and weaknesses of the suggested model, because a successful introduction of e-government and required execution of organisational changes in public sector organisations are not only affected by elements within organisations, but also by external factors such as the political will for change, financial resources, elimination of distrust towards new technologies, legal obstacles, user demands, etc. This model should be supplemented further with external factors, which are extremely specific in the public sector and cannot be directly compared to private sector organizations.

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