

## Electronic Government and Electronic Participation

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# ELECTRONIC GOVERNMENT AND ELECTRONIC PARTICIPATION

# Innovation and the Public Sector

The functioning of the public sector gives rise to considerable debate. Not only the efficiency and efficacy of the sector are at stake, but also its legitimacy. At the same time we see that in the public sector all kinds of innovations are taking place. These innovations are not only technological, which enable the redesign of all kinds of processes, like service delivery. The emphasis can also be put on more organizational and conceptual innovations. In this series we will try to understand the nature of a wide variety of innovations taking place in the public sector of the 21st century and try to evaluate their outcomes. How do they take place? What are relevant triggers? And, how are their outcomes being shaped by all kinds of actors and influences? And, do public innovations differ from innovations in the private sector? Moreover we try to assess the actual effects of these innovations, not only from an instrumental point of view, but also from a more institutional point of view. Do these innovations not only contribute to a better functioning of the public sector, but do they also challenge grown practices and vested interests? And what does this imply for the management of public sector innovations?

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# Electronic Government and Electronic Participation

Joint Proceedings of Ongoing Research, PhD Papers, Posters and  
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# Preface

Under the auspices of the *International Federation for Information Processing* (IFIP) Working Group 8.5 (Information Systems in Public Administration), or IFIP WG 8.5 for short, the dual IFIP EGOV-ePart conference 2016 presented itself as a high-caliber five-track conference and a doctoral colloquium dedicated to research and practice on electronic government and electronic participation.

Scholars from around the world have used this premier academic forum for over fifteen years, which has given it a worldwide reputation as one of the top two conferences in the research domains of electronic, open, and smart government, policy, and electronic participation.

This conference of five partially intersecting tracks presents advances in the socio-technological domain of the public sphere demonstrating cutting-edge concepts, methods, and styles of investigation by multiple disciplines.

The *Call for Papers* attracted over one hundred thirty-five submissions of completed research papers, work-in-progress papers on ongoing research (including doctoral papers), project and case descriptions as well as four workshop and panel proposals. Papers in the Joint Proceedings of IFIP EGOV-ePart 2016 comprise accepted submissions of all categories and all tracks with the exception of twenty-four papers from the General EGOV track, the Open/Big Data Track, and the Smart Gov Track, which were published in Springer LNCS vol. 9820, and fourteen papers from the General ePart Track and the Policy Modeling and Policy Informatics Tracks, which were published in Springer LNCS vol. 9821.

As in the previous years and per recommendation of the Paper Awards Committee under the lead of the honorable Professor Olivier Glassey of the University of Lausanne, Switzerland, the dual IFIP EGOV-ePart 2016 Conference Organizing Committee again 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 has always been a highlight of each dual IFIP EGOV-ePart conference.

The dual IFIP EGOV-ePart 2016 conference was jointly hosted in Guimarães, Portugal by University of Minho (UMinho) and United Nations University Operating Unit on Policy-Driven Electronic Governance (UNU-EGOV). Established in 1973, UMinho operates on three campuses, one in Braga, and two in Guimarães, educating approximately 19,500 students by an academic staff of 1,300 located in eight schools, three institutes and several cultural and specialized units. It is one of the largest public universities in Portugal and a significant actor in the development of the Minho region in the north of Portugal. UNU-EGOV is a newly established UN organization focused on research, policy and leadership education in the area of Digital Government, located in Guimarães and hosted by UMinho. The organization of the dual conference was partly supported by the project “SmartEGOV: Harnessing EGOV for Smart Governance”,

NORTE-01-0145-FEDER-000037, funded by FEDER in the context of Programa Operacional Regional do Norte.

Although ample traces of Celtic and Roman presence and settlements were found in the area, Guimarães became notable as the center of early nation building for Portugal in the late 11th century, when it became the seat of the Count of Portugal. In 1128, the Battle of São Mamede was fought near the town, which resulted in the independence of the Northern Portuguese territories around Coimbra and Guimarães, which later extended further South to form the independent nation of Portugal. Today, Guimarães has a population of about 160,000. While it has developed into an important center of textile and shoe industries along with metal mechanics, the city has maintained its charming historical center and romantic medieval aura. It was a great pleasure to hold the dual IFIP EGOV-ePart 2016 conference at this special place.

Many people make large events like this conference happen. We thank the over one-hundred members of the dual IFIP EGOV-ePart 2016 Program Committee and dozens of additional reviewers for their great efforts in reviewing the submitted papers. Delfina Sá Soares of the Department of Information Systems at the UMinho and Tomasz Janowski of the UNU-EGOV and their respective teams in Guimarães, Portugal, were major contributors who helped organize the dual conference and manage zillions of details locally. We would also like to thank the University of Washington organizing team members Kelle M Rose and Daniel R Wilson for their great support and administrative management of the review process and the compilation of the proceedings.

September 2016,

The dual IFIP EGOV-ePart 2016 Lead Co-organizers

*Hans Jochen Scholl* (2016 Lead organizer)

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Along with co-chairs Yannis Charalabidis, Mila Gascó, Ramon Gil-Garcia, Panos Panagiotopoulos, Theresa Pardo, Øystein Sæbø, and Anneke Zuiderwijk

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# eParticipation

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# Assessing Mobile Participation: A Case Study of iCitizen, Buycott and USHAHIDI

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**Abstract.** The ubiquity of mobile devices has led to the provisioning of mobile e-administration services in many countries and it possesses the potential to introduce new practices of e-participation specifically. Applying case study methodology, this paper identifies iCitizen, Buycott and USHAHIDI as practical examples for m-participation offers and compares them in regards to features, influence in the policy cycle, and usability. The lessons learnt highlight that m-participation should be a part of a wider strategy that includes offline and other media channels, that it utilises mobile features such as location-based services and Social Media integration to enhance efficacy of participation, and to make the offer focused on the user experience rather than a singular topic.

**Keywords.** E-participation, m-participation, mobile applications, evaluation

## 1.Introduction

Clark et al. [1] argue that the use of mobile devices in e-participation can increase the overall number of participants. The number of mobile phone users worldwide are estimated to be at 5.47 billion in the year 2017 (see Statista [2]), making mobile devices de facto ubiquitous. The reasons for this vast expansion are decreasing costs of purchasing and maintaining a mobile device, and increasing network coverage through telecommunications companies. Mobile platforms provide a way of motivating deeper citizen participation through its unique technology attributes. Misuraca [3] argues that mobile devices improve the chances for success when organising civic campaigns and engaging citizens in information sharing and decision-making.

At the time of writing, research on mobile participation (hereafter referred to as m-participation) seems to be present yet leaves distinct room for improvement in terms of terminology and scope of research. This is due to the field being fairly new and quick-paced. It is lacking a sound number of practical applications showing what real world impact different tools of m-participation could have. The aim of this paper is to identify offers of m-participation in practice and to analyse and compare them in regards to features, influence in the policy cycle, and usability. Eventually, lessons learnt are presented.

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The remainder of the paper surveys the state of play in the literature and it provides a definition for m-participation in section two. It presents the data collection process and the applied case study methodology in section three. The comparison of three mobile apps is conducted in section four, followed by a concise discussion in section five and a research outlook in section six.

## **2.Literature review**

### *2.1. E-participation and m-participation*

Overviews of e-participation research have been collated by Sæbø et al. [4], Medaglia [5] and Sussha and Grönlund [6] amongst others. Their conclusions were that the field is characterised by multiple disciplines describing and analysing what they see in practice and that it is marked by quick dynamics in terms of publications and shifts in research foci. Political and communication science as well as information systems science are the main contributors to this field. Medaglia advises researchers to take into account more contextual factors, to put a greater emphasis on the citizen, and to design research that is in itself participatory. This paper aims at following this advice by trying to take a broader look into the literature and by evaluating the cases presented here with a more direct connection to real-world applicability.

According to Van der Meer et al. [7], scholars have described e-participation development as a linear growth model with the stages information, interaction, transaction, and participation building on each other. However, they argue that a successful implementation of e-participation is independent of e-administration, and that transparency, openness and engagement represent increasing levels of sophistication within e-participation. In this paper, we put forward that while e-administration and e-participation are independent from another, e-participation provides a foundation for m-participation as it comprises the use of mobile devices and technologies for the purposes of e-participation.

### *2.2. Mobile applications for participation*

Schröder [8] conducted research on mobile apps for citizen participation to determine users of mobile apps and how do they use specific apps. Results show that the number of m-participation users depends on the device and channel used. This means that using a smart phone or cell phone can make a difference just as complementing an m-participation offer with other activities such as face-to-face interaction or e-participation in general, the former of which seems to be the most promising approach. The study concluded that m-participation should serve the needs of stakeholders involved such as public servants and citizens in order to gain popularity. Additional features that accommodate the user's needs are presented by Korn [9] and de Reuver et al. [10]. They point out that mobile devices enable situating engagement in the location of the participants which is supposed to be reflected through camera and voice annotations. In contrast to e-participation, participants of m-participation initiatives do not need to indicate their location which can actively be sourced through GPS data collection (see Ertiö & Ruoppila [11]).

The Republic of Korea is an example of the practical development and deployment of mobile apps once the institutional and organisational setting has been laid down.

Korea is one of the leading nations both in terms of e-government and e-participation implementation taking the first rank in both indices (see United Nations [12]). An account of the mobile apps provided by national and local governments and administration in Korea is given by Eom and Kim [13]. They surveyed all public apps which were 405 as of December 2012. Their analysis concluded that while the quantity of apps in Korea is high, the quality is rather low in terms app maturity. Three key characteristics of apps reported with low maturity are: (1) apps were large in size, i.e. displaying a lot of content without enabling further interaction; (2) apps belonged to low level administration facilitating only information provisioning to the citizens; and (3) apps belonged to administrations that had a large budget. There is a need for guidelines on aligning apps and its features to administration's organisation and its processes.

### 3. Data collection and methodology

This paper follows cases study methodology which allows us to focus on a qualitative analysis providing greater detail on the empirical observations that we are making and thereby contributing to the development of an overarching theory (see Creswell [14]).

We approached the search for practical examples systematically by reviewing the literature for leaders of e-participation as a proxy for m-participation (see United Nations [12], OECD/International Telecommunication Union [15]). Based on the E-Participation Index from the year 2014 published by the United Nations, we looked into the top ten countries of the index which were the only ones to reach a score of 90% or more in this rating. Of these, we looked at the website of the government for each country: Singapore, the United States of America and Australia were the only ones who provided a consolidated overview of the mobile offers made available to the public; Korea and Japan could only be studied with limitations due to language constraints; the remaining countries did not provide a similar accessible overview.

The respective websites from Singapore<sup>2</sup>, the USA<sup>3</sup> and Australia<sup>4</sup> provided a large number of mobile offers and apps created for a certain purpose, but they almost exclusively focused on providing e-administration services with different degrees of technological maturity. E-participation offered in practice such as those around participatory budgeting were not complemented with a mobile app, instead these websites were frequently linking to Facebook, Twitter, and RSS reader subscription.

We browsed through the Apple App Store and the Google Play Store, yet the use of search terms such as "participation", "collaboration", "deliberation", "vote", "voice", "movement", "protest", "boycott" in the form of nouns or verbs did not yield many positive results that would actually meet the demand for a participatory app. The apps that were eventually chosen were further investigated by downloading them, trying to participate and studying reports on them on different websites and their Social Media accounts.

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<sup>2</sup> <https://www.ecitizen.gov.sg/eServices/Pages/default.aspx#tabs-3>

<sup>3</sup> <https://www.usa.gov/mobile-apps#>

<sup>4</sup> <http://www.australia.gov.au/news-and-social-media/apps>

Features include the location it is used in, whether it is a top down or bottom up initiative, and a description of user guidance, different actions that can be taken, and on which platforms the apps are available. Classification of the influence in the policy cycle is based on the analytical framework introduced by Wimmer [16]. It includes the categories stakeholders involved, the participation area tackled, the level of engagement, and the stage in the policy-making process. As for the level of engagement, we are using the scale provided by the United Nations [12] which differentiates less granularly between e-information, e-consultation, and e-decision-making. We found that the less granular view is sufficient for the field of m-participation as the field itself is still young and less elaborated at the time of writing. The usability evaluation is done in a structured and systematic way and leans on the approach developed by Bicking and Wimmer [17], taking multiple perspectives into account such as the policy domain in question and the tools and technologies employed. The evaluation did not involve user reviews of the apps because they may focus on aspects that are not relevant to a systematic study of m-participation. Reported issues can have root causes that do not stem from the app itself, and based Apple App Store and Google Play Store. The three cases iCitizen, Buycott and USHAHIDI that we have selected are analysed based on features, influence in the policy cycle, and usability in the following section.

## 4. Case studies

### 4.1. iCitizen

iCitizen (version 1.5.2) is an app that is provided by the iCitizen Corporation founded in 2012. It is a private initiative that aims at strengthening civic engagement and political discussion in the USA. The app is available for Android, iOS and Kindle and integrated with social media such as twitter.

The iCitizen app provides a number of features and sub-features. There are four main sections: “Home” displays trending issues or issues relevant to the user’s preferences. It features stories and an option to vote and make one’s voice heard on a particular topic. “Issues” allows the user to select a number of topics of interests which feed into the home screen, or to browse through all 21 pre-defined topics. Within each issue, the user can deep-dive into the history, current developments in the media and the parliament, and participate on any planned bill. “Reps” allows to review all representatives on federal or state level and look at their voting record, participation in committees, and to make contact with them. “Votes” provide a list of all polls that are currently featured on the app.

iCitizen is the only example we have seen that tries to provide a tool connecting both citizens and politicians at the same time. It explicitly targets politicians asking them for their buy-in and interest in the people’s opinion made available here. Even though political discourse is the nature of the app, there is a threat that the platform can be perceived as biased, e.g. when a user sees that his opinion is always deviating from the majority or feels that news articles argue for one side only. Therefore, balanced content is essential to ensure user retention. Also, there are other apps available such as Countable that gives the user a similar feature to voice his opinion. The app providers need to make sure that all information published is bipartisan and that it is keeping up with trends in terms of usability that its competitors are implementing.

#### 4.2. *Buycott*

Buycott (version 2.2.0) is an app available for Android and iOS. It was developed by Buycott Inc. in 2014 with its mission statement being: Vote with your wallet. Users are meant to be educated whether or not products they intend to buy align with their convictions. By browsing through a database or scanning the barcode of a product, the user is told how a brand or company is doing in light of campaigns such as the demand for labelling genetically modified food. The app is a bottom up initiative and can be used in any country. The user will need to sign in via Facebook or email to be able to join and contribute in a campaign, while the database of companies and campaigns can also be viewed when the user is not signed in.

The app offers four main sections: “Main” lists featured campaigns, trending campaigns, and a timeline of one’s own activities. “Search” allows the user to either do a text search for a campaign, company or brand, or to browse through a set of 17 campaign topics. Within these topics, users can create and join a campaign which provides information about it, a list of companies that can be supported or should be avoided, and a feature to discuss and comment. Within a campaign, the user can share his activity via Facebook and Twitter or email and SMS. However, this share only contains a default statement that the user is using the Buycott app, and does not link to any specific campaigns.

Currently, it supports English, Arabic, French, Japanese, Russian and Ukrainian; hence, promotes large number of users and discussions can be quite dynamic. This creates difficulties in structuring of discussions as actions are scattered across the world. Eventually, abandonment of the app as users may get involved at some stage but are dropping out due to an insufficient community feeling.

#### 4.3. *USHAHIDI*

USHAHIDI is a Swahili word which means “testimony” or “witness”. It was created as a website by Ory, Okolloh and other 15-20 developers in the aftermath of Kenya’s disputed 2007 presidential election. The main focus was to get information in and out immediately to the Kenyans on ongoing political conflicts and violence using local sources [18]. The first version of USHAHIDI website allowed the use of mobile phone through SMS and web for reporting violence. Messages were approved by staff by through calling or emailing the reporter to verify the information before publishing it on the site; however the issue of trust was not clearly solved (see Okolloh [18]). After using the platform in the Democratic Republic of Congo, several challenges were observed and the current USHAHIDI platform was designed.

Currently, USHAHIDI is a non-profit software company that develops free and open source software for information collection, visualisation and interactive mapping. Okolloh [18] explains that the tool supports gathering of crisis information by displaying data from various sources such as phones, internet and mainstream news on one page. It also incorporates administration levels to verify submitted reports. USHAHIDI can be downloaded and used in or by any country, region or organisation to bring awareness on any issue in the concerned area. The platform has so far been used by several countries for different purposes, such as for natural disaster reporting and solving (e.g. earthquake in Haiti (see Meier [19])), for monitoring purposes (e.g. healthcare treatment in the region of Uttar Pradesh in India in 2012-2014 (see McKenzie [20])), and as a group check tool for emergencies (e.g. Kenya mall siege in

the year 2014 (see Hersman [21])). Our evaluation found that USHAHIDI is not purely an m-participation project since it is rather informative and outside of the formal policy-making process.

**Table 1: Comparison of iCitizen, Buycott and USHAHIDI (table by authors)**

	<b>iCitizen</b>	<b>Buycott</b>	<b>USHAHIDI</b>
<b>Features</b>	Polling on topics, issues tracker, voting on bills and contacting elected officials	Campaigns, database w/products and companies, and scan barcode	Violence reporter, monitoring issues and group check tool
<b>Stakeholders involved</b>	Citizens, politicians, political parties, elected representatives and NGOs	Citizens, industries, companies and NGOs	Citizen groups, government, companies and NGOs
<b>Participation area</b>	Information provisioning, lobbying and discourse	Information provisioning, campaigning and protesting	Information provisioning and discourse
<b>Level of engagement</b>	E-information, e-consultation and e-decision making	E-Information	E-Information and e-consultation
<b>Stage in policy making</b>	Agenda setting, policy formulation and decision making	Agenda setting	Agenda setting
<b>Usability of tools and technology</b>	Strength: Location-based services and social media integration	Strength: use of Social Media	Strength: Online platform and SMS
	Ease of use	Ease of use	Ease of use
	Appropriate for this kind of participation and for discussion of topic	Appropriate for this kind of participation and for discussion of topic	Appropriate for this kind of participation
	Weakness: Location-based services should be mandatory not optional	Weakness: Topics can be discussed, but threads are unstructured/ too instantaneous	Weakness: Feedback loop should be more transparent to the participant

## 5. Discussion

A consolidated overview of our analysis is presented in Table 1. There are similarities such as citizens (or citizens groups) and NGOs being key stakeholders that are addressed and involved; information provisioning being an integral part to enable m-participation; and a contribution to the agenda setting process in all instances. It also highlights that Buycott for instances is active in terms of campaigning and protesting yet does not enable policy formulation as a result of it. Similarly, USHAHIDI enables

discourse and e-consultation yet also fails in shaping the policy formulation of the topic that is being discussed. This disconnect may be because the apps are bottom-up initiated that lack leverage or are not a formal part of the political process.

In areas with limited internet access such as developing countries, the use of SMS for participation should be emphasised. This will allow citizens regardless of their economic background to become involved. However, even though SMS is a two way communication, it is difficult to respond to each participant on sent claims or issues discussed instantly. Thus, the community will not immediately profit from individual remarks and cannot get exposed to a dynamic discourse. We propose that feedback of the discussed topics should not only be given to the organisation running the initiative but also to the participants and to a wider audience. Additional media channels like newspapers can create an awareness for and attractiveness of the initiative. Furthermore, apps need to be available for all mobile operation systems and a part of a wider initiative that also involves other media channels and offline representation

## 6.Outlook

M-participation involves the use of mobile technologies such as SMS, mobile internet access and mobile apps for e-participation purposes. But the underlying technical maturity has turned out to be a substantial differentiator. USHAHIDI is an example of how SMS can be used especially in societies where mobile phones may be more likely used to communication rather than computers. The limited dynamic discourse and lack of transparency indicates, however, that this kind of participation primarily seems to lead to information and opinion mining rather than promoting dialogue through participation. In contrast, mobile internet and mobile apps allow for a greater degree of interaction and participation from and among users. More systematic analysis on technical maturity is required to answer to what extent technical limitations automatically limit m-participation and what organisational infrastructure is required to translate popular input into formal processes.

Social Media integration stands out as a general trend for providers to disseminate their message and for users to interact using existing accounts. Mobile apps become a sort of portal that in turn make themselves superfluous as they re-direct a topic-based communication to Social Media. The question then is: what is the app for? It seems implausible that installing an app for each policy will create communities that are forcefully advocating for change. Research is required to investigate the dynamic between the length of participation through an app and migration of users from an app to Social Media, and what that means for the development of the topic that is discussed in either of these two channels.

In regards to top down initiatives, the fact that different developers are in charge of developing and deploying apps for specific purposes within one country or ministry or administration leads us to believe that the required level of political leadership (see Zheng *et al.* [22]) is lacking. This lack of established relationships or integration into existing political processes may explain why none of the apps manages to have any influence on policy implementation or policy evaluation.

USHAHIDI projects have shown that a level of trust in participation is necessary for both participation to occur and for submitted content to be trustworthy. Future evaluation approaches should involve trust models to assess the level of trust on existing e-participation and m-participation projects.

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# ‘Probing with the Prototype’: Using a Prototype e-Participation Platform as a Digital Cultural Probe to Investigate Youth Engagement with the Environment

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**Abstract.** This study describes how we used a prototype e-participation platform as a digital cultural probe to investigate youth motivation and engagement strategies. This is a novel way of considering digital cultural probes which can contribute to the better creation of e-participation platforms. This probe has been conducted as part of the research project STEP which aims at creating an e-participation platform to engage young European Citizens in environmental decision making. Our probe technique has given an insight into the environmental issues concerning young people across Europe as well as possible strategies for encouraging participation. How the e-participation platform can be utilised to support youth engagement through opportunities for social interaction and leadership is discussed. This study leads to a better understanding of how young people can co-operate with each other to provide collective intelligence and how this knowledge could contribute to effective e-participation of young people.

**Keywords:** e-Participation, Youth Engagement, Environmental Policy, Digital Cultural Probe.

## 1. Introduction

With dwindling participation (especially by young people) then the democratic process becomes less democratic and more dependent on the voices of the few rather than the many. This study aims to better understand what motivates young people to participate in environmental discussions and the policy making process. We describe how we used a prototype e-Participation platform as a Digital Cultural Probe to investigate youth motivation and engagement strategies with environmental policy making. The core contribution of this paper to e-Participation is discussing an exploratory approach to pinpoint engagement of young people with a specific social issue (the environment) along with their engagement with the e-Participation platform created to support and facilitate a wider (EU level) participation with that issue. This study is part of STEP - Societal and political engagement of young people in environmental issues - (<http://www.step4youth.eu>) an Horizon 2020 project whose goal is to increase and support participation of young European citizens (aged 18-29) in decision making for

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environmental issues. STEP aims to design and release an e-Participation web & mobile platform which will facilitate interaction between policy makers and young people, allowing policy makers to quickly and easily open-up to young people's input for their policy ideas. STEP aims at: providing young people with personalised information on decisions under consultation; giving them the opportunity to express their opinion; informing them on what other people are saying and giving them the opportunity to bring their own issues to the attention of policy makers. European young citizens and policy makers from 5 Pilot cities/regional authorities, in 4 countries (Italy, Spain, Greece & Turkey) are involved in the project. During the project's life time, STEP pilots are expected to involve 8,200 young users and 85 policy makers. In addition, 65 environmental decision making procedures are expected to be tested. One aspect which is paramount for the success of the project is to scope out the level of engagement of young people with environmental issues and to translate this into strategic ideas for the e-Participation platform. In other words: how to pinpoint and relate young people's engagement with the environment to a lasting and meaningful engagement with the e-Participation platform? For investigating this problem we have conducted a digital cultural probe using an early prototype of the STEP platform itself.

Probes have been described by Wallace *et al* [1] as '*directed craft objects used in empathic engagements with individuals around issues centered on self-identity and personal significance*'. This definition fits with the remit for their use in our work, with our aim being to better understand how young people engage with environmental issues that are significant to them. The cultural probe is a qualitative and inspirational research technique originally devised by Gaver *et al.* [2] which includes open-ended and evocative activities for participants to pursue in their own time to help narrate their lives to technology designers. A Cultural Probe is usually based on a 'toolkit' containing material to aid and inspire this self-reporting, such as a disposable camera, maps and/or a diary. Probes are used for exploring new opportunities – both in term of design and strategic actions – rather than for solving functional problems [3]. An extensive study on the use of cultural probes was carried out by Boehner *et al.* [4], and they argue that cultural probes are not simply "another technique" for getting data, but frame an alternative account of knowledge production. While the original technique was based on a physical kit, the research community has started to use the probe technique with the support of new technologies, such as mobile phones [5] or known social digital media, such as Instagram [6]. While these "digital" probes lose in part the physical and creative aspects, they offer advantages in terms of distribution and collection of the material as well as opportunities for social interactions among participants. For our research we created and conducted a digital cultural probe using an early prototype of the STEP e-Participation platform. By conducting this probe via the prototype we have been able to investigate simultaneously – in an inspirational and design oriented fashion – both engagement with environmental issues and engagement with the e-participation platform itself. For this study we involved fourteen participants from the pilot partners' areas, as well as a number of young citizens in other European countries (UK and Czech Republic).

In what follows we discuss our core findings which, in line with the probe techniques, relate to engaging young people with environmental decision making and with an e-participation platform. Key aspects emerging from our probe are: the type of environmental issues which may be more relevant for young people; the concept of 'the

future' in which young people have higher stakes than current adults; and the role of youth leadership in supporting wider engagement. These aspects can be translated into recommendations for the design and development of the e-Participation platform. The piloting phase can nurture these aspects for facilitating the wider participation of young people, for example by piloting environmental policy discussion around the topics that are more relevant to them. In line with this, in the discussion the paper highlights a number of strategic recommendations for actions.

## **2. E-Participation, Young People and the Environment**

The STEP project is situated within the European context where there is recognition that Europe's future depends on promoting youth participation. Citizen engagement with public policy and decision making is not a new concept, but recently there has been an increase in the number of initiatives to include the general public in policy making. This is also taking place within a context in which there is ample recognition of a wider decline in public participation and social capital [7]. This applies to young people too where, for example, according to recent findings in Europe [8] traditional channels of representative democracy, such as voting at elections only partially stimulate young people's interest in active participation. There is nowadays recognition that citizen engagement and participation can enhance citizen trust in government [9], improves governmental responsiveness [10] governmental legitimacy [11] and policy making [12]. Digital and web platforms have been studied [12][13] and trialed for this scope – in particular, consultation in policy making - with examples such as Liquid Feedback being widely known and discussed [14] as well as the use of established social media platforms in a more bottom-up fashion [15]. There is also recognition that stakeholders should be engaged with crowdsourced actions - at the very start of the policy cycle when agendas are being designed [16]. There is however discussion on whether the use of ICTs really facilitates wider participation in decision making and if the people participating are representative of the population as a whole [17]. Furthermore, as one would expect, there is also a very specific discussion around the use of tailored platforms for supporting young people's participation [18]. There are other European Projects such as EUth<sup>2</sup> or CATCH-EyoU<sup>3</sup> supporting youth e-participation. Discussion around tailored platforms for young people clearly presents the same issues as the general one: consideration of the possibilities offered by e-Participation for young people [19] but also the need to acknowledge difficulties [20].

Engagement with environmental issues can be seen as a sub-area of the wider movement toward facilitating citizens' engagement with decision and policy making [21][22]. However environmental decision making is of particular importance for gaining the participation of young people as decisions taken now will have long-term consequences that will affect future generations. Hence young people, are said, to have higher stakes in the future of the environment [23] than the current adult generations and can provide an invaluable force to shape future positive change [24]. However, data from a recent Eurobarometer [25] shows that young EU citizens (aged 15-24) have

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<sup>2</sup> <http://www.euth.net/>

<sup>3</sup> <http://www.catcheyou.net/>

far less engagement than older people with issues such as protecting the environment. It is also widely accepted in literature that there is the gap between a positive environmental attitude and the actual action for the environment, ie. a positive attitude does not necessarily translate into action [8]. Literature also emphasizes the importance of peer participation and youth leadership and the opportunity for young people to have dedicated spaces where they can share ideas [24]. Hence as for the general perspective of platforms for the wider engagement in policy making, there could be an expectation of having examples of platforms dedicated to young people's engagement with environmental decision making. However here the state-of-the-art presents initial weaknesses as – from internal analysis conducted for the STEP project – there does not seem to be a relevant presence of e-Participation platforms dedicated to this. Nonetheless, from both a research and innovation perspective the problems identified in this paragraph would still apply: (1) e-Participation needs to be facilitated and not taken for granted because tools are available; (2) there is a gap to be filled between positive attitude toward a policy issues (e.g. the environment) and wider public engagement with decision making and (3) there needs to be an acknowledgment of the unique contribution that young people can bring to decision making. The importance of a well-designed platform to encourage this is vital, as in most areas of life, if something is poorly designed and we don't have to use it, then the chances are that we won't [17].

### 3. STEP and the Digital Cultural Probe Methodology

In an effort to pinpoint young people's engagement with environmental issues to factors that could facilitate e-Participation we conducted a digital cultural probe directly within a prototype of the STEP platform. In this way we were able to use the platform as a probe to explore new opportunities and the experiential perspective of young people toward the environment. By staging the probe within the STEP prototype we also explored how young people could interact within the e-Participation platform when they present and discuss their ideas about the environment. The STEP technology offers the ability to transform existing communication methods and enhance citizen engagement with environmental policy making. The prototype is based on co:tunity<sup>4</sup> and we used it in a similar way to a closed Facebook group, features allowed :

- Setting up a specific '**challenge**' which engages users in high and low level challenges/tasks. In our case the high level challenge was a 3 week long cultural probe about the perspective that young European citizens have about environmental issues, whereas low level challenges were the specific self-reporting tasks (see later).
- Easy **upload** of images and **posting of** textual descriptions. allowing self-reporting of their experiences (equivalent to a camera and diary in a traditional probe).
- A **user profile**, where participants upload their photo, coupled with a leaderboard where the profiles of those making the most contributions appear.
- Ability to **comment on and "like"** the content posted by other participants, fostering social collaboration and social engagement with the content.

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<sup>4</sup> The platform Co:tunity is developed by project partner Kairos, see <http://www.cotunity.com>

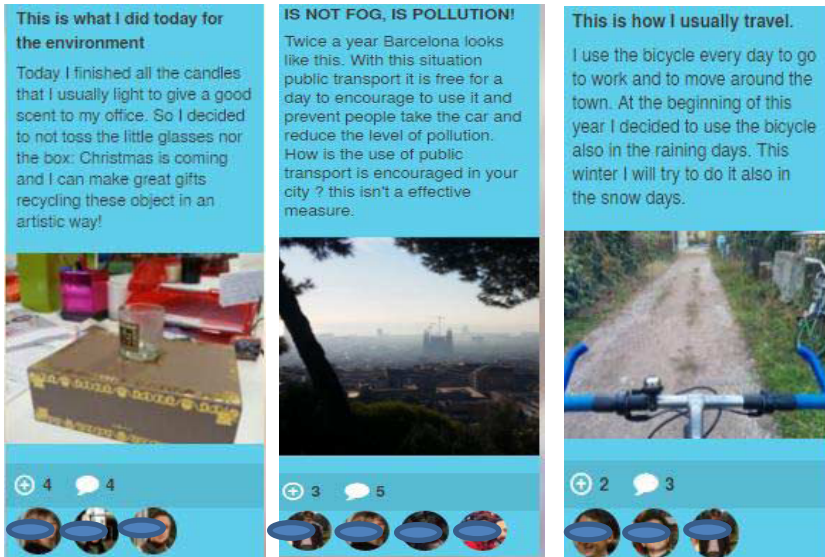
- Promote a **Collective mentality** based on the idea ‘Together we can make a difference’, where the narrative of the probe was one of young people joining forces to make their voice heard and hence capture the energy and enthusiasm of Youth.

Sixteen participants were invited to the Challenge in the expectations that at least half would participate. For enrolment we relied on pilots and project partners, the number of acceptances was 13 (6 males and 7 females). The probe was launched in mid-November 2015. The STEP Digital Cultural Probe was organized with specific challenges released at weekly time intervals: **Week one** was a gentle introduction to the platform, allowing the participants to log-in and upload their photo; they were asked (Via the platform with an additional email prompt) to make 3 posts to give us an idea about: the environmental issues that concerned them; what they would like to improve and what inspires them when it comes to the environment. **Week two** asked how they usually travel, and about an action that they made for the environment. We also wanted to get a feel for where locally they felt was important / somewhere they liked to visit and also to discuss what areas of their life they felt they could do better with. The challenge about action was included because, as noted in the literature review, there is often a gap between people having a positive attitude toward the environment and actually doing something about it. We wanted our participants to self-reflect on these issues and report on their experiences. The issue of youth leadership – again relevant in literature – was introduced in week two; we wanted participants to self-report on their ideas to improve the environment in their local area if they had the power to change things as the mayor of their town. **Week three** further developed the leadership theme on a larger scale, i.e. at the country level what would they do if they were the prime minister. This theme continued by asking them about where decisions are currently made in their region and by whom. We also wanted to know how they thought others could be motivated to be involved in environmental issues, asking them what the best way would be to do this. This was asked with the intent of making participants reflect on possible strategies for facilitating participation of young people. Participants could also comment on other posts and offer further perspective on what was happening in other areas. Finally participants were asked to contribute to an analytical phase, and give greater accuracy for what topics they deemed ‘relevant’. The STEP platform allows posts to be tagged with themes and also to assign relevance scores (1-10). One of us tagged posts at regular intervals and from this certain themes emerged. The platform allows co-analyst participants to plot a ‘graph for the themes to chart impact and predictability of the trend.

#### 4. Results of the STEP probe

Initial observations of the participants’ interaction with the probe showed that not all the participants had the same level of engagement. About a third of the participants were extremely engaged with the platform, contributing on a regular and ongoing basis and also with more content than what they had been asked to produce. This group of ‘very enthusiastic’ participants also interacted with others on the platform regularly. This indicated a bottom-up process of youth leadership emerging, where young people in an entirely independent manner were displaying skills and capacity to show how to

conduct our challenge. Another third carried out all the tasks and made rich contributions, but did not show the same level of enthusiasm. This second group were posting and commenting on a more irregular basis. The remaining third made some valuable contributions, but did not complete all the tasks. This of course may also be for issues which are independent from the probe itself (e.g. having exams at University). Overall, the cultural probe challenge generated 143 original posts.



**Fig. 1.** Example of Posts with comments and likes from other participants

Alessio (Spain), Federico (Italy), Elena (Greece) and Monica<sup>5</sup> (Czech Republic) made the greatest number of contributions and topped the leaderboard. A few participants were curious to know what criteria the platform used to allocate the leaderboard points, which shows that they were looking at those emerging as leaders. It was interesting to see examples of the participants asking questions of the others and stimulating discussion, with Transport, Recycling and Pollution most frequently discussed.

#### 4.1 Taking Action

Two of the questions asked the participants to reflect on something they could improve; the first was a more personal reflection on what they themselves could change. Posts reflected on personal actions such as walking or cycling more, buying products with less packaging, and reducing their energy/water consumption. The second was a more general question and evoked responses such as improving local recycling facilities, having better control over energy and better access to sustainable transport. Other posts gave examples such as converting vegetable oil into Biodiesel. The question asking about an action they had done for the environment evoked posts on issues such as recycling, upcycling, and saving energy or water. A post on upcycling prompted several

<sup>5</sup> All names changed for anonymity

comments, then a flurry of other posts on creative ways to make use of material that would otherwise be thrown away. Posts for encouraging others to act mentioned: inspiration, education, setting good examples and promoting small changes.

The wording of the questions was important; we framed them in the first person – asking specifically what they themselves would do, rather than asking, for example, about what the mayor of their town should do. This type of question promotes greater self-reflection and is likely to increase engagement, not requiring thoughts on existing politicians whom they may have negative feelings towards. The responses were thoughtful insights as to what could be achieved at a local and national level, topics covered improving sustainable methods of transport, cleaning up suburban side-walks to increase walking/cycling and improving the local areas. Regional actions included rewarding towns for using cleaner methods of transport, giving tax incentives for renewable/alternative energy and for reducing food waste. Others mentioned repealing laws allowing the suns energy to be taxed by the government; setting a good example as a leader and rewarding pro-environmental behaviours.

Trend	Average Significance	No. of Posts
Sustainable Transport	8.3	33
Recycling	8.1	37
Reducing Waste	8.0	40
Energy Saving	8.0	13
Local Environment	7.8	44
Pollution	7.7	35
Natural Habitats	7.7	23
Climate Change	7.6	23
Making Decisions	7.4	25
Saving Water	7.1	9
Sustainable Agriculture	7.0	18
Redevelopment Urban Land	6.9	5

**Table 1.** Trends identified from the posts and their average significance

Table 1 shows the number of posts made on the topics that emerged from the Challenge. Participants were encouraged to tag posts and give a ‘relevance score’ via the platform interface, which the ‘highly motivated’ group did. The average significance score comes from these combined scores. Posts could be tagged with more than one theme: ie. a post on traffic congestion could be tagged with ‘sustainable transport’ and ‘pollution’.

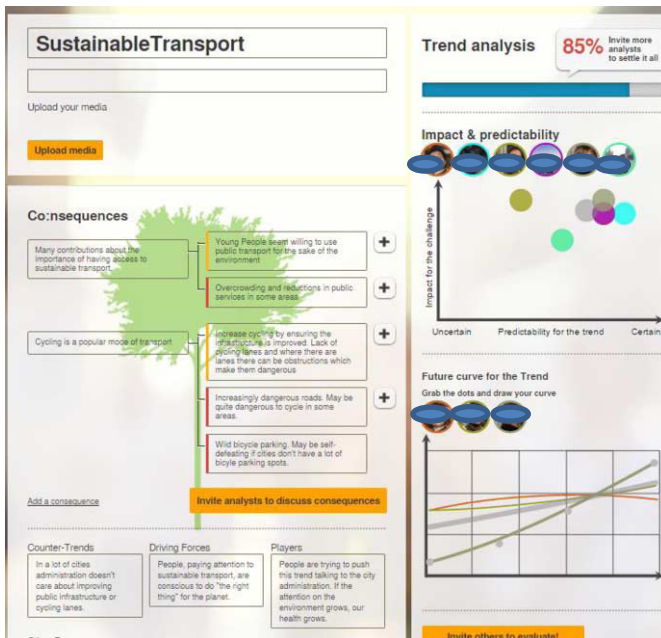


Fig. 2. Examples of Trend Analysis on the STEP (Images of Participants covered)

#### 4.2 Spontaneous Posting and Co-Analysis of Posts by Participants

As the Challenge progressed the highly engaged participants began posting spontaneously on issues that we were not asking them about, this emerged during the second and third weeks and the topics were varied. The 2015 United Nations Climate Change Conference, was held in [Paris](#), from 30 November to 12 December 2015 which coincided with the duration of the probe. Some posts were about this event, such as a link to an article about the fake adverts by artists being posted across Paris<sup>6</sup> protesting against corporate takeover of the Climate talks. A list of 30 actions to combat Climate Change was also posted, showing that the platform was used to raise awareness of issues. The participant listed how many of the actions she made and asked others how many they themselves made – encouraging interaction and reflection. The same participant also posted a link to a documentary about the ‘throw away culture’<sup>7</sup>. Another person was very interested in Sustainable agriculture and posted a link to a video on Sustainable Seed production<sup>8</sup> and a detailed post showing how local neighbourhoods could produce organic food from small urban spaces. The fact that spontaneous posts were being made suggests that participants were highly engaged with the platform and with the topics they were posting about.

Once the participants had been given co-analyst rights in week 3 then they were also able to tag posts and carry out theme analysis using the platform functional-

<sup>6</sup> <http://www.thisiscolossal.com/2015/11/brandalism-fake-ads-paris/>

<sup>7</sup> <https://www.youtube.com/watch?v=mUaCLzbDgm0>

<sup>8</sup> <https://vimeo.com/126110309>

ty, which contributed to the richness of the data generated. Five participants contributed to at least one theme, with some contributing to several different themes, such as sustainable transport (see Figure2), sustainable agriculture, local environment and recycling. The ‘Impact and predictability’ option was completed more often than the ‘Future Curve’ trend. It became apparent that for this analysis to work well then it was essential to make clear beforehand the direction of the trend; eg. Cycling, it should be clear that you are asking them to predict if there will be more or less cycling in the future – this affects the way the plots are made on the graphs.

## 5. Discussion; Recommendations for e-Participation

Due to space limits it has not been possible to show here the richness, complexity and extent of the data and insights we collected from the probe. We will devote some space to a discussion of what inspirational aspects we have learned. The challenges of using Cultural Probes are both practical and methodological and there is debate as to interpret the results, given their ‘uncertainty’[26]. This varies between gaining inspiration, of particular lives to obtaining information that seeks to pinpoint the exact needs of the community. For [27] this is symptomatic of the different stances on interpretation, it rather depends on whether it should be open or closed [28]. The open approach sees interpretation as opening up a variety of possibilities whilst the closed sees interpretation as a process of negotiation toward a single and unambiguous understanding [27]). For [29] *‘Probes involves recording a point-of-view, while ‘in-the-moment’ and making visible, on one hand, particular actions, places, objects, people etc. and, on the other, wishes, desires, emotions and intentions’*. The posts made during the STEP challenge were rich and insightful and conveyed information about the participants’ emotional involvement with the environment. The insights we have interpreted from the posts are about relating the engagement with environmental issue to the engagement with an e-participation platform. The themes that emerged from the posts gave us a deeper understanding of the topics that are important to young people, and what would motivate them to engage in an e-Participation platform. Our participants were more concerned about certain environmental issues such as Sustainable transport and recycling. In piloting the e-participation platform, focusing initially on the discussion of policies that are close to those concerning them most can ensure a better and larger participation. A number of key lessons were learned for the design, piloting and sustainability of STEP:

1. **Focus on issues of interest:** the piloting of the e-Participation platform should focus on the discussion of policies/issues that are of direct interest to Young People: transport, food, Reducing Waste /recycling. This is likely to increase participation.
2. **Promote trust:** There is some level of mistrust between young people and policy action and this inevitably will reflect on their participation. While it’s clearly outside the scope of STEP to bridge this gap, some design solutions for the platform may be considered including trust /reputation mechanisms for rating the relevance of proposed policies as well as their implementation. The look and feel of the platform should also aim to promote trust.
3. **Give feedback;** inform young people how their previous actions have made a difference, state how any information was used and highlight any actions following a con-



sultation. In terms of design this would call for appropriate feedback mechanisms to be included in STEP.

4. **Engage Young People with High Social Influence:** Those Young People who have high social influence are likely to engage others young people. These people should be nurtured and encouraged to remain engaged.
5. **Leadership ‘mechanisms’:** aspects of action such as leadership can be nurtured with appropriate gamification/reputational mechanisms. Existing gamification features of STEP prototype (e.g. leaderboard) should be adapted to support this.

## 6. Conclusion: Future Work for Future Engagement

In this paper we presented a novel approach to the use of a digital cultural probe for supporting the design of e-Participation, in particular linking the engagement in social issues (environmental decision making) with the engagement in the use of an e-Participation platform. The novelty of our approach has been in conducting the digital cultural probe directly within the prototype of the platform, showing that it is possible to simultaneously investigate both aspects. We acknowledge that our approach also presents some limitations, such as participants possibly being influenced by previous posts and the fact that we worked in English whereas participants were from several EU countries, due to the requirement of participant interaction. However the final e-Participation platform interface will be in the specific national languages, thanks to the use of language translation technologies<sup>9</sup>. Despite these limits, our probe conducted within the platform prototype has delivered relevant results in the form of actions/recommendations to be undertaken during the piloting of the e-Participation platform. We claim that **Probing with the Prototype** is a useful approach for the design of e-Participation that can be replicated by other projects. The similarity with familiar social networking sites may increase youth engagement with the platform.

This Cultural Probe activity has given us good insights into how young people can engage with environmental issues and with an e-Participation platform. STEP intends to further utilize the participation of young people by carrying out Co-Design sessions with them to enable a degree of personalization for the platform for each of the pilot partners and to ensure the design of the core platform functionalities meets their requirements. So far five participatory or co-design sessions have been carried out with young people (and a further two with policy makers) including a session on trust to develop solutions for better reciprocal trust and collaboration. A remote but synchronous co-design session is also planned, again using the STEP prototype which has ‘round table’ functionality that will allow users to engage in a co-design despite being located in different European countries. Our aim is to investigate several issues such as; the appropriate mechanisms supporting youth leadership within the platform, for example the co-design of a badge system [30]; the important issue of trust and finding the appropriate way to feed back the results of e-participation to participants.

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<sup>9</sup> These are provided by project partner Linguattec - <http://www.linguattec.net/>

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# Smart Cities Through Implicit Participation: Using Gamification to Generate Citizen Input for Public Transport Planning

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**Abstract.** In this paper, we present a case study of the mobile app and ecosystem *Trafpont*. Trafpont is a system for registering when and where people travel by public transport, using gamification in an attempt to convince more people to travel in environmentally friendly ways. We argue that the Trafpont app is a good example of what we call “implicit participation”, where user-generated data from volunteers generate valuable input for the political decision-making process. With the growth of sensors, smartphones being ubiquitous, and the growing interest in the Internet of Things, this form of participation has the potential to become very valuable for decision-makers in the coming years.

**Keywords.** eParticipation, smart cities, gamification, mobile development, case study

## Introduction

As of 2009, more than 50 percent of the world’s population live in urban areas [1], and this number is forecasted to increase in the coming years. Cities occupy only 2 percent of the planet, but account for 60-80 percent of energy consumption [2]. As the sizes of cities grow, so do the challenges facing cities [3]. These challenges include issues related to public health and socio-economic factors [4], energy consumption, transport planning and environmental issues [5]. Air pollution caused by traffic jams is but one concrete example of the many challenges facing growing cities [6]. Therefore, it is an obvious need for cities to be “smart”. Smart cities refer to “places where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems” [7].

Many researchers and political theorists see political participation as an important way of enhancing democracy [8]. By engaging more citizens in political processes, the citizens will take more responsibility for their own situation, and contribute more to society. Simultaneously, other research [9] has shown that citizens are not that interested in participating. Their main interest is that government provides services in a good way.

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For the last decade, there has been many initiatives to utilize electronic communication to improve participation. However, citizens report they appreciate the opportunity to communicate, but remain passive and do not believe eParticipation projects will improve democratic engagement [10]. Those who report to be active participants in democratic processes only makes up a small percentage of the population [11].

Amnå and Ekman [11] claim that while a lot of research has presented participation as an active/passive dichotomy, we should rather think of it in terms of degrees of participation, ranging from completely disinterested to completely active. While the group of active citizens is relatively small, there is a latent political interest, called “standby participation”, in a much larger group of citizens. This group follows political news and current affairs, has opinions and will participate if something triggers their interest [11]. While some argue that political participation is in decline, others point out that civic engagement is as strong as ever, but not in the same way as in the past [12]. One way of using this engagement could be what we call passive, or implicit, participation, for example by using their smartphones to send data to decision-makers.

In this paper, we present one example of implicit participation. Trafpoint is an app and digital ecosystem for monitoring and improving public transport, developed by a consortium of private and public partners in Southeast Norway. We argue that Trafpoint is a good example of how implicit participation can contribute valuable insights to decision-makers, in an area highly relevant to the challenges faced by the smart cities of the future. At the time of writing the system has not yet been implemented. Thus, this paper presents ongoing research and will hopefully be expanded if and when data from a full implementation becomes available.

## 1 Related research

### 1.1 *Smart cities*

Cities are growing at a rapid pace, and this growth brings with it several challenges related to infrastructure, pollution, traffic congestion and social problems [13]. In response to these challenges, the research area Smart cities has emerged in recent years.

Reflecting the novelty of the area, there are many and varying definitions of the concept. Doran and Daniel [14] define Smart City as “Interaction of systems enabled through ICT’s” (p.60). They include economic, environmental and social systems in their definition. Urban challenges addressed with smart solutions are seen as “wicked problems” – problems and challenges that require coordination and collaboration between several disciplines and organizations [15]. Angelidou [16] expands on existing definitions through a comprehensive literature review, and adds four assets, or objectives, for smart cities: Human capital (citizen empowerment and knowledge creation), social capital (social and digital inclusion), behavioral change (sense of ownership and meaning) and a humane approach to change, where technology responds to the needs and interests of the user.

One of the more recent and influential articles, at least in the eGovernment field, is that of Gil-Garcia and colleagues [13]. Based on a review of academic literature and practitioner tools, they present a framework for smart cities. ICT’s, data and information makes up the technology side, while the social side consists of government (institutional arrangement, services and management), society (knowledge economy, human capital,

collaboration) and the physical environment. Their claim is that smart city projects should be evaluated based on the components of this framework.

On the technology side, the Internet of Things (IoT), such as sensors in smartphones, and (big data) analytics are popular topics. A sensor is a component that is capable of detecting changes in its environment and convert this change into an electrical signal. Many mobile devices have built in sensors, e.g., a GPS sensor or accelerometer. These sensors can be useful for things such as traffic monitoring [17]. The data collected can be analyzed using a range of techniques, and used for predictions, pattern recognition, forecasting, visualizations and decision-support [18].

### 1.2 *Implicit participation through gamification*

Democracy comes in many shapes and sizes. In direct democracy, each citizen takes part in a political decision. This can be done through popular votes. Switzerland is famous for having popular votes on a multitude of topics, and direct democracy experiments are found in countries as diverse as Italy, Paraguay and Bolivia [19]. Representative democracy is a model where citizens choose representatives to act on their behalf for the upcoming election period. The voters may then change their mind on who to support on the next election [19].

The idea of participation is to give citizens more influence between the elections. Several mechanisms have been proposed to facilitate such participation. Citizen' initiatives is one way to influence political agenda by collecting signatures. The governing body would then be obliged to discuss or vote on the matter within a certain time limit [20]. Other, more informal alternatives are discussion forums and consultations. Participatory budgeting is a process where citizens have a direct influence on budget spending. In some cases, governments allocate a portion of the budget for citizens to decide upon [21].

However, all these mechanisms require the citizens to spend a certain amount of time to take part in the participation. If citizens find the process too time-consuming, they may choose not to participate out of convenience, by not having opinions on a topic. This could especially be true for the large group of "standby participants", citizens who are interested in politics and society, but who still choose to remain mostly inactive [11].

In order to get this relatively large group of citizens to participate, decision-makers can implement passive crowdsourcing, which requires less commitment and time than other forms of participation [22]. This can be done by using sensors and smartphones, coupled with analytics software that provides important data for decision-makers (see i.e. [24-26]), and by adding elements of gamification we provide citizens with additional incentives to become participants without having to spend a lot of time reading or debating. Gamification can be defined as "*the use of game design elements in non-game contexts*" [23]. Gamification is seen as an important element of user experience and user engagement, and can be applied to make applications more interesting [24]. One approach to this could be by awarding user contributions through a points system, where a leaderboard and possibly also other rewards provides incentives for participation [25].

## 2 **Research approach**

The objective of this paper is to show how citizens can become participants in smart city initiatives through implicit participation through their smartphones. In order to

address these objectives, we have conducted a qualitative case study of *Trafpaint*, a system consisting of applications for monitoring public transport, and an analytical engine.

We collected data for the case in November 2015 and February 2016, and consists of e-mail interviews with the developer, participation in a workshop between the developer consortium, members of the ICT industry in Telemark, Telemark county Smart cities' office and representatives from the urban planning industry. At the workshop, the development team presented and demonstrated the system, after which there followed a long discussion about the system in relations to smart cities in general, and for Telemark County more specifically.

Follow up-interviews with the lead developer and a representative from the county were conducted via e-mail in February 2016. A video recording of a presentation of the system has also been part of the data material. As interviews were electronic, there was no need for transcription. The first author made field notes at the workshop in November 2015. In addition, the County council's web site has been a source for documents and plans related to the case.

The data is analyzed by applying the case findings to the framework of Gil-Garcia, Pardo [13], in order to examine the maturity of the case and identify any possible weaknesses. In addition, we discuss how this and similar projects can be used to engage more people in decision-making through implicit participation.

### 3 Case presentation and findings

A consortium with members from business and academia created *Trafpaint* as a response to a call for innovations in transport planning, presented by the IT industry organization in Telemark. The consortium has four members from business, IT and nanotechnology.

The innovation challenge that started the project was "how can we get more people to travel by public transport, in a region where most people prefer to travel by car?"

*Trafpaint* was created to answer this call. The system consists of four elements. The first is a mobile app that users can download, using beacon<sup>2</sup> and Bluetooth technology to automatically register when people board and leave the bus. When the user's phone moves outside of the bus-mounted beacon's range, the user is registered as having left the bus. Users build the environmentally friendly profile by earning miles for each trip, and can share their position on the leader board on social media such as Facebook. This social aspect is where the developers hope gamification will help to motivate more people to travel by bus, by creating a social pressure and contest for who is the greenest traveler.

The second element is an application that counts all passengers entering and leaving the bus, using video and a motion-detection algorithm created to recognize people without identifying them. The application runs on cheap hardware, and the motion-detection can be adapted for different distances between camera and object. Data about passengers boarding and leaving is registered in real-time and transferred to the back-end.

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<sup>2</sup> For information on beacons, see <http://www.webopedia.com/TERM/B/beacon.html>

The third and fourth elements are the back-end analytics. All data is transferred to a cloud-storage Hadoop database, which uses parallel processing to calculate live statistics for when and where people are travelling.

This is coupled with a front-end that decision-makers can access to perform analyses of public transport use. The current version registers daily statistics for each stop – How many people enter and leave the bus, the times of day with heavy traffic, and the total amount of people on the bus are examples of the statistics being recorded. The road authority maintains the list of bus stops, and Trafpoint imports this list at regular intervals. The front-end also uses Google maps to visualise transportation patterns. Predictive statistics is not part of the solution at present, but there are plans for implementing this when the amount of data is large enough to facilitate prediction.

While Trafpoint is promising, the application has yet to be implemented on a large scale. So far, the findings reported are from development and pilot testing. The developers report that they are still working on commercializing the system, and they are working with several partners from the private sector, as the technology behind Trafpoint is just as interesting for airports, shopping centers and other large constructions where people flow is an issue. As a private company, their focus is on profit, and they report they will take the technology in the direction that is most promising in terms of maximizing profits.

### 3.1 Analysis: Trafpoint as a smart city project

Gil-Garcia et al [13] has created a framework for smart cities consisting of ten dimensions, grouped into four categories. While the framework is meant to evaluate cities, it can also be used to examine individual projects. The following section analyses Trafpoint according to this framework.

The first three dimensions are concerned with the inner workings of government. *Public services* is the first dimension, as effective services are essential for creating smart(er) cities [26]. Services aimed at reducing transport emissions are mentioned specifically [26]. In light of this, Trafpoint can be a valuable application for smart city development, as its objective is to get more people to travel by bus. *City administration and management*, the second dimension of the framework, points to the use of e-government, efficiency and proper funding for new projects. Here, Trafpoint meets its first hurdle. As the county government is yet to make a decision on implementation, the entire project is in danger. *Policies and other institutional arrangements* is the third dimension, and includes visions for the future and policies supporting these visions. While the county has established a Smart City office, this is but a small part of the county's office for regional planning. There are no hits for "Smart City" or related subjects on the county's web site.

The next three dimensions are related to society, and aimed at uncovering if the region has sufficient resources to support smart city development. The dimensions *Human capital & creativity*; *Governance, engagement, & collaboration*; *Knowledge economy & pro-business environment* examines collaborations between civil society actors, education and knowledge levels, and the presence of high-tech and creative industries capable of transforming policy into actual products and services [13]. As Norway is large country with a scattered population, these dimensions are difficult to meet outside of the largest cities. In the Trafpoint case, the project involves actors from three different counties working together. Using ICTs for communication and collaboration means this is not a big obstacle, as the collaborative environment is strong.



Here too, government and formal obstacles are more visible. For example, the representatives from Telemark County expressed concerns that the project involved too many actors outside of the county. When each county works towards its own interests, this presents an additional challenge for inter-regional collaboration.

The next two dimensions are related to the physical environment. *Built environment and city infrastructure; and natural environment and ecological sustainability* examines the physical infrastructure of cities (road, rail, communication) and holds these up against the objective of environmental sustainability. Compared to the rest of the country, Telemark has a lower share of public transport: Only 3% of journeys, compared to 8% as the national average [27]. The county's objective is to increase this number, but there are several challenges related to infrastructure. The population is scattered across one city region with 90.000 inhabitants, and several smaller towns and villages. Centralization of public offices and services means that more people have to travel longer distances to get to work, school etc. [27]. If Trafpoint is implemented, it can help to increase the share of public transport, both through analytics of travel patterns and through the gamification aspects of the mobile app.

The final two dimensions are grouped under the heading technology and data. A smart city should have a well developed communications infrastructure, and they need to have access to, and analysis of, data from relevant areas such as traffic, power, health, safety and others [13]. According to the post and telecommunication authority, the southern parts of Norway have good coverage of 4G mobile Internet, and high-speed fixed broadband is readily available, at least in the more densely populated areas<sup>3</sup>. This means that at least in the city region, the infrastructure is not an obstacle for Trafpoint and similar applications. The data registered by the system can be used to optimize public transport schedules, in order to make public transport accessible and usable for more people by examining when and where people travel. This could be supplemented with additional data from car transport (for example from tollbooths) in order to create a better match between people's travel needs and public transport schedules.

#### 4 Discussion and Conclusion: apps for implicit participation?

Traditional forms of participation require the citizens to spend a certain amount of time to take part in the participation. If citizens find the process too time-consuming, they may choose not to participate. This could especially be true for the large group of "standby participants", citizens who are interested in politics and society, but who still choose to remain mostly inactive [11]. Passive crowdsourcing has been proposed as a solution for getting input from this large group [22]. Smartphones, coupled with analytics software that provides important data for decision-makers [24-26] is one way of getting citizen input, and gamification provides incentives for citizens to become implicit participants[24].

Applications such as Trafpoint meet these criteria, and can become an important way of engaging the large group of standby participants. While the video-based monitoring of people boarding and leaving the bus does a good job of collecting data, the mobile application takes it a step further by making the citizen take an active choice to participate. Gamification elements mentioned above, such as the leaderboard with your personal green footprint and social media sharing, makes participating more fun. If

<sup>3</sup> [http://eng.nkom.no/topical-issues/reports/\\_attachment/16031?\\_ts=14abf0b9644](http://eng.nkom.no/topical-issues/reports/_attachment/16031?_ts=14abf0b9644)

enough citizens start sharing their green habits in social media, network effects and the competition to be the greenest traveler can potentially contribute to lasting change in people's travelling habits, and to even more becoming engaged, participating and contributing their own data – which in turn helps decision makers to find the optimal solutions for public transport.

As all research, this paper also has its limitations and questions. Trafpoint, while the focal point of this paper, is but one example of how smartphone sensors and analytics can help recruit more citizens to become participants. Unfortunately, questions about implicit participation has to be answered with the word potential. As the application is still in the pilot stage, there is no real data on this as of yet. Future research, if the application is implemented, will examine if this potential has been realized.

Potentially, all the relevant smart city areas such as transport, pollution, health and others, can use the same techniques to gather input from citizens and thereby contribute to even better services. The question is if citizens are willing to install a number of apps on their smartphones, for all kinds of data collection. An ordinary citizen might be interested in contributing data on a number of issues, but having individual applications for this would soon take up too much space on the phone. An important area for future research could therefore be to examine if it is possible to create one single “participation app”, where citizens can choose different types of data they want to share.

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# A Comparative Study of e-Participation Effectiveness Evaluation Approaches

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**Abstract.** E-participation is becoming an increasingly important factor in the development of mutually beneficial relations between the state and society. In order to meet the needs of both sides, this development must be accurately measured and effectively controlled and for this we need to select and apply the most appropriate metrics and methods for measuring e-participation results, impacts and created values. This paper presents the results of the comparison of techniques currently used to assess different aspects of e-participation performance and impacts. The paper also proposes a new method of assessment and suggests a way to select the proper e-participation assessment methodology. The authors applied T.Paronson's AGIL paradigm to identifying the social functions and values that are prerequisites for any society to be able to persist and evolve over time. The research results show that the majority of approaches were focused on technology and policy frameworks existence and use, as well as on different interpretations of social impacts. This study revealed the lack of economic impacts interpretation and measurement tools for decision-making evaluation. The authors detected the necessity of additional indicators needed to measure the e-participation progress and prepare recommendations for its' sustainable development. Proposed conclusions can be useful for selecting the most appropriate e-participation assessment methodology and detection of measures missing to obtain a rigorous assessment in the specific country context.

**Keywords.** e-participation, evaluation, measurement, impacts, public values

## Introduction

In recent decades, how to achieve good G2C dialogue via the development of ICT has been a critical concern for public administrators and scholars in public administration. The development of e-governance and e-participation supposes the active involvement of citizens in the processes of interaction with the authorities. A lot of words about the indisputable advantages that new technologies could bring to citizens have been told from the official tribunes. It was a priori assumed that citizens will actively use the new feedback channels to express their opinions and attitudes towards innovation and the authorities' actions.

E-participation tools (portals for urban problems and e-petitions) began to appear in Russia in 2007 but began to take a special popularity in 2012 and showed the birth of new forms of social activity mediated by ICT. The evaluation and prediction of ICT impact on the efficiency and openness of governments at all levels are getting more and more important, but these dependencies are not well understood yet. This paper is dedicated to the comparison of existed approaches to measuring the social impacts and values generated by e-participation tools and application.

## 1. State of the Art

The topic of measurement, evaluation and monitoring techniques appeared not just recently, but make a specific background for evaluation frameworks. We have gathered different approaches trying to distinguish 4 main components: the object of evaluation, indicators, methods and opportunities (or distinctive features). The brief description of the selected techniques used recently is presented below.

The composite index assessing the completeness and quality of feedback for electronic participation procedures by Yakimets et al. [1] measures the governmental informational resources through such indicators as the completeness of feedback opportunities (% of tools available at site) and feedback quality (informativeness, usability, simplicity). This technique has been successfully applied in Russia, using governmental websites' sites binary rating scale and expert poll conduction.

Statistical Indicators Benchmarking the Information Society [2] is used for measuring progress between the European Union countries. This monitoring values the technologies usage, citizens' adaptation to new technologies, barriers and upcoming opportunities. The following indicators are evaluated: interactivity level, eEurope indicators, barriers, technology, costs, training, needs, equipment, efficiency. This technique is based on statistical analysis and questionnaire. As a result, this monitoring system gives the barriers' segregation for three types of users (government, business, and citizen), focus on measuring the degree of user acceptance of new services.

The Taylor Nelson Sofres (TNS) [3] also provides a monitoring study of e-government usage in 31 countries paying a special attention to online services usage. It used a special questionnaire to evaluate the online services' utilization and the extent of information channels safety. This monitoring method allows identify the impact of Internet on the government's work at global and national levels.

Yakimets developed the Index for public policy evaluation and monitoring [4] with the use of democracy and public sphere indicators. For such measurement, a survey poll (civil servants, businessmen and NGO- representatives) was conducted using a 10-points scale of assessment. The proposed mathematical matrix gave the range of estimates for each of the groups of the respondents. We can conclude that this index is quite good for comparing different regions.

Mathematical modeling of political stability proposed by Akhremeko [5] is also used for rating the relative effectiveness of decision-making in countries and regions and municipalities within countries as well. The researchers have a deal with official statistics (budget spending, the level of social welfare and productivity), economy analysis, and use MaxDEA 5.214 for results' counting. According to the approach, budgetary costs are considered as input, the level of welfare as an output. Output efficiency shows what proportion of potentially possible in the given conditions the outcome the decision-making really achieves. Input efficiency shows how decision-making reduces costs while maintaining the current result.

The research on government influence on public trust in Spain by Belanche and Casalo [6] addresses to a social concept of public trust. According to research methodology, the public trust could be measured through the following sub-categories: e-services quality, public administration communication, attitude towards government, efficiency, confidentiality, performance, system availability, communication and governance, attitude to e-governance, the belief in the public administration. On the base of the Spanish case, they applied online opinion poll and Larker's scale method. This study linked the complex to the model of indicators.

Critical factors of public value [7] have been studied in Shri-Lank by Karunasena and Deng. The scientists paid attention to the quality of information, services delivery, user-orientation, openness, responsiveness and the environmental sustainability. The sociological survey, SEM methodology, Fornell and Laker's methods have been used. The research revealed that citizens did not appreciate budget savings and staff reduction due to e-governance development.

Institutional and technological determinants [8] provides Jho and Song the detection of e-participation level. Assessing the population online, political institutions, E-Government development index UN, ITU Statistics, Freedom House Index, Economist Intelligent Unit (E-Democracy level), Human development index, the authors made a complex of indicators influencing e-participation development. They used regression analysis, modeling, PSS, three-way ANOVA as research tools. Regression analysis showed that the level of technology and political institutionalization were the variables that determined e-participation.

Sivarajah et al. evaluated the use and impact of Web 2.0 technologies in local government [9] looking at web 2.0 efficiency criteria, the usage of web 2.0 at local level, as well as web 2.0 impact on business processes at local administrations. They formulated different categories of monitoring indicators: organizational, technical, social. A complex of research tools was concentrated on the indicators evaluation, including literature review, expert semi-structured interview and observation of the local government employees' working process in Great Britain, document analysis, NVivo, Larker's method. This monitoring is oriented at local level and provides a detailed classification of costs caused by web 2.0 and the associated risks.

The impact of government form on e-participation has been measured at New Jersey municipalities by Zhen et al. [10] with the focus on structural types of municipalities and its' impacts on e-participation. The three management systems called "Council-manager", "Mayor-Council", "Township", as well as technology, transparency, e-services, budget, municipal size were subjected to statistical analysis and correlations. The results showed that municipalities with a form "Mayor-Council" gave more opportunities to citizens' participation in the life of city online.

A study "Evaluation of E-Participation Efficiency with Biodiversity Measures" by May et al. [11] represents the case of the Digital Agenda Vienna. This index was originally intended to be used for open-ended questions, where you can analyze the distribution problems. The open format produces a list of problems themselves while the frequency can be taken as the number of votes for the problem, the number of "Likes", the number of posts on the issue, the number of posts which had "retweets", etc. However, ENI may also be used in closed matters agree / disagree (Larker's scale).

A classic study by Macintosh and Whyte towards an evaluation framework for eParticipation [12] tested the applicability of methods measuring democratic, project and socio-technical criteria. A case study of eParticipation evaluation for four local authorities, semi-structured interview, phone interview, observation, project documentation analysis, web-server analysis made the base for research analysis. This research underlined the importance of multi-method approach, and the complexity domain needed to be developed.

The 5 levels of participation (eInforming, eConsulting, eDiscussion, eParticipation, eEmpowerment) have been selected for another evaluation framework by Ter'an and Drobnjak [13]. The authors assessed web-presence, media diversity, synchronous and asynchronous communication channels and used modeling as the main research tool.

This approach showed the benefits Web 2.0 network. The framework proposed in this work allowed a quantitative evaluation of different e-participation projects. The results of the evaluation showed the lack of the following technologies usage: Web 2.0, Web 3.0, audio, video, interactive video, and synchronous communication channels.

A complex approach has been developed in UNDESA and was called METEP (Measuring and Evaluating e-Participation) [14]. The METEP aims is the measurement of e-participation in different socio-economic conditions. The research indicators are separated into a political, social and technical blocks. Using the official statistic data, expert poll and questionnaire this method proposes to evaluate good, satisfactory, certain, marginal or no progress at all. This approach is well-balanced and good for measurement the progress and differences between countries, regions, municipalities.

The study of e-participation in Germany by Schroetera and colleagues [15] tested the value of public participation by analyzing inclusiveness, information exchange and learning, and the influence on the political decision. Semi-structured interviews, qualitative research, document analysis were put into research practice. The study revealed 8 dimensions of participation process: expectancy, transparency, acceptance, fairness, effectiveness, efficiency, own impact, satisfaction.

Evaluating websites from a public value perspective in Turkey [16] assessed public value created through participation online using the standard criteria (content, usability, quality), and public value indicators (accessibility, citizen engagement, transparency, responsiveness, dialog, balancing of interests). They applied website assessment, systematical scanning approach, an extensive search of journals, automated tests of websites (using SortSite 4.7.564.0, Xenu's Link Sleuth 1.3.8, CSS validations of Turkish MM websites, Web Accessibility Inspector 5.11). The researchers noticed the fact that the most websites had a high rate according to standard criteria and the low rate of the public value development.

An interesting view on e-participation indicators has been developed by a team of Spanish and German researchers [17, 18]. From the perspective of their approach, there are three dimensions to be measured: efficiency (doing things correctly), efficacy (achieving goals) and effectiveness (doing what is right). The researchers revealed a system of indicators for each of the factors and tested it in the municipality of Cadrete (Spain). An online questionnaire was used for establishing the values for each of the indicators, and an expert poll was selected for reviewing the framework for e-participation assessment.

The analysis of modern approaches showed a variety of approaches covering seemingly all possible measures regarding e-participation but discovered the fact that none of the methodologies can cover all necessary indicators at once. Summarizing the current situation in the field of e-participation assessment we should underline the following trends:

- a lack of complex approaches embracing the different spheres of the research object,
- the research teams usually develop their own tool for assessment, but not modernize the existed approaches (which covers some of the topics very well),
- the results of studies at specific locality (like municipalities, districts or even regions) are not usually translated into a wider areas or national level,
- there are no attention to the functional side of e-participation and its' features that could explain the relations between stakeholders and the level effects of their actual involvement.

## 2. Research Methodology

This research is focused on determination of different approaches' limitations in the context of values measurement. This comparison allows us to draw conclusions about the applicability of particular techniques or their combination for a variety of economic, organizational, social or political objectives in terms of the completeness of the response to different research questions.

To evaluate and compare a variety of techniques that assess different aspects of e-participation in terms of its relationship with the society as a whole, we used a framework which covers the development of society and its factors as fully as possible. After a preliminary study, the T. Parsons' AGIL paradigm [19] proposed over 60 years ago was chosen as the most comprehensive, consistent and versatile. This scheme is based on the structural functionalism concept which is appropriate to describe the interaction within e-participation technologies, where the power institutions have a certain structure, management levels and determinate rules for establishing the interaction. This approach extends the traditional systematic view on the studied subject showing the elements' functional characteristics with their contribution to the systems' preservation or modification.

We have applied T. Parsons' AGIL paradigm based framework in which every social phenomenon must be presented to maintain stable social life. We have looked at e-participation development as a complex of adaptation, goal attainment, integration and latent pattern maintenance, and distinguished the groups of indicators needed for e-participation analysis and resulted into different sides of AGIL scheme.

The summary of the proposed framework is showed in Table 1.

**Table 1.** The summary of the proposed framework

Core functions	Indicators		
	<i>Presence</i>	<i>Use/utilization</i>	<i>Impacts</i>
Adaptation (economic)	Resources (financial etc.)	Services development Risks of usage	Costs and expenses
Goal attainment (political)	Policy framework with clear goals	Political control Rights protection, Transparency	Quality of decision-making
Integration (social)	Stakeholders with common norms and goals	Community creation Stakeholders' involvement	Crowdsourcing. Attitude and trust to services
Latency (technology maintaining pattern)	Technologies (supporting institutes)	Technology usage Open data	Usability, satisfaction

This evaluation of selected techniques should provide an answer to the question of their ability to detect and evaluate some specific society function, feature and their impact on the society development. The last (impact) was added because of the understanding of the fact that the presence of the function or feature does not guarantee its effective utilization for the society benefit. That is why the proposed evaluation methodology was complemented by such indicator as the ability to appraise the use and effects of a certain e-participation artifact. This study not planned to obtain accurate estimates of the quality of measurements, therefore, to achieve its goals only the presence or absence of instruments for each type of functions, their use and impacts evaluation in the analyzed techniques have been assessed.

This focus was determined due to the logic of a structural approach.



3. Findings

As a result of careful study of the selected techniques’ specifications and practical application, the picture of their coverage of society’s functions (according to T. Parsons’ AGIL paradigm) has been created. The comparison revealed the gaps in monitoring of important functions work.

The summary of the research findings presented in Table 2.

Table 2. Summary of various techniques evaluation

Approach	Economic			Political			Social			Technology		
	presence	use	impact	presence	use	impact	presence	use	impact	presence	use	impact
Quality of feedback index										V	V	V
EU Information society benchmarking			V	V			V			V		V
TNS survey							V		V	V	V	
Public policy evaluation				V	V	V				V		
Mathematical modeling of political stability	V	V	V				V					
Public trust in administrations			V		V				V	V	V	
Factors of public value	V		V	V						V	V	
Institutional and economic determinants of e-participation				V	V				V	V		V
Use of web 2.0 technologies in local government	V			V			V	V	V	V	V	
Impact from e-participation to government	V	V		V	V					V		
E-participation efficiency						V	V		V			
E-participation evaluation framework for e-participation				V	V			V	V	V		V
5 levels of e-participation					V	V		V		V	V	
METEP				V	V	V	V	V	V	V	V	
Value of public participation in Germany			V			V		V		V	V	
Evaluating websites from public values perspective					V	V			V	V		V
Evaluating effectiveness, efficacy and efficiency			V			V		V		V		

As we can see, despite the breadth of the used framework coverage, it is absolutely all society’s functions (including their presence, use and impacts) were covered by some of the considered techniques. However, none of the studied techniques covers all core functions at once.

The frequency of indicators detection in the studied techniques showed in Figure 1.

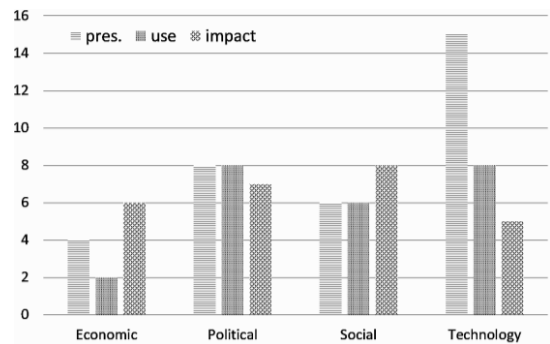


Figure 1. The number of indicators detected in the studied techniques

Indirectly, this tells us that different methodologies developers realized the importance of all these factors, but some reasons forced them to narrow the scope of their research. Due to the strong ties between all core society functions such narrowing of the evaluation focus seems extremely undesirable. The expansion of the range of indicators significantly increases the complexity and cost of studies, particularly large-scale ones, but political, social, economic losses because of their lack may also be great.

The research results showed that there is a higher interest in the technological indicators but such important functions of e-participation as economic, political and social are not measured at the majority of cases.

The assessment of chosen techniques validity has not been intended in this paper. At the same time, the authors believe that positive experience of the studied approaches could be used for a complex e-participation evaluation methodology development.

#### **4. Conclusion**

The contribution of this study lies in two areas. First, it analyzed how different techniques measure different aspects of e-participation, i.e. how existed approaches measure the existence of e-participation tools and application, their use and impacts on different functions of society. This knowledge will allow interested researchers to choose the technique or a combination to use thereof that will more fully meet the specific needs of a particular study. Second, it shows that there is currently no technique allowing us to assess the state of e-participation, its use and impacts on the society development in its entirety. This finding encourages us to continue our study of existing assessment techniques, develop and test the new ones in order to be able to control and manage all critical factors of the society development. In addition to the explored T.Paronson's AGIL paradigm, such frameworks as Public Value, Architectural approach, Balanced Scorecard etc. are of interest for further research as they are able to allow us to consider monitored and managed phenomenon from all sides as a whole. Search and / or creation and application of such integrated approaches will help us to avoid the lack of attention to important factors that happen quite often in the Russian reality and usually leads to unsatisfactory results and negative impacts of the e-participation mechanisms implementation projects.

#### **5. Discussion**

The research revealed the necessity in the further analysis of the validity and consistency of specific e-participation efficiency measure technics because it has been found that different tools bring different answers on the same question.

The further research could be addressed to the development of a complex approach considering the temporal horizon and the planning level. This is important because the effects of the decisions taken at different levels can appear immediately, soon, or in the distant future.

Another problem for future research - the impact of the applied method of e-society or e-participation development valuation on the goals of this development. At least in Russia [20], immediate adjustments of e-society development objectives were found as an after-effect of applying certain performance evaluation methods with the intention to improve the results of these measurements.

## 6. Acknowledgements

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# The Public Value of Sense of Community in eParticipation

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**Abstract.** Concerns over a decline in social capital have been noted resulting from reduced civic and political engagement; recently however, the impact of Web 2.0 has been proposed as a revolutionary force to redress this deficit enabling greater participation by citizens and reinvigorating civic society. eParticipation is an increasingly important area of study to evaluate the promise of social media technologies to engage citizens in the democratic decision making process. This paper responds to the challenge by introducing the public administration paradigm of Public Value to eParticipation research in order to conceptualize and evaluate key issues of value, power, democratic participation and the quality of the decision process. This study introduces Sense of Community (SOC) to the eParticipation research field and highlights the important mediating effects of (SOC) to critical Public Value outcomes. Through the Public Value lens, the quality of the decision making process is reflected in the legitimacy of the public policy mandate; for eParticipation this means looking for ways to improve the quality of the decision making process. The aim of this research is to create a new measure of SOC for eParticipation that is based on Public Value theory.

**Keywords.** Sense of Community, eParticipation, Public Value, IS Success Model,

## 1. Introduction

As computing becomes increasingly ubiquitous, and social media and smart phone usage increases exponentially, according to Sæbø the possibilities of Web 2.0 open up new channels for citizen participation [1], in particular two way communication that facilitates change in existing interaction patterns needs to be investigated [2]. A key role of eParticipation is to facilitate engagement using interactive tools [3], for example leading e-Government practitioners such as Noveck have developed online communities of participation and demonstrated the benefits [4]. Calls for research come from Policy Informatics Krishnamurthy [5] as the generation and dissemination of feelings of empathy among users of participatory platforms is a complex challenge requiring systematic research. Sussha and Grönlund call for eParticipation research that examines citizens' personal attitudes and their self-perceptions [2]. In answer the Community Psychology term, Sense of Community (SOC) is introduced to eParticipation to help explain participants' attitudes and experiences to the generation of a sense of shared community to pursue shared goals. SOC is defined as "a feeling

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that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" McMillan and Chavis [6]:9). Nabatchi urges the (re)discovery of the public in public administration; leading to a greater understanding of publicness, and to rich interactions with the public aided by developments in theory and practice. These developments include the advancement of Public Value (PV) and participation as priority research areas, in so doing, processes and mechanisms must be identified that maximize the creation of an organized collective will capable of addressing and resolving public problems [7]. In response, PV theory is introduced to eParticipation, as it facilitates the evaluation of access to ICT which goes beyond access to technology and takes into account motivational access, material access, skills access, and usage access and context of technology adoption [8] and includes political inequalities [9]. Any progress made in the pursuit of creating an organized collective will or '*public*' must endeavor to draw the best from both the eParticipation and Public Administration research areas to create a better quality of participation (s) that enables the creation of Public Value. The eParticipation process should both produce intrinsic value and instrumental outcomes of value to the offline political policy process [9, 10]; and facilitate both online and offline participation as appropriate [11] enabling a new digital democracy [12]. As the SOC construct has not been used until now in eParticipation, a literature review of SOC was conducted, drawing on writing from the domains of community psychology, social media, e-commerce and cyber-psychology. This informed the construct development of SOC in eParticipation, the model was constructed with regard to the specific requirements of eParticipation

The object of this research is to: elucidate the theory behind Sense of Community as a contribution to eParticipation research. Explore the expected benefits of SOC to the eParticipation process and develop constructs to represent SOC in eParticipation and to create a new measure of SOC for eParticipation that is based on Public Value theory.

## 2. Public Value and eParticipation

eGovernment already has a rich tradition of research on Public Value e.g. Bannister and Connolly, Cordella and Bonina, Grimsley and Meehan, Seltsikas and O'Keefe etc. [13-16]. Public Value (PV) provides a framework that enables the examination of values, both tangible and instrumental including participation, engagement and trust [17, 18]. As stated by Nabatchi [7] the research areas of PV and participation are of strategic importance to the future of public administration research and to understanding citizen engagement, a key tenet of democracy. Until now PV has not been applied to eParticipation; yet it can facilitate the examination of equal access, regime values and the requirements of the diverse range of stakeholders. Because PV has been defined by Moore as a framework that helps us connect what we believe is valuable and requires public resources, with improved ways of understanding what our '*publics*' value and how we connect to them Williams et al. [19]. Two key ways that the theory of PV can be of benefit to eParticipation is in the creation of a '*public*' that can understand and act in its own interests, which is at the heart of the PV paradigm, enabling citizens to be arbiters of Public Value [20]. Also Moore's PV strategic triangle reflects the interdependence of a range of stakeholders in Public Value goals, authorizing environment and operational capacity [21]. These describe the interaction

between a society's public values, the strategic goals which provide the normative consensus about the rights, benefits and obligations of citizens to society, the state and one another. The authorizing environment which must be legitimate and politically sustainable to key stakeholders; and public sector decision makers who must be accountable upwardly and outwardly to these groups and engage them in an ongoing dialogue over organizational means and ends [19].

A recognized weakness of earlier PV research is the lack of attention given to entrenched power and political bias; that by enlisting the public as co-participants in the creation of PV there lies a risk of developing further a managerial mode of governance that falsely implies power to the citizen [9] without recognizing the conflict among contending interests [22]. The reinforcing public values of the public sphere and progressive opportunity; refer to open communication and deliberation that looks to the social conditions required to ensure that members of society have an equal ability to exploit their capabilities and objectives [23]. These are attempts to redress the balance in participation, along with the recognition of regime values which refer to the collective benefits of the normative foundation of the state and are seen as a source of legitimacy guiding public servants [24]. While accepting that governments must define strategies to enhance partnership and empower citizens to create environmental conditions that stimulate citizen engagement [21]. PV has an important role to play in the analysis of eParticipation, as it incorporates important public administration concerns as highlighted above with the practical concern of situating eParticipation within the broader socio-political landscape.

### **3. eParticipation**

According to Cordella and Bonina the term e-Government is generically used to define any adoption of ICT to facilitate the daily administration of government and/or the production and delivery of government services to citizens through ICT [13]. The evolution of eGovernment consists initially of dissemination of information, then two way communication and eServices, with eParticipation occurring at the highest level of Moon's maturity model [25]. eParticipation research inherits a rich tradition of theory from the areas of sociology, politics, psychology, management and economics. Recently the electronic part of eParticipation, ICT in the form of Web 2.0 and mobile applications have enabled participation activities to develop an ever increasing range of scenarios in what amounts to a revolutionary change [12]. The most influential definitions from both Public Administration and eParticipation literature include: Macintosh who describes eParticipation as the use of information and communication technologies to engage citizens, support the democratic decision making processes and strengthen representative democracy [26]. For public administrators Creighton suggests that public participation is the process by which public concerns, needs and values are incorporated into governmental and corporate decision making [27], the ultimate goal being better decisions that are supported by the public.

As it has matured eParticipation has moved beyond an exclusively top down government led process, instead recognizing the duality of eParticipation as the integration of government led and spontaneous citizen-led eParticipation [28, 29] and a recognition of the role of social media in eParticipation [1]. The focal point of eParticipation is the citizen but there are also a wide variety actors involved in eParticipation processes: including politicians, government institutions; voluntary

organizations [30]; also expert administrators/technical experts selected by politicians and professional stakeholders, the paid representatives of organized interests and public officials [31]. For Bryson, the identification and mapping of these stakeholders is of crucial importance to the design of the public participation process [32]. Government led participation often aims to improve the acceptance and legitimacy of the political process whereas citizens, lobbyists and non-governmental organizations usually demand their own interests through political channels or through activism [30].

As a maturing area of study there is an increased need to examine the contextual factors affecting the eParticipation process [33]. Of value to eParticipation is the proficiency of sense of belonging a subset of SOC to affect intentions to get and share knowledge and it has also been found to mediate the relationships between social capital factors and a virtual community member's intentions to participate [34]. To improve eParticipation it is important to gain a greater understanding of the barriers that impede participation, which present a variety of challenges including: a lack of citizen trust in political institutions, behavioral patterns that inhibit participation and difficulties in defining the role of eParticipation in the creation of value [35]. The stage has been set for citizens to play their part in the political policy process, and yet overcoming barriers to participation, engaging people in these processes and encouraging them to contribute in a meaningful way continues to be a challenge. As the role of government changes to that of a convener and enabler [36], government agencies continue to provide the rules, platforms, and access, as citizens and communities take on more responsibility in exchange for a greater say [37].

#### **4. Sense of Community (SOC)**

An extensive literature review was carried out to ascertain a greater understanding of the theory behind Sense of Community, to examine how SOC is created and its relevance to eParticipation. In 1974, Seymour Sarason presented the concept of psychological sense of community as the overarching value by which community psychology should be defined [38]. McMillan and Chavis describe it as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" McMillan and Chavis [6]:9). In spite of the importance of SOC as demonstrated by extensive empirical studies [39-45], a consensus about the dimensions of SOC does not exist. The most influential measure of SOC is the 1986 McMillan and Chavis Index which built on the work of Doolittle and McDonald [46] and Glynn [47]. They describe the origins of each of the SOC dimensions and how the dimensions interrelate to produce SOC. SOC theory is well validated in numerous online and offline communities, including; virtual learning environments [48], e-commerce [34, 49, 50] and social media communities [44, 45]. Virtual communities extend a new horizon by which to think about human identity online as people often become more confident online and explore new personas [51], potentially giving citizens a greater opportunity to participate in civic and political processes.

SOC is proposed as a mediating factor to successful eParticipation; as community building is a key role of citizen participation that includes the coming together and forming of online communities of eParticipation and the empowerment of such communities Tambouris et al. [31]. SOC can provide many levels of value to eParticipation including: SOC has been found to act independently of individual level

traits of gender income etc., and is a strong and positive predictor of internal and external efficacy and personal and political trust [52]; it has been found to positively affect organizational citizenship behavior; loyalty, civic virtue, altruism, and courtesy, in work communities [53] and in fostering both civic and political participation in offline communities [54, 55]. In a virtual community, sense of belonging refers to the feeling of belonging, membership, or identification to the virtual community; the feeling of members that they are integral parts of the virtual community, Zhao equates this to a SOC [34]. Trust has the strongest influence on a sense of belonging to a virtual community [56], reflecting the differences between electronic and face-to-face communication and the importance of identity online.

Without face-to-face contact, members of a community must feel trust to participate in the community. SOC represents a key variable in the development of online trust, as it enables members to develop their own identity and exchange support with other members, and influences members sense of belonging to the community [40, 50, 52, 56, 57]. According to Preece the impact of trust on participation comes from a history of positive past interactions that lead participants to expect further favorable interactions [58]. SOC is also a strong predictor of information sharing and even more importantly self-disclosure which is critical for maintaining and building relationships [59]. Interestingly for eParticipation; it has been found that when community members experience a SOC it reduces the negative impact of information overload on stickiness, community members may spend more cognitive effort dealing with relevant information, thereby increasing their information processing abilities [60, 61], this could result in greater citizen engagement.

It is recognized that the unique relationship of extensive benefits and obligations between the citizen and government [62] distinguish the research area of virtual communities of eParticipation. As such, the constructs of SOC in eParticipation require careful development to include the system functionality and the users experience of using the system Petter et al.[63]. With the PV framework, which is particularly useful when assessing the appropriateness of eParticipation constructs as it enables the review of public administration concerns within the broader sociopolitical landscape of eParticipation.

#### *4.1. Membership /Sense of belonging*

The first construct of McMillan and Chavis [6] SOC Index is Membership which creates a sense of belonging and identification and involves the feeling, belief, and expectation that one fits in the group and has a place there. To build a feeling of SOC in eParticipation important questions of identification and belonging must first be addressed. Giddens has argued that with modernity, people's sense of belonging becomes reflexive, he proposes that autobiography in its broadest sense is at the core of self-identity in modern social life [64]. In a similar vein, Castells network society is characterized by belonging moving from the civil society of nations to identity becoming the main and possibly only source of meaning where people organize their meaning not around what they do, but on the basis of what they are, or believe they are [65]. In a later paper McMillan [66] extended SOC measures by emphasizing sense of belonging over boundaries, reflecting this the construct sense of community is chosen for this research model (Figure 1). To assess the functional and user experience of the new eParticipation construct sense of belonging constructs from E-S-QUAL [67] Fulfilment which measures the extent to which the platform fulfils the needs of the



community and Privacy measures the degree to which the platform provides a safe environment for participation. As SERVQUAL ignores the influence and quality impact of participation and support between users [68]. The construct Responsiveness [68-70] will be used to measure peer supportiveness.

#### *4.2. Influence*

The second construct of SOC is Influence a bidirectional concept; an individual must feel they have some control and influence over the community, whereas, conversely, for a group to be cohesive, the community must also influence its individual members [39, 53, 66]. Regarding eParticipation, Grönlund identified both the impact of different governance structures on the transaction zones of formal politics, administration and civil society and the *influence* of different partially conflicting forces or actors [71]. This research argues that Influence is an important aspect of eParticipation and that feedback both from the organizing agency and other participants plays a key role in promoting participation, mediating the power relations between the stakeholders; and affirming political efficacy and trust. Along with the McMillan and Chavis Index construct Influence, constructs from E-S-QUAL [67] Fulfilment referring to the extent to which the platform fulfils the needs of the community and the construct Responsiveness [68-70] to measure agency feedback and peer supportiveness will be used to assess the functional and user experience of the new eParticipation construct Influence.

#### *4.3. Integration and fulfillment of needs /fulfillment and shared goals*

The third component of SOC is integration and fulfillment of needs. Meaning reinforcement, a known motivator of behavior. To create a positive sense of togetherness, the individual-group association must be rewarding for its members. The extent to which individual values are shared among community members, will determine the ability of a community to organize and prioritize its need-fulfillment activities [6]. It is proposed that for the eParticipation process the ability of participants to prioritize values, create common goals and receive feedback from the organizing agency is of primary importance. As the shared common purpose unites the community (although people may well disagree with the details) creating a feeling of Integration and Fulfilment of needs. SOC theory helps us to understand why the agency organizing the participation process must ensure that the views expressed by the participants have been handled fairly, Christensen et al. found that, regarding process legitimacy participants may be willing to accept not achieving the desired outcome, as long as they perceive the process to be fair [72]. Using SOC theory, unfairness could equate to the sense of shared values being broken. Along with the construct Influence from McMillan and Chavis Index, constructs from E-S-QUAL [67] Efficiency will be used to measure whether the platform is simple to use and structured correctly and Fulfilment to measure the extent to which the platform fulfils the needs of the community will be used to assess the functional and user experience of the new eParticipation construct Fulfillment and shared goals.

#### 4.4. Shared emotional connection/ Identified participation

The fourth part of McMillan and Chavis SOC Index is shared emotional connection this partly concerns a shared history. But importantly for eParticipation it is *not* necessary that group members have participated in the history in order to share it, but they must *identify* with it [6]. Wellman and Gulia [73] have argued that the public exchange of support may increase members' perceptions of being a supportive group when in fact, few people are actually involved in the supportive exchange. Lurkers are often not seen as valuable to the community [74], yet reading content produced by others can be seen as an essential form of participation [34] that can support the development of a SOC, although to create value the input of lurkers should be made visible through ratings and voting tools [75]. Giving and receiving support contributes to a sense of belonging and creates feelings of attachment and obligation [39]. As observing the behavior of others is an important behavior in virtual communities and it is important to recognize citizens' direct and indirect participation to value both readers and posters, in this way it is important for the platform to accommodate many different levels of user [76]. From the McMillan and Chavis Index Shared emotional connection measure will be used along with constructs from E-S-QUAL [67] Fulfilment measures the extent to which the platform fulfils the needs of the community and the construct Responsiveness [68-70] will be used to measure peer supportiveness to assess the functional and user experience of the new eParticipation construct Identified participation.

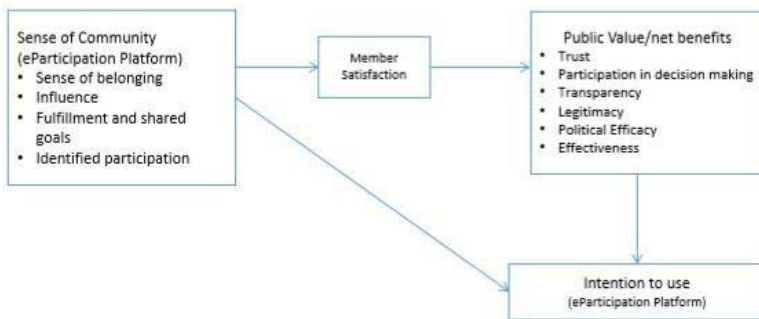
### 5. Measuring Public Value outcomes in eParticipation

With the aim of improving the quality of eParticipation and encouraging greater engagement, this research asks what are the Public Value components in eParticipation and how can a SOC be created in eParticipation? The main contribution of this research is to create a new measure of SOC for eParticipation that is based on PV theory. The PV paradigm as defined by Moore enables the conceptualization of a broad measure of eParticipation success from the citizen's perspective [21]. The significance of PV to eParticipation is that the framework facilitates the analysis of competing public administration concerns of efficiency, effectiveness and social values. With the creation of a public that can understand and act on its own interests [77]. This research builds on the PV eGovernment Net Benefits concept empirically validated by Scott et al. [78] they draw on the mirrored concepts of PV net value referring to the creation of PV as a function of both the value received and the cost of consumption and resources expended resulting in a net value, with the DeLone and McLean concept of Net Benefits in IS Success research [79]. Unlike later studies which used a narrow conception of Net benefits [80], the original construct conceptualized by DeLone and McLean [79] broadly refers to the extent that IS contributes to the success of individual, groups, organizations, industries and societies. The broad focus is very appropriate because of the diverse nature of the eParticipation process.

The draft constructs (Figure 1) proposed to measure Public Value/Net Benefits experienced by a user of an eParticipation platform were produced following a review of literature from interdisciplinary research areas of eParticipation, eGovernment, Public Administration and Political Studies and Community Psychology. Proposed Public Values include the highly complex construct Trust [81], in this research it is

defined as an outcome variable resulting from the direct experience of the user [14, 76, 78]. Other values include Participation in decision making [78, 82]. Transparency, the assessment of government transparency as perceived by the user [78, 82]. Legitimacy involving the question of procedural legitimacy and the quality of the decision making [83], Political Efficacy, internal efficacy the beliefs about one's own ability to influence the political process, external efficacy the beliefs about the responsiveness of government officials to the concerns of citizens [52]. And the Effectiveness of the platform [78] all as perceived by the user.

## 6. Research Framework



**Figure 1** proposed model for the Public Value measurement of SOC in eParticipation with Net Benefits

The model in Figure 1 shows the new SOC in eParticipation constructs as outlined in section 4 and eParticipation Public Value/Net Benefits in section 5. Drawing on past research and using the DeLone and McLean IS success model, the expectation of causal interrelations between these constructs in line with the arrows indicated is drawn. The construct Member Satisfaction is drawn from the work on social media communities with SOC by Zhang [44], Satisfaction in virtual communities and Net Benefits Lin [84], Kim and Lee's Satisfaction with eParticipation applications [82] and Teo's Intention to Use on Government websites [76]. As this research introduces both SOC and PV to the eParticipation research domain, the conceptual model development process a rigorous methodology for developing constructs based on the Churchill [85] framework as advocated by Lewis [86] is being used to develop the SOC in eParticipation and PV in eParticipation Net Benefits constructs. The aim is to create a more relevant and precise tool for measurement that will enable the collection of data. Leading to the creation of a new measure of SOC for eParticipation that is based on Public Value theory.

## 7. Conclusion

This paper introduces SOC and PV theory to eParticipation with the aim of creating a new measure of SOC for eParticipation based on the Public Administration paradigm, Public Value. This research proposes new SOC constructs for eParticipation and new PV/ Net Benefits using the PV framework to better situate eParticipation within the broader sociopolitical context and measure eParticipation success from the citizens'

perspective. The next step for this research will be an exploratory validation of the new measure.

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# Inclusion and Privacy in E-Participation Platform Design

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**Abstract.** Austria has seen some efforts in e-participation initiatives during the last years. However, a single platform comprising many e-participation levels and activities for a broader target group is so far missing. In the project *ePartizipation* researchers and practitioners worked on a platform demonstrator that integrates multiple online identification methods and offers activities on different levels of e-participation. This paper describes the conceptualisation of the platform and the inherent design principles, the first project results, in particular related to strategies aiming at enhancing inclusion and privacy, and the experiences from the project team.

**Keywords.** E-participation, identification, accessibility, Privacy by Design

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## Introduction

E-participation is often seen as a means to increase engagement in political processes. There are many measures to be taken if platforms are meant to be hosted by public authorities, and if they are to attract a variety of citizens and not only tech-savvy users. Not only strategies to foster digital inclusion need to be considered [9, 6, 4] but also regarding privacy and data handling processes of the system [5]. Within regulations

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and declarations of the European Union, e-participation and e-accessibility are seen as a measure towards social justice<sup>2</sup>. E-inclusion can be defined as a means to meet the goals of inclusion [11, 12, 7]. Recent research emphasizes foremost a capabilities approach [10]. As privacy is a key aspect in e-participation platform design, it is necessary to identify how Privacy by Design (PbD) can be included in the design of an e-participation platform. This paper presents the development of such a platform with consideration of the above mentioned design principles. The paper combines the insights of several publications that relate to the project *ePartizipation* and are listed in the bibliography.

## 1. Project Description and Methodology

The core goal of the project *ePartizipation* is to design a platform demonstrator that can be used as a single site for multiple e-participation purposes on different levels of participation. One of the sub-goals of the project was to map different methods of online identification and authentication with activities of e-participation. The methodology for the theoretical framework of the platform concept integrated desk research, the input from a focus group with interested citizens, qualitative expert interviews, and an internal focus group [14]. Within the scope of this paper, the authors will only focus on aspects of inclusion and privacy.

Latest data regulations were analysed on national and on EU-level. Legal advisers within the consortium constantly provided feedback to the developers during the implementation phase. At the time of finalising this paper, the platform is in the final development phase. While usability tests were integrated in the entire implementation phase, user acceptance tests are about to take place.

## 2. Project Results

### 2.1. Platform Demonstrator: Features and Design Principles

The concept of the tool allows high flexibility in the usage of the tool. On the one hand side, providers of e-participation processes can design their processes according to their needs. This means that a discussion activity can be followed by co-decision activity, which can be the end of a process or again be followed by a discussion. The platform allows the integration of multiple e-IDs for authentication. The host of e-participation processes can choose the e-IDs for each individual participation activity. This means that multiple e-IDs can be allowed in one participation process. While the activity of stating ideas could be open for social IDs, the process of co-deciding could be only allowed to users that login with a unique ID implemented by the state (e.g. in Austria: citizen card). The following design principles are reflected in the demonstrator:

- Integration of multiple online identification methods (e-IDs)
- Aspects of e-inclusion (Design for All)

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2 Europäische Kommission, KOM (2007) 332, 14.06.2007, Altern in der Informationsgesellschaft, <http://eurlex.europa.eu/legal-content/DE/TXT/?uri=URISERV%3A124292> (aufgerufen am 6. Januar 2016).

- Privacy and Security by Design

In the following, we will describe those features and their application.

## 2.2. Integration of Multiple Online Identification Methods

One aspect of e-inclusion and low participation threshold is already reflected in the flexibility of being able to choose between different e-IDs as described above. E-participation providers are advised to implement a multiple identity management system that allows users to participate in some processes completely without registration (e.g. commenting). An e-ID management system allows the hosts of platforms guidance in selecting appropriate e-IDs. This allows both users and hosts some flexibility in selecting e-participation processes and their preferred ID method.

## 2.3. Inclusion of Target Groups: E-Inclusion and Design for All

The use of information and communication technology (ICT) in web-based participation-models creates the risk of excluding some target groups. These comprise people with disabilities such as visual, auditory, physical, cognitive, learning and neurological disabilities, as well as non-native speakers and elderly people. Each of these target groups imposes different requirements with view to accessible online content<sup>3</sup>. A comprehensive description of the different needs as well as a wide range of recommendations for making web content more accessible can be found in the Web Content Accessibility Guidelines (WCAG) 2.0<sup>4</sup>. Some of the layers of guidance<sup>5</sup> were accepted by the International Organization for Standardization as an ISO International Standard (ISO/IEC 40500:2012) in October 2012.<sup>6</sup> Additionally, pure online participation-models exclude people with no access to ICT as well as people who deliberately refuse to make use of ICT [13], which is why these people must be considered as target groups that can only be reached through offline activities (while this is not reflected in the demonstrator, future usage scenarios of it should take this into account). People with difficulties to make proper use of ICT, like elderly people, non-native speakers or people with disabilities, can also be helped or encouraged by capacity building. Summarizing, some people can be helped with (1) measures enhancing e-accessibility, some with (2) capacity building, some with (3) both, and some require (4) other support, like legal regulations or offline measures.

### 2.3.1. Measures Towards Inclusion: Design for All and E-Accessibility

Public authorities have to design accessible platforms. Private providers have to do this according to their resources. Independent from this prerequisite, which needs to be considered if the demonstrator is used in the field, there are simple features enhancing

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3 Wagner-Leimbach, H. ( 2010). Gestaltung barrierefreier Internetangebote, WEBACC 2.1.1 vom 30. August 2010, pp. 7–9; [reference.e-government.gv.at/fileadmin/\\_migrated/content\\_uploads/webacc-2-1-1\\_2010-0830.pdf](http://reference.e-government.gv.at/fileadmin/_migrated/content_uploads/webacc-2-1-1_2010-0830.pdf) (accessed January 2nd, 2016).

4 <https://www.w3.org/TR/WCAG20/> (accessed 21st March 2016). The WCAG 2.0 is an international, legally non-binding standard that defines how to make web content more accessible to people with disabilities.

5 Specifically the overall principles, general guidelines and testable success criteria

6 [http://www.iso.org/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=58625](http://www.iso.org/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=58625) (accessed 21st March 2016).

inclusivity and accessibility which are reflected already in the demonstrator. The concept Design for All is based on the idea of accessibility. As design for “[...] social inclusion and equality”<sup>7</sup> it avoids the need for a specialised design or different viewing versions in order to not stigmatize some users. The demonstrator software is fully functional on a PC or mobile devices like tablets. Measures like mobile accessibility and operability via keyboard only can be done even by providers who are otherwise short on resources.<sup>8</sup> In line with the Design for All principle, one viewing version is recommended. Providers should seek to offer application specific user integration and many different e-IDs to attract different target groups. Even though some groups can nowadays be reached easily by mere online measures, it is still advised to offer online options in combination with offline participation or to make specific exceptions for certain target groups. Another measure is to stick to simple language and to offer content in other languages [4]. The target group should be crucial in defining processes and e-ID methods, and active exclusion of offline procedures or a specific group should only be made on the basis of a factual reason (f.i. youth participation projects with a target group that is 100 % on specific media channels).<sup>9,10</sup>

### 2.3.2. Legal Framework for Inclusion and E-Accessibility

On an international level, the probably most prominent legal basis in this context is the United Nations Convention on the Rights of Persons with Disabilities<sup>11</sup> (Article 1). One of its principles is the full and effective participation and inclusion in society (Article 3 (c)). In the European Union, the Proposal for a Directive on the accessibility of public sector bodies' websites<sup>12</sup> aims to approximate the laws and regulations of the Member States on the accessibility of websites of public sector bodies to all users, including people with functional limitations (Article 1 paragraph 1).<sup>13</sup> The Federal Constitutional Law of Austria (original version Federal Law Gazette No. 1/1930, as amended by Federal Law Gazette I No. 102/2014) states (Article 7) that no one shall be discriminated against because of disability. Furthermore, the Republic commits itself to ensure the equal treatment of disabled and non-disabled persons in all spheres of everyday life. More specifically, Section 1 paragraph 3 of the Federal Act on Provisions Facilitating Electronic Communications with Public Bodies (E-Government Act – E-GovG; original version Federal Law Gazette I No. 10/2004, as amended by Federal Law Gazette I No. 83/2013) stipulates that measures shall be taken to ensure that official Internet sites which provide information or support are structured in such a

7 EIDD Stockholm Declaration, 2004. <http://dfaeurope.eu/what-is-dfa/dfa-documents/> (accessed March 15th, 2016).

8 The question whether e-participation websites fall under the service category according to [ordinance on barrier-free information technology](#) (as it would be the case according to e-government law) is not relevant on the demonstrator design level, however, later the provider of such a platform becomes crucial, as with private providers the question of reasonableness has to be asked. To shorten this discussion, it is recommended to stick to simple design measures.

9 DIVSI (2014), *Kinder, Jugendliche und junge Erwachsene in der digitalen Welt*, Hamburg, Februar 2014. <https://www.divsi.de/publikationen/studien/divsi-u25-studie-kinder-jugendliche-und-junge-erwachsene-in-der-digitalen-welt/1-einfuehrung-3/> (accessed 6th January, 2016).

10 Online only options could be used for processes that are done more frequently though.

11 <http://www.un.org/disabilities/convention/conventionfull.shtml> (accessed 21st March 2016).

12 Proposal for a Directive of the European Parliament and of the Council on the accessibility of public sector bodies' websites [COM/2012/0721](#) final, adopted by the European Parliament legislative resolution of 26 February 2014, 2012/0340 (COD).

13 The proposal is still in negotiation.

way as to comply with international standards for access, including unhindered access for disabled people. Accordingly, platforms provided by Austrian public authorities have to ensure accessibility. For private entities, the Austrian Federal Act on the Equalization of Persons with Disabilities (original version Federal Law Gazette I No. 82/2005, as amended by Federal Law Gazette I No. 138/2013) seeks to avert the discrimination of people with disabilities (Section 1), including discrimination by not accessible websites (Section 6 paragraph 5). Although the law is fully applicable for the federal administration (Section 2), private providers only fall under the obligation to ensure reasonable accessibility (Section 6).

### *2.3.3. Scenario Works Council Election*

The demonstrator software also offers the option of co-decision or decision processes, for which the scenario of works council election was implemented. Arguments often used against online voting are the general principle of the personal right vote and the exclusion of people without access to ICT or of people with lacking IT-skills. However, in Austria the Regulations on Works Council Election 1974 (original version Federal Law Gazette No. 319/1974, as amended by Federal Law Gazette II No. 195/2012) makes an exception from the general principle of the personal right vote by providing the possibility for postal voting. PCs also allow for authentication. Consequently, online voting would be feasible for works council elections from the perspective of inclusion as it is at least equal to the already existing postal voting.<sup>14</sup>

## **3. Privacy by Design**

PbD implies addressing privacy and data protection during the entire technology lifecycle (van Rest et al. 2014), integrating privacy and data protection into the system during the software development process as a whole. In the future General Data Protection Regulation (GDPR) of the European Union “data protection by design” will become a fundamental principle. Papers dealing with PbD in practice [16, 3, 18, 8] have some principles in common, most importantly data minimization. This (MINIMISE) is the first of eight privacy design strategies listed by Hoepman [5]. Other data-oriented strategies are to hide personal data (HIDE), to hold them separated and to process them in a distributed way (SEPARATE) on the highest level of aggregation that is still useful (AGGREGATE). The four process-oriented privacy design strategies are to inform data subjects about the data processing (INFORM), to provide them agency over it (CONTROL), to put in place and enforce a privacy policy compatible with legal requirements (ENFORCE) and to be able to demonstrate compliance with the privacy policy and legal requirements (DEMONSTRATE).

### *3.1. PbD in Software Engineering*

PbD as a concept has been existing for quite some time, but was hardly relevant for software development. For this reason, we propose extensions of the Scrum framework to ensure privacy and data protection. Agile development processes are based on the

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<sup>14</sup> However, risks of abuse and lacking traceability must not be neglected.

Agile Manifesto [1]<sup>15</sup>. Scrum is the most popular way of establishing an agile process by providing a lightweight framework to optimize predictability and control risk [15]. PbD has to be treated individually for every project by implementing strategies, design patterns and technologies according to the required purpose. This procedure can be called privacy engineering and demands dedicated experts or privacy engineers. Usually the Product Owner (PO) is responsible for managing the requirements but often does not have the abilities of privacy engineers. Privacy experts are also not found in a typical Development Team (DT) that help in analysis, planning, implementation and validation of appropriate measures to protect individuals. For this purpose, a dedicated privacy team consisting of privacy experts assists the Scrum Team (ST) in accomplishing privacy related tasks. This team is represented by one Privacy Representative (PR) which has a holistic view on development, infrastructure, privacy and data protection. The PR is then an additional PO and is allowed to create, modify and prioritize privacy related US and acceptance criteria in consultation with the traditional PO. The privacy team is coordinated and represented by the PR in all Scrum meetings.

Privacy related requirements are normally non-functional requirements, making privacy invisible in standard Scrum. The following measures were taken in order to model PbD during development, make privacy more visible, explicit and sustainable:

- Adding privacy requirements to Product Backlog (PB) as User Stories (US), technical US, acceptance criteria or definition of done.
- Adding US from the perspective of a potential attacker that wants to abuse the system which are also referred as evil user stories or abuse stories.
- Integrating static code analysis based on custom code annotations to enforce encryption when accessing personal data.
- Executing automated privacy related tests.
- Performing incremental reviews of all artifacts through privacy glasses.

### 3.2. Implementation and Practice of PbD for E-Participation Platforms

Privacy-relevant US are added in the PB. Their effort is estimated within the Sprint Planning just like regular US. Our experience with this has been very positive. However, as this is the first time we apply the process, we believe that there are further software engineering cycles necessary to determine efficiency and usability of this method. Plus, in this project we find highly motivated developers who are interested in privacy, which lead to some lessons learned. The aforementioned design principles directly influenced the implementation of the platform. In particular, we designed several components that will establish the PbD principles [17]. The first component checks and verifies the identities used within the participation platform. The second component provides all functionality necessary for online participations. The advantages are that data is only requested according to the level of assurance (LoA). The LoA refers to the required quality of user identification. LoA 4 is the highest level and guarantees an identity verified by the state, LoA 1 includes social IDs (f.i. Facebook), LoA 2 applies to reputation based IDs, LoA 3 refers to application specific user management (e.g. Microsoft Active Directory) and LoA 0 indicates no

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<sup>15</sup> This Manifesto is a collection of basic values which specifically weights “individuals and interactions”, “working software”, “customer collaboration” and “responding to change” more than classic models.

identification. Furthermore, no personal data is stored in the platform. The identity is not known by the e-participation component and the specific participation activities are unknown to the identity component. This ensures not only privacy in participation, but also enables the participant to identify which data is requested for which process. F.i., if the platform requires further data such as age or location, the participant will receive a notification during identity check and verification.

#### 4. Summary

Even though focusing on the technical solutions in e-participation is important, factors like technical skills and perceived privacy can only partly explain participation numbers and citizens' motivation, and strategies of inclusion only offer some chance to enhance participation. But if such measures are not undertaken, projects run the risk to exclude people from important processes or to violate human rights [7]. Furthermore, e-inclusion should always be seen in relation to social inclusion, for which other differences (f.i. education) might need to be addressed first. However, e-participation could offer, particularly if based on institutional resources, the chance to support principles that are otherwise given less priority in the hype around mainstream or economically orientated technology innovations. Additionally, research focusing on aspects of capabilities should be supported. While some of our recommendations focus on technical accessibility, measures of inclusion should not be limited to it [2, 10]. This could mean putting more emphasis on user capabilities with regard to privacy and personal data. On the project level, this could be done by video messages or a specific F.A.Q. On the broader level, capabilities and participation could be seen as two complementary subjects finding their way into educational curricula. An evaluation of the platform demonstrator with user acceptance tests is planned in June 2016. This should shed further light on citizen's motivation to use the platform.

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# e-Government Evaluation



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# Mobile Government Readiness: Proposing a Multidimensional Framework and an Assessment Tool

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**Abstract.** Public managers at all levels of government are increasingly facing a great diversity of technological changes, from the arrival and rapid adoption of social media to the emergence and growing popularity of mobile phones and related technologies. Many times, they need to make decisions regarding the implementation of mobile government without the necessary knowledge and tools. Based on a review of recent literature and a set of group and individual interviews, this paper proposes a preliminary multidimensional framework to assess an agency's readiness for mobile government. The variables included in the framework are categorized into three main dimensions: (1) Technical, (2) Organizational, and (3) Workforce Environments. The paper also shows how these dimensions have been integrated into the prototype of a tool called Mobile-Readiness Assessment, which public managers could use to better understand mobile technologies and help them ask the right questions and collect appropriate data before starting a mobile government project.

**Keywords.** Mobile Government, Capability Assessment, Multidimensionality of E-Government, Mobile Capability, Readiness, Assessment Tool, Digital Government, Electronic Government

## 1. Introduction

Mobile government (mGov) can be seen as a specific case of electronic government and governments around the world are investing a great amount of resources in electronic government (eGov) initiatives. In order to develop relevant knowledge about this complex phenomenon, researchers and practitioners need to identify and assess the main conditions, variables, or factors that have an impact on eGov success [14].

mGov have become the most rapidly adopted technology in history and the most popular and widespread personal technology in the world [31]. These changes affect the way governments do their work, engage and communicate with the public, and provide services to their citizens. In order to understand the complexity of these emergent technologies in different social contexts, digital government researchers are employing diverse strategies such as the use of multiple methods and new theoretical lenses [16] [36]. As with many other technologies embedded in social and organiza-

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tional contexts, the potential uses and effects of mobile phones in government and society are not well understood. Technology is only one piece of a more complex socio-technical system [25] [26] [34]. This complexity is reflected in a high rate of failure [8] [20]. According to Heeks [20] the rate of IT project failure in public sector settings in industrialized, developing and transitional countries, is in the range of 80 percent. Practitioners and scholars alike have consistently sought to uncover reasons for unsuccessful IT projects and create strategies to prevent systems failure [17].

Institutions build guidelines for action; however, they also constrain those actions [36]. The complex relationships between information technologies and social structures, involving a complex set of decisions and interactions has been acknowledged in previous studies. All the time these interactions are constrained by several and different institutional arrangements [12]. It seems necessary to use theoretical models that capture the interaction mechanisms among multiple theoretical constructs [14]. With a more comprehensive and integrative approach, this view argues that in order to understand information technologies, it is necessary to analyze not only the technological artifacts, but also the social and organizational aspects around those artifacts [14]. These aspects are reflected in the capabilities and resources that a government agency possesses. Therefore, assessing and improving organizational capabilities are central to virtually all efforts to improve government performance, including mobile government.

We argue that mobile government should be seen as a multidimensional concept, and, therefore, any evaluation framework for mobile government should also consider the complexity and multidimensionality of this phenomenon. Tools for assessing capability for government IT projects are central to success, especially on projects that involve many actors, different levels of government, different interests, different educational and cultural training, wide range of information, and different types of technologies [4].

In recognition of the need for an in-depth study of the challenges connected with government adoption of mobile technologies, this paper presents preliminary results of a research project that focuses on the use of mobile technologies in government, including the development of mobile Apps by government, employee adoption of mobile technologies, and using mobile technologies to engage with and serve the public. The project's main focus is to understand various capability aspects that contribute to the success of mGov efforts and propose a multidimensional framework and an assessment tool. It presents some insights based on those experiences to inform the efforts of both practitioners and researchers. An important challenge for researchers and practitioners alike is to gain knowledge about these emergent technologies in specific contexts before they are actually implemented.

The paper is organized in three sections, including this introduction. The second section explains the multidimensionality of Mobile Government, including a characterization of eGov as a Multi-Dimensional Phenomenon and Capability Assessment as an approach to study and assess eGov Initiatives. Finally, section three provides preliminary findings and suggests areas for future research about this topic.

## 2. Multidimensionality of Mobile Government

This section presents some important concepts related to mobile government, e-government as a multi-dimensional phenomenon and the use of capability assessment as an approach to analyze and assess e-government initiatives. It offers some theoretical implications to understand eGov, including mGov, as a multidimensional phenomenon, involving much more than technology.

### 2.1 Mobile Government

mGov could be seen as a platform of communication between government and citizens. This paper uses mGov in two ways: (1) the opportunity that governments have to use mobile devices as delivery channels for information services to citizens; and (2) the use of these devices by public managers in their daily activities [6] [27]. And highlights both the public managers' use of mobile devices and government-delivered services on mobile phones. Mobile technologies provide significant opportunities for governments to achieve greater cost optimization, improve communication and provision of services to citizens, and make progress in terms of digital equality [7]. Over 70 percent of world's population uses SMS (short message service) and voice technologies showing that many countries have similar situations [22]. It is important to understand that government efforts to use digital media can be unfruitful if they do not consider citizens' internet access and the necessary skills to meaningfully use some of these information/services, and the characteristics of the groups and organizations in which those individuals live and work [7] [28] [29] [32]. So, it is important to consider the relationships between information technologies, organizational characteristics, and related public policies [14].

### 2.2. eGov as a Multi-Dimensional Phenomenon

Being a multidimensional phenomenon, in order to understand eGov, including mGov, it is necessary to pay attention to the relationships between multiple variables such as information technology (IT), organizations, embeddedness, and institutions [12] [13]. Decisions from government and their partners are affected and constrained by organizational and institutional variables [14]. There are few comprehensive and integrative theoretical models, which capture multiple theoretical approaches to this phenomenon. Some researchers have presented some examples of these integrative approaches: (1) Structuration Theory and Structuring Informations Technologies, in which technologies leverage the way the social world of people is structured in terms of defining the ways people behave, think, and ranges of possible consequences [9] [21] [24] [32]; (2) Socio-Technical Systems Theory and the Process Model of Computing Change - in this perspective, technology is conceived as socio-technical networks, where - implementation is an ongoing social process, and effects are not direct and immediate; and (3) Institutional Theory and the Technology Enactment Framework - IT initiatives, it is acknowledged they comprise an inscrutable set of interactions and decisions [19], which are constrained by institutional arrangements. In this perspective, the technology enactment framework attempts to understand the influence of institutional arrangements and organizational forms on the selection, design, implementation, and use of IT in government agencies [3] [19].

The vision from multiple theoretical lenses could provide a x-ray of the phenomenon. Based in the research from Gil-Garcia and Pardo [15], and Gil-Garcia, Pardo and Baker [18], relevant variables are organized into five categories: (1) information and data factors, (2) information technology factors, (3) organizational and managerial factors, (4) policy and legal factors, and (5) environmental factors. As a result of the different actors and stakeholders involved in the use of information technologies who have different views and different approaches [1] [11] [23], it is difficult to reach consensus on evaluating the performance of IT projects and information systems. Therefore, understanding and measuring eGov readiness or success is not an easy task and faces myriad challenges, from deciding on a measuring technique to incorporating different perspectives on the evaluation of a particular eGov initiative [1] [35]. As eGov is not only about technology, it is necessary to assess as many variables as possible.

### *2.3. Capability Assessment for eGov Initiatives*

According to Cresswell et al [4], capability assessment can play an important role in the digital government domain in at least two ways: 1) to provide a basis for judging whether agencies are ready to initiate some digital government innovation, and 2) to judge the impact of a digital government initiative in terms of improved capabilities, providing both baseline measurements and evidence of subsequent improvements. Therefore assessing the organizational and technical capabilities to successfully engage in such an effort is an important part of the planning and preparation of eGov projects, including mGov initiatives. However, despite efforts to produce assessment toolkits for several types of digital government initiatives, apparently a specific tool to judge whether agencies are ready to initiate mGov is not available.

eGov initiatives are typically difficult and prone to failure [30] [18]. Therefore, before making organizational and financial investments in such high risk initiatives, it is valuable to know whether the necessary capabilities are present or can be made available [5]. Public managers need to make decisions regarding the implementation of mobile government almost without the necessary knowledge and without adequate tools. Capability for successful eGov projects is important when collaboration and information sharing across domains are central to success, where organizations must establish and maintain collaborative relationships for resolving the inevitable problems. For example divergent data definitions and structures, diverse database designs, highly variable data quality, and incompatible network infrastructure, which are in turn embedded in larger political and institutional environments which shape goals and circumscribe options [5]. Thus the capability assessment problem spans many organizational and technical issues.

Instead an eclectic approach to understanding and applying ideas about capability can yield both interesting paths to new theory development and useful practical results and can be useful in framing the diverse mix of capability concepts into an assessment tool with a meaningful theory foundation and practical utility [5]. In addition, we argue that mobile government should be considered as a multidimensional phenomenon, in which mobile technologies represent only one component of a highly complex socio-technical environment. This view should be regarded as a critical element in carrying out an eGov initiative [33].

According to Concha et al [2], holistic approach models are designed to be applied in public services development projects to help agencies identify if an eGov project will be successful or not, by examining capabilities through indicators. Some models

are covering some features and introducing new ones, it seems that others are just ignoring them [10]. Understanding the multidimensionality of mobile government is central to generating a capability assessment framework and designing a useful tool. Therefore, a holistic approach allows us to consider the interactions between multiple variables and a capability strategy helps us identify and describe some of the organizational capabilities and resources already developed or needed.

### 3. Preliminary Findings

Based on group and individual interviews, we have two important results from our study: (1) a multidimensional assessment framework and (2) a flexible and easy-to-use tool (prototype), which can be used for testing the framework empirically in government agencies. The variables were derived from our qualitative data and the grouping is based on previous literature. We analyzed our qualitative data using the initial capabilities found in the literature as a framework, but we were open to variables that emerge from the data as important for interviewees.

The proposed multidimensional framework includes twelve variables to help agencies assess their readiness to move toward mobile government. The variables are clustered in three dimensions: organizational, technical, and workforce environments. One way to think about the groupings is in terms of the individual who would be assessing each category. For instance, we could assign the organizational environment to the executives of the agency and the technological environment to the chief information officer (CIO) of the agency. The workforce environment assessment can be done either at an agency level, in which case would also be assigned to the executive, or at a program level, if the mobile government effort is only targeting a certain area, population, or subdivision within the agency. However, in many situations is advisable to have group discussions before answering most of the questions, since they should reflect an actual organizational perspective. Figure 1 shows the dimensions and their respective variables.



**Figure 1** – Variables and Dimensions affecting mGov Initiatives

The tool called "Mobile-Readiness Assessment" is based on the twelve key dimensions included in the multidimensional framework. Based on the score on each dimension, the tool provides an overall score/rating, which gives an agency a rough outline of where they are at and where they need to go from there.

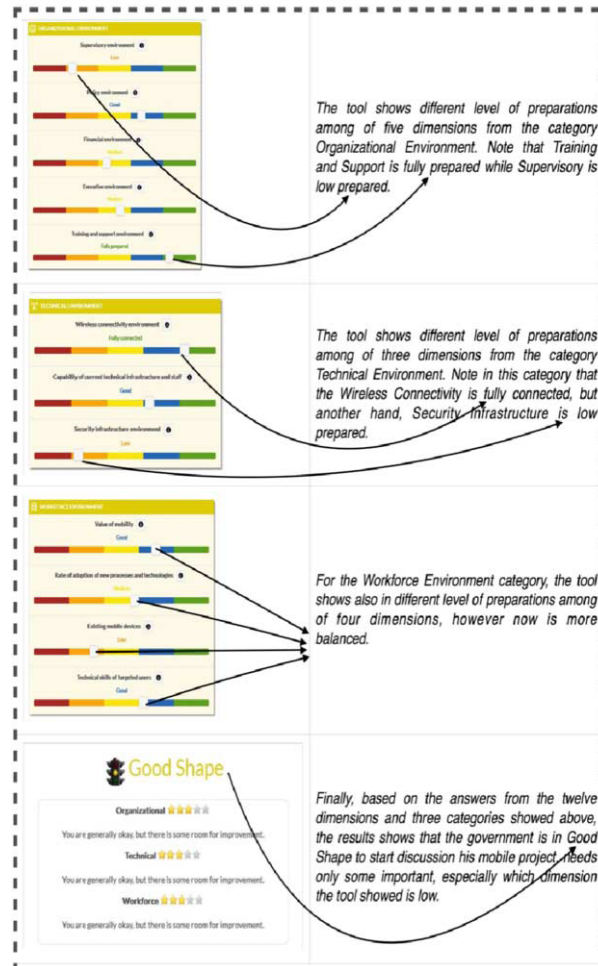


Figure 2 – Mobile-Readiness Assessment Tool (Prototype)

A tool like the one presented here could be used in different ways and with different purposes in mind. The results shown in this study are based on the following criteria and they are only to illustrate how the tool could be interpreted. The suggested thresholds are somewhat arbitrary, but they attempt to reflect situations in which actual public managers need to make decisions. They have not been validated, but this is part of our future efforts about this topic. For instance, a score between 0 and 15 points indicates do not proceed, the environment agencies are currently in is not likely to produce a successful mobile deployment. No matter the design, your organization needs to first develop core capabilities that would enable it to support such effort. It is important to understand if the results are one-sided – for instance, if they are low mostly in the technical, organizational or workforce areas. This could help to better understand what it is needed. Overall, it is better to be high across the board on all three dimensions and many of their variables than to be really strong in some and weak in others.

Finally, if the results high (e.g., between 50 and 60), your organization is well prepared for deployment, but still needs to pay attention to weak areas, especially some

deal breakers that need to be jointly identify. If a government agency is weak in any of the 12 main variables, do not proceed before addressing them, or at least creating a plan on how they will be addressed. Figure 2 shows a simulation from using individual how to use this tool.

The mobile capability assessment tool's purpose is to help agencies assess their readiness for adopting mobile technologies by providing a comprehensive set of conditions that have to be considered for both internal and citizen-facing mobile efforts. In addition, the tool provides agencies with information that allows them to improve the design of their mobile efforts and assess the need for organizational changes for successful adoption/development. The goal is to enable agencies to match their plans to their capabilities, and to enable them to achieve this balance by either altering their design or acquiring additional capabilities and resources.

The tool can be used for overall agency assessment or for the assessment of individual projects. For example, a supervisor or project manager could use this tool in a mobile phone or desktop and quickly get a snapshot assessment of organization readiness. This, of course, will be very different from a group-effort assessment in which many individuals in the organization are using the tool to discuss each variable and make decisions about their current status and potential next steps. However, any of the two uses would lead some useful information for decision making and will be better than not doing any readiness assessment. As a next step in our research, we would like to systematically test this tool with public managers representing different responsibilities and hierarchical positions in diverse government agencies. We would like to understand if the dimensions are useful, if the questions are the best representations for each dimension, and how the tool could be improved in terms of functionality and usability.

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# Comparing and Contrasting e-Government Maturity Models: A Qualitative-Meta Synthesis

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**Abstract.** The e-government maturity model has dissimilar stages that range from basic to advance online interaction competence. E-government's portals use the stages to determine maturity. The aim of this paper is to evaluate e-government maturity models through a comprehensive review of related literature by identifying and mapping cohesions across the models. Apparently, the paper picks seventeen different e-government maturity models and makes contrasts and comparisons using a qualitative meta-synthesis method. Ideally, the paper draws two key results namely presence, communication and integration are main stages involved in all the maturity models and the level of interaction and complexity are found in all models

**Keywords:** Maturity model · e-Government · Qualitative meta-synthesis.

## 1.Introduction

The use of Internet and the World Wide Web to communicate, inform, interact, and deliver government information and services to the citizens by the private sector and government agencies is referred to as e-government [1]. Apparently, the model applied when analyzing the maturity of an e-government portal has many different stages. The stages range from basic information provision to advance transaction capabilities. They are used to determine the maturity of the e-government portal. By applying a maturity model to rank e-government portals, governments and practitioners understand improvements required to make to the e-government portals [2, 3] [4]. Literature studies reviewed e-government maturity models and gave different results [3], [5, 6]. Fath-Allah [5] completed a comparative study of selected e-government maturity models, from the results the author proposed what he called a best practice based e-government portal maturity model. Siau & Long [6] performed a meta-synthesis study on five existing e-government maturity models and derived a new e-government stage model. Finally, Lee [3] also conducted a qualitative meta-synthesis of 12 e-government stage models.

The creation of different metaphors and themes aids practitioners to plan future e-government projects. Several models are available to examine e-government

structure and functioning, but the uniqueness of the study is to create a new basis for a model that can be used by other researchers to develop new models. As a result, the paper has 17 different e-government maturity models are analyzed and selected carefully through the application of a 'Qualitative meta-synthesis' method. The synthesis technique is briefly explained in the next section. Sections 3 and 4 illustrate a comparison of the 17 models based on the year of publishing, the number of stages and the name of the stages. Section 5 presents the research synthesis, and finally, Section 6 outlines the conclusions. The main research questions and the methodology adopted are illustrated in the next section.

## 2. Methodology

Stern & Harris developed the qualitative meta-synthesis. [7]. It is used for the systematic review of various qualitative studies in a subject. The goal of the process is to develop an explanatory theory to analyze and explain the findings of a group of related studies [8,9]. The activity aims at aiding researchers to assess the manner in which different studies are related. The process has a number of stages [6] that are illustrated below. Because of the simplicity of this research, the analysis of the stages is combined. (e.g combining stage 2 with stage 3)

### *Stage 1: Identifying the Research Question*

The stage involves the appropriate research question that fits the frame and purpose of the meta-synthesis selected.. The research will examine 17 e-government models in order to find commonalities among them. The research answers three main questions namely:-

- Q1: Are there common stages among the 17 selected models?
- Q2: What are the main common maturity level variables that can be noticed when moving from one stage to another?
- Q3: Do the existing 17 selected models have drawbacks?

### *Stage 2 & 3: Identifying the Literature Relevant to the Research Question and Appraise the Studies*

The stage incorporates Google Scholar, Web of Science, and Scopus as the main sources of literature. An initial search produced a large number of articles that discussed e-government models. The majority of them explained and discussed the selected 17 models. The authors were able to understand the thought process of the scholars who proposed the various models by assessing the articles. Later on, several documents that discussed and analyzed the model were also obtained. Around 200 journal articles, books, and reliable websites were selected for the research.

The examination of the study depths together with pre-mediated criteria that were framed earlier takes place on stage 3. The goal of the research was to select articles published in reputable journals and conferences that discussed the 17 chosen maturity models. Ideally, the selection criteria were strengthened and made stricter. The quality of research, the number of references and the quality of journals were repeatedly evaluated. The list of 200 articles was further reduced to 130. These were high-quality articles written by academics of good reputations.

*Stage 4,5,6,&7: Determining How The Studies Are Related, Translating The Studies Into one another, Synthesis of Translation and Presenting the Findings*

Steps 4 and 5 are core steps during the meta-synthesis approach [6]. 17 different e-government models are compared in the two stages. The comparison is made by identifying each model. A table that shows each model's year, stage number and the name of the stage is constructed. Details of the model such as representation, the explanation for maturity and development are compared and contrasted. The illustration of the process takes place in sections 3 and 4 of the paper. Finally, in the last two steps, the findings from steps 4 & 5 are synthesized and the translated. The main results and the conclusions are illustrated in Section 5.

### 3.E-government Models

The section presents an analysis of various e-government models. A descriptive account of the models is presented and then section 4 provides a comparison review.

**Layne and Lee:** Layne and Lee [10] proposed a four-stage model to explain the development and evolution of e-government. They proposed four stages of growth namely, cataloging, transaction, vertical integration, and horizontal integration. The model is placed on an XY plot. The X-axis has the dimensions of sparse, integration, and complete while the Y-axis has the dimensions of simple and complex [11]. The main criticism of Layne and Lee model is that the focus is on technology, and shifting the inefficient bureaucracy to an online mode [29][2][6]

**Hiller and Belanger:** Hiller and Belanger [14] proposed a five-stage maturity model for e-government. The model has more details than other models in such a way that it examines the convergence of the stages together with the relations between the government and its components. The five stages include information, two-way communication, transaction, integration, and political participation. The focus is on maintaining the privacy of individuals and the government apparatus. Hiller and Belanger model is mainly speculative, and technology based. There is no effort to understand the citizens' needs; there is a lack of accountability and urgency from the government staff. [30]

**UN:** The United Nations five-stage model developed after an intense survey of more than 193 United Nations member countries. The model presents a realistic picture of e-government maturity [15]. The model is somewhat similar to other mentioned models. The model has five stages, and they represent the stages of emerging economies to the highly developed countries. The five stages include emerging presence, enhanced presence, interactive presence, transactional presence, and seamless or fully integrated presence.[15] The UN model is developed from practices in 193 countries, and the model was developed as a post observation of the practices in these countries [31] that could be conspired ad a drawback of the model.

**IBM:** IBM with its deep insights into understanding user requirements and application building, proposed four stages to capture e-government maturity, which are automate, enhance, integrate, and on-demand. IBM uses its commercial expertise to propose a model that resonates with today's market needs. The model suggests that evolution and maturity must be viewed as three waves of change. The first two stages (automate and enhance) capture the accessibility of services while the integration and on-demand stages capture market needs [16]. The IBM model does not consider social improvement and social welfare, as the main objective of the government. In many instances, it is not possible to develop metrics for costs, benefits, and weigh them on a cost/ benefit ratio [32]

**Cisco:** Cisco is one of the leaders in providing web applications and connectivity solutions proposed the three-stage model to understand e-government maturity. The model is an evolving one, and it has three stages namely, information interaction, transaction efficiency, and transformation [17]. Cisco model prudently keeps the future evolution and maturity open [33]. This indicates that further stages are possible in the model.

**Accenture:** Accenture is one of the leading management consultancies and software development firms developed a five-stage maturity model. The model was developed to rank the e-government systems of a number of countries such as Canada, Singapore, Brazil, and Mexico. The five stages represent online presence, basic capability, service availability, mature delivery and service transformation [18]. Accenture model gives a result of the evaluation of eGovs of different countries. While Canada occupies the top position, countries such as Brazil and South America are the bottom layer [34]. The model does not consider the technical and intellectual capital of the nation, the huge population, and the needs of the people.

**PWC:** The PWC, Price water House Coopers, the model was framed after a deep and comprehensive analysis of 50 e-government systems in various USA states. The accompanying documentation reveals a wide depth of research into the intricacies of government portals. The model has five stages namely, customer service, services organization by events, customization, diversity management and legitimacy [19].

PWC model is mainly academic, since the model presents the current practices of eGovs in USA. The model does not suggest interoperability [35]

**Ernst and Young:** Cap Gemini and Ernst & Young developed the model in response to a request from the European Commission DG Information Society [20]. A survey was conducted among 15 Europe member nations to assess the features, characteristics, and functionality provided by the e-government portals. The main shortcoming of Ernst & Young model is that it represents findings from a survey, and shows the status of eGovs [36]. There is no way to understand the progress and path used for maturity. The stages indicated are stops, with no methods to indicate how they are linked [37].

**Moon:** The Moon model [2], developed during the early stages of e-government evolution, and it has five stages. The model was developed after Moon surveyed a number of municipalities in the USA, to understand the manner in which e-government evolved and the services they offered. The stages of the model include simple information dissemination with one-way communication, two-way communication with request and response, service and financial transactions, integration, and political participation [2]. It is clear that the Moon model that was developed in 2002, does not consider modern developments such as social media, e-commerce, knowledge management and collaboration [38]. There is no indication as to how the portal will connect with other municipalities and state portals [39].

**The World Bank:** After consultation with its member nations, The World Bank developed a three-stage maturity model. The steps include: publish, interact, and transact [21]. The model is simple but considers that all the three phases are interlinked. In the first stage, information is published on the net. The information includes forms, documents, regulations, rules and facilities. Interaction makes up the second stage, users can provide feedback and comments on the policy, rules and proposals. The third stage involves a transaction, where users can complete secure online transactions [22].

**The UK National Audit:** The UK government developed this model in 2002 to facilitate the transformation of over one hundred e-government portals in the country. The model has three main steps. The second step has four sub-steps. The first step is basic information provision, the second step is made up of sub-steps which include interactive, account management, e-publishing, and basic transactional capability, and the third step captures complex transactional capability [23]. The censure of the UK National Audit Model is that it assumes that all government portals and departments take up transactions [40]

**The modified UN:** This model was designed after a survey of 193 member nations to understand the manner in which e-government systems were formed. The features of the services and the method are used to reach maturity. The model has four stages

namely, emerging information services, enhanced information services, transactional services, and connected services [24,25].

**Alhomod & Shafi:** Alhomod & Shafi [26] developed a four-stage maturity model to explain the manner in which e-government developed. The stages include presence on the web, interaction between citizen and government, complete transaction over web, and integration of services. The main criticism of Alhomod model is that while the model was developed in 2012, there is nothing new or revealing, and the same ideas are rehashed [41]

**Lee & Kwak:** This five stage model extends e-government systems to include social media and web 2.0 tools. The model was developed from research into the US Healthcare Administration agencies. The five stages are initial conditions, data transparency, open participation, open collaboration, and ubiquitous engagement [27]. The main disadvantages of Lee & Kwak about the model is that while e-voting and e-petitioning are encouraged from the public, the manner in which the feedback is used is not clear [42]

**Chen:** This model with three stages was proposed after research into e-government activity in China [28]. The three stages include catalogue, transaction, and vertical integration. The catalogue stage involves the establishment of online presence an online presence is established, with presentation and downloadable forms. During the transaction stage, databases are provided along with an interface for online transactions. In the third stage of vertical integration, other departments of the government are integrated [28]. The shortcoming of Chen model is that the linear model adopts a standard approach for model development [4] There is no indication of external and internal drivers that guide the government into setting up a portal. Relations with private enterprises, and citizens, and the mechanisms are not explained [43]

**Wescott:** The model has six stages. It was based on the development of e-government systems in the Asia-Pacific region. The six phases are setting up an email system and internal network. The purpose was to enable inter-organizational and the public to have access to information. It allows 2-way communication leading to an exchange of value, digital democracy, and joined-up government [12]. Wescott finds very little application among many Asia pacific nations, since many of the countries are at the initial stages [44]. The model suffers from lack of clarity since it does not explain the nature of exchanges between the government and the people, and if only directives are issued [45].

**Kim & Grant:** The model has five stages namely, web presence, interaction, transaction, integration, and continuous improvement. The model was developed by considering inputs from four sources, human capital, structural capital, relational capital, and IT investment. The model considers the combination of these sources to help define the maturity of the e-government [13]. Kim & Grant model does not reflect

the insight into the manner in which technology adoption is practiced by the users[46]. All the efforts appear to be government directed, and users have very little control over the contents of the portal [47]

#### **4.Comparing the Models and Translating the Studies into one Another**

The majority of the models have four or five stages. Only Westcott model has six stages. Almost all the models have a lot of common features and similarities among them. Although the maturity model stage names are different, their contents are very similar [5]. Many models were developed during 2002-2006 when many tools and applications such as social media, and other collaboration tools had not yet evolved. Only a few models such as Lee and Kwak maturity model introduce the use of such new tools including social media. Apparently, a common pattern is observed in all the models.

The initial stage is considered as the basic e-government stage. In most of the models the first stage is called catalogue, presence or information (e.g. [2],[10], [14,15,16,17,18,19,20,21],[23], [25,26,27,28], and [13] ). The main function of this stage represents e-government as a form of a simple portal with a one-way communication technique. Information is provided for some basic announcements and news about government plans, schemes, and other aspects. The Wescott [12] model captured an initial stage before the presence. It is called “setting up the network system.” This is an initial stage that captured the complex technical and website-use related preparation and coordination work before moving on to the second stage that describes the presence of the actual information.

Ideally, the middle stages point to more development and refinement. The stages capture governments’ efforts to use an online portal to provide citizens with a method to carry out simple transactions. Most models have more than one middle stages that range from the level of interaction between the government and the citizens, such as [14, 15], [18, 19, 20, 21], [2],[23], [25,26], [13], and [27]. Some models (e.g. [10], [16, 17], [28], [12]), have a stage that allows a higher level of interaction between the government and the citizens (e.g. transaction, two-way communication, etc.).

The last stage, commonly seen on all models is that of integration of services. Three models (e.g. [3], [19] and [12]), have gone beyond the integration stage. They introduced a political function stage in which citizens are allowed to e-vote and engage into the political system.

#### **5. Conclusions and Research Synthesis**

In conclusion, The stage models have several common features and similar stages. None of the models present anything new. Most models have three main stages that capture presences, communication, and integration. The table below shows the



mapping of each model's stage to the three proposed main stages (presence, communication, and integration)

Table 1: Mapping the stages

<b>Model</b>	<b>Year</b>	<b>Presence stage</b>	<b>Communication stage</b>	<b>Full integration stage</b>
Layne and Lee	2001	1) Catalogue	2) Transaction	3) Vertical integration 4) Horizontal integration
Hiller and Belanger	2001	1) Information	2) 2-way communication 3) Transactions	4) Integration 5) Participation
UN e-government Maturity	2001	1) Emerging presence 2) Enhanced presence	3) Interactive presence 4) Transactional presence	5) Fully Integrated Presence
IBM	2003	1) Information	2) Transaction	3) Internal integration 4) External integration
CISCO	2007	1) Information	2) Transaction	3) Transformation
Accenture	2003	1) Online presence 2) Basic capability	3) Service availability 4) Mature delivery	5) Service transformation
PWC	2002	1) Customer service	2) Service organization 3) Customization 4) Diversity management	5) Legitimacy
Ernst & young	2003	1) Information	2) One way interaction 3) 2-way interaction 4) Transaction	
Moon	2002	1) Information	2) 2-way communication 3) Service and financial transaction	4) Vertical and horizontal integration 5) Political functions
World bank model	2003	1) Publish	2) Interact 3) Transact	
The UK national Audit	2002	1) Basic site	2) E-publishing	3) Holistic e-govt
The Modified UN model	2012	1) Emerging information services	2) Enhanced information services 3) Transactional services	4) Connected services
Chen	2011	1) Catalogue	2) Transaction	3) Vertical integration
Alhomod	2012	1) Presence on the web	2) Interaction between the citizens and the government 3) Complete transaction over the web	4) Integration of services
Kim & Grant	2010	1) Web presence	2) Interaction 3) Transaction	4) Integration Continues improvement
Lee & Kwak	2012	1) Initial conditions	2) Data transparency 3) Open participation 4) Open collaboration	5) Ubiquitous engagement
Wescott	2001	1) Setting up an email system and internal network 2) Enabling inter-organizational and public access to information	3) Allowing 2-way communication	4) Exchange of values 5) Digital democracy 6) Joined up government

There are two major maturity level variables that are emphasized in the literature. These are level of interaction and level of complexity. The level of complexity has been explained to entail the extent to which the level of difficulty increases with the advances of e-government stages. For example, the last stage, full integration, is meant to be the most complex stage as it involves advanced services and integration between all departments. The second aspect is the level of interaction. The level of interaction can be explained to be the extent to which interaction between citizens and government increases with the advances of e-government stages. For instance, the first stage, presence, requires no interaction while the middle stage requires interaction between the citizens and the government.

Finally, as mentioned previously the models have some drawbacks that can be summarized into the following. The models adopt a stop and jump procedure, where the portal starts at one stage and then jumps to another. There is very little clarity on the prescriptive nature of change required, the transformation strategies to be adopted, and the requirements for progress to be made from one stage to another. Also, all the models indicate that government are interested in automating routine procedures such as filing taxes, paying bills, and completing other tasks. There is very little effort to research citizens' requirements, and address them. In addition, the models do not explain how people from disadvantaged sections of the society, and those in rural areas, are able to access the e-government portal and make use of it. It is clear that e-government caters to the urban literate. None of the models speak of development effort needed to make IT available to wider sections of society. Moreover, there is no mention of developing infrastructure, hardware, software, and increasing connectivity. Issues such as accountability, time taken to resolve issues, corruption, metrics and benchmarks, are not mentioned in the models. Furthermore, Most of the models do not consider inputs from social media or have mechanisms to address complaints, suggestions, and comments from the public. Finally, the models largely focus on information and transactional capability of processes that have a statutory requirement either on the part of the citizen or government and ignore how e-government deals with more complex services such as healthcare, social services or education

## **6. Research Contribution and future work**

This study aimed at providing a review of the key e-government maturity models discussed in the literature together with a summary of current research in the field. The motivation for this review is to highlight some of the commonalties among the current models and prepare the basis for capturing some of the broader dimensions of public sector services that need to be facilitated through e-government. The review performed a study that contributes a qualitative meta-synthesis in this field. This review could assist researchers who are seeking knowledge and references to develop new maturity models by providing them with useful resources for further investigation and study. Finally, as part of future research, the motivation for this review is to highlight the basis for formulating an e-diplomacy maturity framework, which is the integration of ICT

into the ministry of foreign affairs and the function of diplomacy, which will be formulated based on the theory and practice of e-government maturity models.

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# Current Practice and Challenges of Data Use and Web Analytics in Online Participations

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**Abstract.** Information system design and implementation are key factors for electronic participatory processes and procedures. How information systems are designed does not only affect the procedures but also influences the trust building between organizers, operators and participants. In addition, the implementation often has to adhere to legal standards. In this paper, we aim to investigate current practice of data use in online participations. In particular, a qualitative analysis is conducted and 18 online participations are investigated on their data use, i.e. use of participant information, cookies and web analytics. The results show that most projects require and request data during site visits (e.g., IP address, browser type) and for active participation (e.g., name, email). The real benefit, however, for the use of web analytics is often unclear. Furthermore, often proprietary solutions for web analytics are used, even though open source solutions (i.e. that store data locally) exist. For future projects, it is recommended to not only define but also keep privacy policies updated (according to the used technology) and to specify the purpose and goals of using web analytics.

**Keywords.** E-participation, Cookies, Data Use, Web Analytics, Security

## Introduction

Information and Communication Technologies (ICT) are a key factor for the success and acceptance of e-participation as shown for example in [13,15]. Electronic, participatory decision processes are dependent on the underlying technologies used. Hence, the decisions for information system design (e.g., designing an architecture, define software engineering tools and methods) and furthermore the concrete information system implementation (e.g., choosing data formats and protocols) have critical impact on the e-participation solutions such as the acceptance, privacy or usability.

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Furthermore, the technology has an influence on the participation procedures itself and the participants. In particular, trust plays a significant role for (electronic) participation initiatives (e.g., [14,6,16]). For example in [17], a security analysis is performed to identify potential risks and shortcomings that could have an affect on the trust of people towards e-participation technologies. In fact, the authors define security requirements and preventive measures to minimize the risk of exposure and to enable “*trust by design*”.

The e-participation domain is particularly interesting as trust is likely to be an important factor when participants join and partake in initiatives. Technology is a key factor to provide stable, running and trustworthy implementations for these participatory decision processes. The exposure to threats and attacks might result into a decrease of trust in the cause and implementation. For example, a website defacement that changes the website interface for a few hours or the loss of personal data might lead to a loss of reputation and even more critical the motivation for people to join online participations. That is why adequate implementations should carefully consider the data required during a regular website visit (without active participation such as IP address or browser type) and during active participation (e.g., name, address) as well as the used web technologies.

In this paper, we investigate how current online participations are designed and developed in terms of data use and web analytics. In particular, we aim to analyze a set of online participations and evaluate what data is collected and for which use (if this can be determined), in particular the data collection *during a site visit (without active participation)* or *during active participation*. Furthermore, we aim to address current web technologies in online participations, i.e. the use of cookies and web analytics in this context. These features are important as they are often closely related to data protection laws and the technological feasibility. With this paper, we aim to address the following research questions: (A) How does current practice handle data use and web analytics in online participations? (B) How does current practice declare data use during a site visit (without active participation) or during active participation (e.g., in a privacy policy)? (C) What are recommendations or observations for data collection and the use of cookies, web analytics in online participations?

With this approach, we aim to identify challenges of data usage and raise awareness in e-participation. So far, research has acknowledged that security and privacy principles are important for the trust within e-participation (e.g., [20]), however, it is not clearly defined how this should be handled nor how the usage of data (e.g., with web analytics) influences the trust of participants. Furthermore, benefits of the use of web analytics for citizens or providers is yet undefined. This paper aims to start a discussion on best practices and to provide insights from current practice for future developments.

The rest of the paper is structured as follows: Section motivates the topic. Section 1 investigates related background research. Section 2 outlines the methodology used in the qualitative analysis. Furthermore, Section 3 summarizes the main results of the analysis. Lastly, Section 4 specifies observations and recommendations and concludes the paper.

## 1. Background

Trust between operators and participants can be promoted by choosing secure and stable technologies [17,7]. Standard web technologies are cookies and web analytics, for example. In e-participation, the use of cookies or web analytics have been proposed (e.g., [8]) but have not been investigated towards best practices. In this paper, we use the term *data* as “a set of values of information”. These values could be for example names, address, etc. Which and how data is used in online participations is specified as “*data use*” in this paper. Data is used by web technologies such as cookies or web analytics.

A *cookie* is “a text file that is placed on user’s computer hard drive by a Web site when the user visit that site” [3]. Cookies are intended to make the Internet surfing easier and more comfortable. Based on [3] and [5], there are two types of cookies: **Persistent cookies** “help identify a unique browser to the website, inasmuch as they are the closest thing to tracking a person or unique visitors” according to [5]. Persistent Cookies do not contain any personal information. **Session cookies** help the website to keep track of user movements in the website without repeatedly requiring a user’s authentication and expire when the user closes the browser or logs out. Cookies can be subject to hijacking or other threats (e.g., [11,2,4]) that is why their usage must be carefully planned and implemented in all application domains (e.g., e-participation, e-government, e-commerce).

*Web analytics* “is the measurement, collection, analysis and reporting of Internet data for the purposes of understanding and optimizing web usage” [19]. Different metrics exist for web analytics: For example, basic building blocks include page views, visits, unique visitors. Building on these blocks, further metrics such as returning visitors, repeating visitors, visitor referrer, page exit ratio or page view per visits can be established. Several open source software (e.g., Piwik, AWStats, Open Web Analytics), proprietary software (e.g., Mint, Splunk) and (proprietary) software as a service (e.g., Google Analytics, Adobe Analytics, Webtrends) for web analytics exist. In the following, we will describe the software found during our analysis: **Google Analytics** is a *software as a service* for web analytics (see <http://www.google.com/analytics/>). Google Analytics provides website owners JavaScript libraries to record information what user has seen/done on the website. Google Analytics uses HTTP cookies for these purposes. Google Analytics is ease of use, flexible and easy to configure [9]. **Piwik** is an open source program for web analytics (see <http://piwik.org/>). Unlike other web analytics software, Piwik can be directly hosted on the client server and tracked data can be stored within an inhouse database. Therefore, clients have full control and access to the tracked data. Piwik uses also HTTP cookies. Piwik does not share tracked data with advertising companies.

## 2. Methodology

In this paper, we address the three research questions: (A) How does current practice handle data use and web analytics in online participations? (B) How does current practice declare data use during a site visit (without active partici-

pation) or during active participation (e.g., in a privacy policy)? and (C) What are recommendations or observations for data collection and the use of cookies, web analytics in online participations?

Questions A, B and C are answered within three steps: (1) manual search, (2) qualitative analysis, and (3) manual check. A (1) *manual search* was conducted to identify potential online participations using Google search. Therefore, keywords such as “*e-participation website*”, “*e-participation platform*” were used. The search resulted in a set of 18 online participations (i.e. online participations are synonymously named as websites or platforms throughout the paper) as shown in Table 1. Based on this set, a (2) *qualitative analysis* was conducted between December 2015 and January 2016. In particular, we analyzed the following characteristics of the websites:

- *Level of participation*: Participatory processes can be divided in four tiers (see [12]): Information, consultation, cooperation and co-decision. We applied these levels of participation to categorize the 18 online participations.
- *Procedure*: This characteristic measures the usage of an electronic (i.e. online) or offline channels. A combination of both can be possible [1].
- *Duration*: Duration measures the temporal runtime of the participatory process. We adapted the duration from [1] to: permanent, periodical or onetime procedures.
- *Data use*: This feature analyzes the data that is collected during a site visit (i.e. no active participation, e.g., IP address or browser type) or active participation (e.g., name, email).
- *Web analytics*: This category refers to the collection and analysis of web data for the purpose of understanding and optimizing web usage (e.g., geolocation). In particular, we will investigate which software for web analytics is used and declared in the online participation.

In addition, we performed a (3) *manual check*. We used the declared information (e.g., in privacy policies about cookies and software for web analytics) and compared it to the real usage. Therefore, we investigated the privacy settings in the browser (in our case Firefox 44.0.2) to identify created cookies during the a site visit.

Several limitations could be identified in our study. The selection of platforms was reduced to the spoken languages of the authors (English or German). Hence, only English or German online participations could be selected. Furthermore, the authors emphasized on online participations in Europe, however, two projects were selected that are located in the USA. Keeping these reasons in mind, a qualitative analysis was performed to determine qualitative features (e.g., the use of web analytics). However, this leaves room for quantitative analysis in future work.

### 3. Results

This section summarizes the main results of our analysis for research questions (A) and (B) (see Section 2). In particular, we give an overview of the investigated platforms and analyze their use of data, cookies, web analytics.

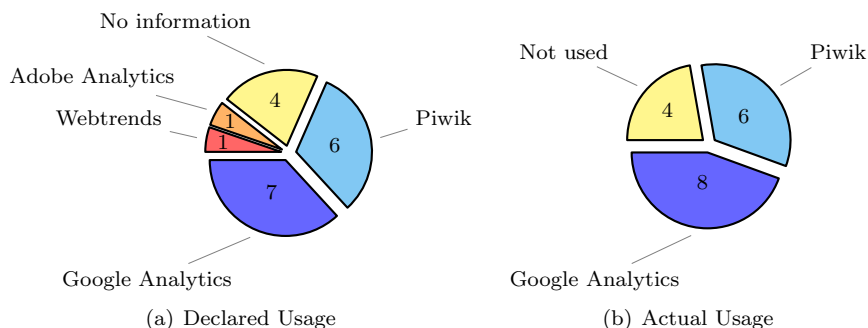


**Table 1.** List of Online Participations

No.	Site	CC	URL
1	Department of Justice	US	<a href="http://www.justice.gov/oip/make-foia-request-doj">http://www.justice.gov/oip/make-foia-request-doj</a>
2	Direkt zur Kanzlerin	DE	<a href="http://www.direktzurkanzlerin.de/">http://www.direktzurkanzlerin.de/</a>
3	Petitions UK Government	UK	<a href="https://petition.parliament.uk/">https://petition.parliament.uk/</a>
4	Züri wie neu	CH	<a href="https://www.zueriwieneu.ch/">https://www.zueriwieneu.ch/</a>
5	Bristol Consultation Hub	UK	<a href="https://bristol.citizenspace.com/">https://bristol.citizenspace.com/</a>
6	Der Online-Dialog der Stadt Köln	DE	<a href="https://buergerhaushalt.stadt-koeln.de/2015/">https://buergerhaushalt.stadt-koeln.de/2015/</a>
7	Digital Agenda Wien	AT	<a href="https://www.digitaleagenda.wien/de">https://www.digitaleagenda.wien/de</a>
8	Planning Portal	UK	<a href="http://www.planningportal.gov.uk/">http://www.planningportal.gov.uk/</a>
9	Stadtdebatte Berliner Mitte	DE	<a href="http://stadtdebatte.berlin.de/">http://stadtdebatte.berlin.de/</a>
10	Regulation.gov	US	<a href="http://www.regulations.gov/">http://www.regulations.gov/</a>
11	Abgeordneten-watch	DE	<a href="http://www.abgeordnetenwatch.de/">http://www.abgeordnetenwatch.de/</a>
12	Your voice in Europe	EU	<a href="http://ec.europa.eu/yourvoice">http://ec.europa.eu/yourvoice</a>
13	Bewegt Politik Campact	DE	<a href="https://www.campact.de/">https://www.campact.de/</a>
14	WeAct	DE	<a href="https://weact.campact.de/">https://weact.campact.de/</a>
15	Kommission Lagerung hoch radioaktiver Abfallstoffe	DE	<a href="http://www.bundestag.de/endlager/">http://www.bundestag.de/endlager/</a>
16	Online-Konsultation Publikationssystem	DE	<a href="http://konsultation.publikationssystem.de/">http://konsultation.publikationssystem.de/</a>
17	Bürgerhaushalt Lichtenberg	DE	<a href="https://www.buergerhaushalt-lichtenberg.de/">https://www.buergerhaushalt-lichtenberg.de/</a>
18	Frankfurt fragt mich	DE	<a href="https://www.ffm.de/frankfurt/de/home">https://www.ffm.de/frankfurt/de/home</a>

### 3.1. Data Use

This aspect is concerned with what data is collected during a regular (web) site visit and during the participation. From the selected examples, we observed that almost all of online participations collect anonymous information (see Section 3.3). Considering this, it is not surprising that IP, browser type, time of a visit and visited pages are often logged. In particular, during site visit the following data is collected (the number in brackets represent the sum of online participations that collect the piece of data): IP (15), browser type (9), time of visit (9), visited pages (7), 7/OS (7), referring site (6), ISP name (5) and two websites specified no information for data collection (2). However, how this information is exactly used and if the information provides actual benefits to the web usage (e.g., usability improvements) is not clear and can be subject to future work. Furthermore, we examined data requested during active participation; i.e. when a participant actively gets involved such as filling out a form or registers to make or rate a comment. In this case, personal data such as name, email, address or telephone number are requested and can be mandatory or optional. The exact results for active participation are: email (18), name (16), postcode (6), address (3), country (3), telephone number (2), district (2), gender (2), age group (2) and background (2).



**Figure 1.** Use of Web Analytics

### 3.2. Cookies

Cookies are frequently used in online participations. The results of the analysis show that almost all websites declare online that they are using session (15) and persistent (16) cookies. Only few websites provide concrete information about the use of cookies: used types of cookies, purposes and expiration time. Some website do not have information about cookies, however, they provide information about the usage of web analytics software and according to this information we can suppose/expect that they are using session and persistent cookies. We reviewed the declaration by manually reviewing the cookie use during a site visit. Persistent (17) and session (18) cookies are used in the analyzed websites but are sometimes not declared on the website.

### 3.3. Web Analytics

Web analytics are frequently used in websites for e-participation as shown in Figure 1. In Figure 1(a), it can be seen that almost all websites are using web analytics for collection and analysis of web data. However, we wanted to assess the actual usage too (see Figure 1(b)). In particular, we assessed which cookies were created during the site visit and further assess if these cookies belong to Google<sup>2</sup> or Piwik<sup>3</sup>, for example. The results show that not all websites declare their web analytics usage correctly. 14 out of 18 websites use cookies for web analytics. However, we cannot identify whether this is intended or unintended in this study. To do this, a in-depth-analysis with contacting the providers would be required.

## 4. Observations, Recommendations and Conclusion

Trust and transparency play an important role in the context of e-participation (see [20]). For example, trust can be established by designing and implementing

<sup>2</sup>Google analytics uses the following cookies: `_ga`, `_gat`, `_utma`, `_utmt`, `_utmb`, `_utmc`, `_utmz`, `_utmv` (see <https://developers.google.com/analytics/devguides/collection/analyticsjs/cookie-usage#gajs>, visited on 11.03.16).

<sup>3</sup>Piwik uses `_pk_ref`, `_pk_cvar`, `_pk_id`, `_pk_ses` or `piwik_ignore` (see [http://piwik.org/faq/general/faq\\_146/](http://piwik.org/faq/general/faq_146/), visited on 11.03.16).

tools that use secure and privacy-aware technologies or by providing updated privacy policies. To summarize the findings for research question (C) (see Section 2), we derived three recommendations that can boost trust and transparency in e-participation based on the results of the study.

- *Security-aware information system design and implementation*: Building a secure and privacy-aware information system starts with the design and implementation. Building security and privacy measures into information systems are important particularly for systems that cooperate and interact with the public. Incidents or other events are likely to have a high public coverage and might affect the intended project unexpectedly. Therefore, it is important to use - already during the software engineering - a privacy-aware or security-aware approach (e.g., [18]). Furthermore, the information system design should already cover and describe policies for data use and web analytics.
- *Use of web analytics*: The use and benefit of web analytics in e-participation is not yet clearly determined. Apart from the general benefits such as usability improvements or analysis of web experience, it can be easily misused and lead to threats (see e.g., [10]). Furthermore, information about web analytics tools should be clearly documented in the terms of service of web applications. We found mixed declarations on how web analytics is used (or how long data is going to be stored). Moreover, it is astonishing that operators tend to use the proprietary software than open source software. However, future developments should also consider open source solutions; they often provide the opportunity to own all data generated with web analytics (as opposed to proprietary solutions).
- *Transparent and consistent privacy policy*: Operators should provide comprehensive and updated information about the used technologies (e.g., cookies or web analytics). Updates and modifications of the privacy policy should be marked or highlighted; so that participations can understand and identify updates easily. For example, this includes information about the usage of cookies (e.g., purpose and expiration date).

Although these recommendations seem very generic at first, they seem to be needed as current practice shows different results. For example, policies are not up-to-date and do not apply to the used technology.

In summary, this paper described and analyzed current practice of data use and web analytics. The results showed that online participation policies often not fully declare their use of cookies and web analytics. This could be better maintained in permanent online participations. In the long run, this can contribute to providing more secure participatory processes and promote trust between operators and participants. For future work, we aim to investigate how data use and privacy policies can affect the trust of participants in online participations. This should provide insights on how these policies should be visualized and defined.

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# Open Data and Open Government

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# The Acceptance and Use of Open Data Infrastructures - Drawing upon UTAUT and ECT

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**Abstract.** While governments and researchers often focus on the opening of data through open data infrastructures, the *adoption* and *use* of open data infrastructures has received less attention, despite the fact that this use should result in the envisioned benefits. This study aims to examine to which extent and by which factors the acceptance and use of open data infrastructures by researchers can be influenced. For this purpose we use an integrated model of the Unified Theory of Acceptance and Use of Technology (UTAUT) and the two-stage Expectation Confirmation Theory of Information Systems continuance (ECT). Our research confirms the hypothesis that Perceived Usefulness (PU), Effort Expectancy (EE), Social Influence (SI) and Trust (T) in the pre-usage stage can be used to predict PU, EE, SI and T in the post-usage stage, which may subsequently influence the acceptance and use of open data infrastructures. Nevertheless, not all of our findings show support for applying the combined UTAUT-ECT model, and the findings suggest that the model needs to be specified and adapted for the domain of open data. We recommend future research to develop models for the acceptance and use of technologies that are more specific to the context of open data.<sup>2</sup>

**Keywords.** Open data, adoption, use, infrastructure, UTAUT, ECT.

## Introduction

Governments often focus on the opening of data through open data infrastructures, and the *adoption* and *use* of open data infrastructures has received less attention in practice. While the scientific literature in the area of open data also often used to focus on the supply-side of open data [e.g., 1], recently awareness started growing that more attention should be paid to the use of open data [e.g., 2, 3]. Paying attention to the acceptance and use of open data infrastructures is important, since this results in more value creation than only opening data [4]. The envisioned benefits of open data infrastructures cannot be realized if open data is not accepted and used.

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Although several articles already discuss variables that may influence the acceptance and use of open data [e.g., 5, 6], there are limited studies that provide overviews of such factors from a user perspective. Moreover, most of these studies are not focused on open data infrastructures in particular, while open data is often offered through these infrastructures. In addition, many articles that discuss variables influencing the acceptance and use of open data do not build on existing theories and theoretical models, while various theories about the acceptance and use of technology in general have been developed that might also be relevant in the context of open data infrastructures. The study aims to examine to which extent and by which factors the acceptance and use of open data infrastructures by researchers can be influenced. We focus specifically on researchers as open data users and other types of open data users (e.g. developers and citizens) are outside the scope of this study.

## **1. Research background**

There is no common understanding of the concept ‘open data infrastructures’. Related domains, such as the literature on digital infrastructures and information infrastructures, may be used to develop a definition of open data infrastructures. As described in the literature, digital and information infrastructures are often defined as shared systems [7, 8], that can be public or quasi-public [9], and that evolve over time [9]. Moreover, these types of infrastructures contain interacting and connected social and technical elements [9-11] that together form a system. Based on the digital and information infrastructure literature, [12, p. 45] defines an Open Government Data (OGD) Infrastructure as “a shared, (quasi-)public, evolving system, consisting of a collection of interconnected social elements (e.g. user operations) and technical elements (e.g. open data analysis tools and technologies, open data services) which jointly allow for OGD use”. We adopt this definition in our study on the acceptance and use of open data infrastructures.

Venkatesh et al. [13] have developed a model that integrates UTAUT and ECT. This model enables us to understand the acceptance and use of a certain technology during the course of its usage. It includes both pre-usage variables, usage variables, and variables concerning the intention to continue using the technology, such as perceived usefulness, trust and satisfaction. UTAUT allows for examining complex and sophisticated organizational technologies of managerial concern [13]. UTAUT has also been used in research on factors influencing the intention to use open government [14], and open data is often seen as an important aspect of an open government. ECT allows for investigating the continuance of Information Systems (IS) [15] as well as changes in the beliefs and attitudes of users during their IS usage [16]. The model of [13] is appropriate for investigating the acceptance and use of open data infrastructures by researchers, since such infrastructures can be considered a specific IS technology in which acceptance and use, but also continuance of use in the future, play an important role. Furthermore, the expanded two-stage model of IS continuance looks at the acceptance and use from a broader perspective than other models do, such as the Technology Acceptance Model (TAM) [17, 18], or UTAUT [13] or ECT [19] by itself.

The key variables in the integrated ECT/UTAUT model of [13] are Perceived Usefulness (PU), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC) and Trust (T). Following this model, we formulated four hypotheses (see Table 1).

**Table 1.** Formulated hypotheses.

Hypotheses
H1: Positive disconfirmation of factor X (PU/EE/SI/T) has a positive influence on satisfaction.
H2: Positive disconfirmation of factor X (PU/EE/SI/T) has a positive influence on post-usage factor X.
H3: Post-usage influence of factor X (PU/EE/SI/T) has a positive influence on post-usage attitude.
H4: Post-usage influence of factor X (PU/EE/SI/T) has a positive influence on continuance intention.

These hypotheses include variables from both the pre-usage and post-usage stage, although for reasons of feasibility we do not include hypotheses concerning the influence of each of the pre-usage stage variables on each of the post-usage stage variables. Even though the post-usage factors (PU/EE/SI/FC/T), post-usage attitude, post-usage satisfaction and continuance intention do not directly measure the acceptance and use of open data infrastructures, we argue that these factors can be seen as important indicators. For instance, if researchers do not continue their use of open data infrastructures, this indicates that they do not accept and use the open data infrastructure in the long run. We therefore argue that the post-usage factors, attitude, satisfaction and continuance intention are important preconditions for the acceptance and use of open data infrastructures by researchers.

## 2. Research approach

In total, 145 people completed two surveys that incorporated the expanded two-stage model of IS continuance by Venkatesh et al. [13]. A first survey was completed in the pre-usage stage, while a second survey was completed in the post-usage stage. The pre-usage survey consisted of questions related to pre-usage attitude and pre-usage beliefs, and the post-usage survey included questions related to disconfirmation (i.e. whether the expectations of respondents were confirmed), post-usage attitude, satisfaction, post-usage beliefs and continuance intention. The beliefs and the disconfirmation encompassed the PU, EE, SI, FC and T. All questions corresponded to the previously validated scales for the constructs as proposed by [13]. The questions were modified to make them suit the context of open data infrastructures [see 15 for the survey].

In the usage stage, the participants completed scenarios related to the use of the open data infrastructures for research purposes using one of two specific open data infrastructures, including searching for data, data analysis, data visualization, interaction about open data and data quality analysis [see 12 for more information about the scenarios]. Approximately 73 per cent of the respondents worked with the ENGAGE open data infrastructure, while 27 percent worked with the DANS infrastructure. Participants were randomly assigned to one of those two infrastructures, but since the number of people that could work with the second infrastructure at the same time was limited, less participants worked with this infrastructure.

Ideally, we would use Structural Equation Modelling (SEM) to investigate the variables influencing the acceptance and use of open data infrastructures. However, since our sample consisted of only 145 responses the data did not meet the assumptions of SEM. Therefore, we used Partial Least Squares (PLS) [20] to analyse the data. PLS can be used for smaller groups of respondents. It can be used to create predictive models for datasets that contain many and highly collinear factors [21]. Since we attempt to find out whether our data can predict the acceptance and use of open data infrastructures, and whether it can predict the intention of a person to continue using

the particular open data infrastructure, we search for a predictive model for using open data infrastructures. Using SmartPLS, we built a model, and thereafter we examined various factors that show the quality of the model. Subsequently, a bootstrapping test was carried out to test the significance of the paths in the model. In case that the t-value of a path was higher than 1.96, SmartPLS removed the path from the model and ran it again. This process was repeated until only the significant paths were left in the model.

3. Factors influencing the acceptance and use of open data infrastructures by researchers

Most of the 145 participants (80%) were between 20 and 29 years old, and most were students (79%). Out of the 142 participants who provided gender information, most were male (75%). The participants were asked to assess their experience with open data use, and this question was answered by 112 participants. On a scale from one (no experience) to ten (very much experience), the majority of the participants (21%) stated that their experience with open data use was on level seven. For almost 60 per cent of the participants their experience was between level three and level six.

Figure 1 shows the results from testing our hypotheses through PLS. We conducted a bootstrapping test to examine the significance of the paths in our model. Non-significant paths are indicated with '-'. There are no significant paths between pre-usage beliefs and disconfirmation and between pre-usage beliefs and satisfaction. The disconfirmation theory described in the UTAUT is not reflected in the results. Interestingly, while there are no significant paths between pre-usage beliefs and disconfirmation, there are significant paths between disconfirmation and post-usage beliefs. The only factor that has a significant influence on continuance intention is perceived usefulness, while post-usage attitude shows a strong significant result.

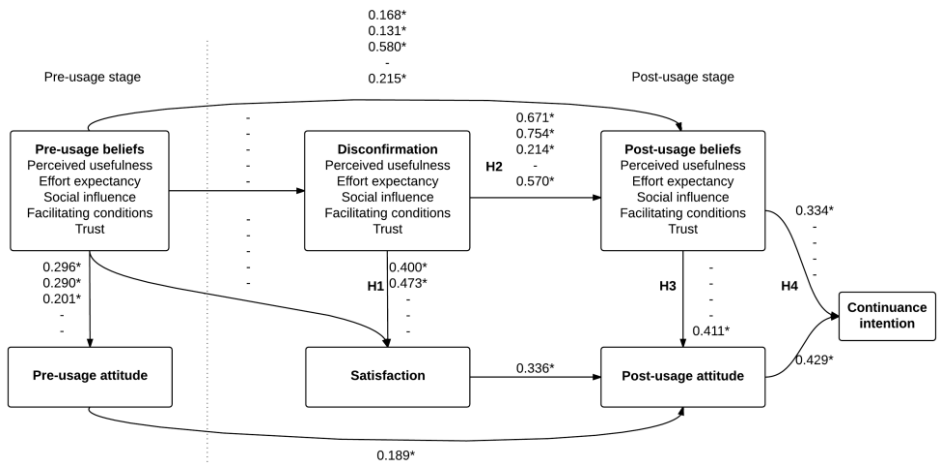


Figure 1: Results with significant paths (\*) and non-significant paths (-) for the acceptance and use of open data infrastructures (model adopted from Venkatesh, et al. [22]).

Figure 1 shows that the data provided relatively much support for the second hypothesis, namely that positive disconfirmation of factor X (PU/EE/SI/T) has a

positive influence on post-usage factor X. For instance, we found that positive disconfirmation of effort expectancy has a positive influence on post-usage effort expectancy, and positive disconfirmation of trust has a positive influence on post-usage trust. Positive disconfirmation implies realization of the expectations. For example, if a user of open data infrastructures expected to trust the infrastructure in the pre-usage stage, this was often confirmed in the post-usage stage. Likewise, if the user (i.e. the researcher) did not trust the infrastructure in the pre-usage stage, this was often also the case in the post-usage case. This means that perceived usefulness, effort expectancy, social influence and trust in the pre-usage stage can be used to predict these factors in the post-usage stage. According to the model of Venkatesh et al. [13], post-usage beliefs subsequently influence the intention to continue using the system.

Some support was also found for the first, third and fourth hypothesis, although this support was not as strong as the support for the second hypothesis. With regard to the first hypothesis, the data showed that the positive disconfirmation of effort expectancy has a positive influence on satisfaction. This means that if users of an open data infrastructure expect that the use of the infrastructure will require much effort, this expectation is often realized. Moreover, if they expect that little effort is required, this expectation is realized as well. Regarding the third hypothesis, we found that post-usage influence of trust has a positive influence on post-usage attitude. As far as the fourth hypothesis is concerned, it was found that post-usage influence of perceived usefulness has a positive influence on continuance intention.

In sum, we found that the positive disconfirmation of factor X (PU/EE/SI/T) has a positive influence on post-usage factor X, that the positive disconfirmation of effort expectancy has a positive influence on satisfaction, that post-usage influence of trust has a positive influence on post-usage attitude and that post-usage influence of perceived usefulness has a positive influence on continuance intention. In the following section we will discuss these findings and speculate about their implications.

#### **4. Discussion of the acceptance and use of open data infrastructures**

Our findings showed that Perceived Usefulness (PU), Effort Expectancy (EE), Social Influence (SI) and Trust (T) in the pre-usage stage can be used to predict these factors in the post-usage stage. Although the respondents did not receive significant positive or negative confirmation of their initial perceptions while they used one of the open data infrastructures (i.e. the path from the pre-usage stage to the disconfirmation is not significant), it is remarkable that the path from disconfirmation to post-usage beliefs is significant for all factors except for FC. Of all pre-usage belief factors, PU has the largest influence on the pre-usage and post-usage attitude. Also in the relation between post-usage beliefs and post-usage attitude, PU has a significant influence, and PU has a significant influence on satisfaction and the highest influence on the intention to continue using the infrastructure. Thus, out of the variables that we tested, PU seems the most important factor influencing the acceptance and use of open data infrastructures. Examples of measures that governments can take to enhance PU are the training of potential open data users, showing examples of how open data infrastructures can be used, and promoting the use of open data infrastructures through social media.

The positive disconfirmation (i.e. realizing the expectations) of EE has a positive influence on satisfaction. At the same time, EE has a smaller and only indirect effect on

the intention to continue using open data infrastructures than PU does. A possible explanation for this is that the open data users in our sample did not care how much effort it costs to use open data if the PU is high enough. Moreover, most open data users in our sample already had experience with open data use and because of this their effort expectancy did not influence the use of the infrastructure. In our study, SI significantly influences the intention to continue using an open data infrastructure. Looking at the number of significant paths, SI seems to confirm the model most. Although SI has the smallest influence on attitude concerning the use of open data infrastructures compared to PU and EE, the total indirect effect of SI on CI (via pre-usage beliefs and post-usage beliefs) is the largest. This shows the importance of combining technical tools for open data use with support for social aspects. FC was found not to be significant, which means that facilitating conditions, such as tools to support open data use, may not significantly influence a person's intention to continue using open data infrastructures. An alternative explanation is that the internal reliability of the indicators was too low, which might be caused by a misinterpretation of the questions by the respondents. Although trust did not have much influence on the intention to continue using open data infrastructures in our model, we found that post-usage influence of trust has a positive influence on post-usage attitude. In addition, there is an indirect effect of trust on CI (via pre-usage beliefs and post-usage beliefs). Through this indirect effect, governments may influence the acceptance and use of open data infrastructures. Furthermore, governments may influence trust through other factors that have not been examined in our model, such as providing considerable metadata about the context in which the data have been created.

Our study shows that the integrated UTAUT/ECT model provides guidelines for very generic hypotheses. Open data infrastructures may require further specification of these hypotheses. For instance, the factor EE could refer to different types of effort, including effort to find open datasets, effort to interpret the data, effort to receive help with the use of open data or effort to use visualization tools for open data. All these different types of effort may be influenced by other factors. While finding open datasets might cost less effort when a researcher already has prior knowledge of existing open data infrastructures, such knowledge may not influence the use of visualization tools and other types of skills are needed for this. The other constructs (PU, SI, T) also require further specification. For instance, PU may be different for data from different domains in relation to the background, skills and domain of expertise of the data user. Social influence may differ per type of data user, as researchers may be influenced by what their colleagues think while this does not apply for citizens. Trust might be influenced by particular characteristics of the open data infrastructure.

Although a few paths in the model were significant, most paths were not. Our data does not show considerable support for applying the combined UTAUT-ECT model in the context of open data infrastructures. For instance, disconfirmation of the pre-usage beliefs was barely found and hypotheses related to Facilitating Conditions were not significant. A potential explanation for the limited number of significant paths in the model can be the limited number of persons involved in our study (N=145) in comparison to the high number of latent variables. Nevertheless, removing a number of variables to reach a more acceptable ratio did not lead to more significant paths.

The model that we used to examine the acceptance and use of open data infrastructures, developed by Venkatesh, et al. [22], was not focused specifically on open data infrastructures. It concerned Information System in general, although it was used previously in the context of electronic government technologies. Although the

model that combined UTAUT and ECT was helpful, the variables were relatively generic and may need to be specified for the context of open data infrastructures. A model focusing particularly on the context of open data infrastructures may better predict the acceptance and use of such infrastructures than the model of [22] does.

Finally, we assumed that satisfaction, attitude and continuance intention would be indicators of the acceptance and use of open data infrastructures. Since the acceptance and use of open data infrastructures cannot be measured directly through a single variable, we argued that a number of factors can function as indicators for the acceptance and use of open data infrastructures. However, we have not tested the relation between the indicators and the acceptance and use of open data infrastructures. This is an important aspect to consider for future research.

## 5. Conclusions

This study aims to examine to which extent and by which factors the acceptance and use of open data infrastructures by researchers can be influenced. We evaluated two particular open data infrastructures through surveys using an integrated model of the Unified Theory of Acceptance and Use of Technology (UTAUT) and the two-stage Expectation Confirmation Theory of Information Systems continuance (ECT) of Venkatesh, et al. [22]. Our study showed that meeting the expectations of open data users (i.e. researchers) regarding their effort expectancy for using open data infrastructures was found to have a positive influence on satisfaction (H1). Perceived usefulness, effort expectancy, social influence and trust in the pre-usage stage can be used to predict these factors in the post-usage stage (H2). Moreover, post-usage influence of trust has a positive influence on post-usage attitude towards an open data infrastructure (H3) and post-usage influence of perceived usefulness has a positive influence on the intention to continue using an open data infrastructure (H4).

Not all of our findings show support for applying the combined UTAUT-ECT model of Venkatesh, et al. [22] in the context of open data infrastructures. For example, disconfirmation of the pre-usage beliefs was barely found and hypotheses related to facilitating conditions were not significant. These findings suggest that certain aspects of the combined UTAUT-ECT model need to be specified and adapted for the domain of open data infrastructures. We recommend future research to study whether model adaptations lead to a model that better suits the open data infrastructure domain.

An important question is whether our findings also apply to other samples and to open data infrastructures in general. This study focused on a particular type of open data use, namely the use of structured data on open data infrastructures by researchers. The data concerned the domains of social sciences and humanities and was derived from research by governmental agencies. Moreover, it focused on a particular type of open data use tasks, including finding, analyzing, visualizing, interacting about and assessing the quality of open data. Many other types of open data use are possible, such as open data use by companies, or the use of other types of data, such a geographic data. We recommend future research to examine whether the findings from our study also apply to other contexts, for instance involving other types of open data use, users and data, and to develop models for the acceptance and use of technologies that are more specific to the context of open data.

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# Sustainable Linked Open Data Creation: An Experience Report

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**Abstract:** A flexible platform supporting the linked data life-cycle has been developed and applied in various use cases in the context of the large scale linked open data project *Fusepool P3*. Besides the description of the aims and achievements, experiences from publishing and reusing linked data in public sector and business are summarized. It is highlighted that without further help it is difficult for domain experts to estimate the time, effort and necessary skills when trying to transfer the platform to other use cases. Applying a new publishing methodology turned out to be useful in these cases.

**Keywords:** linked data, semantic enrichment, linked data life-cycle, data publishing, data integration, resource description framework, data management

## 1. Introduction

The exploitation of the Internet for intelligent knowledge management has been worked on for many years and it still remains one of the main challenges for the scientific community with added value for business, public bodies and civil society. In this attempt, the web is not only used in a classical way for publishing (unstructured) documents as HTML pages, offering online services like shopping, booking or text-based search engines, but also as a platform for processing and managing structured information. It appears in the form of data, which is published, interlinked and integrated with other structured information as linked data [1], that can subsequently be browsed or queried.

Annotated with appropriate vocabulary terms from ontologies, this interlinked structured information can not only be searched by keywords, but on a semantic level, thus laying the foundation for the Semantic Web [2]. Through linked data, information and services on the Internet and in web-based applications and mobile apps can and have already been enriched in a sophisticated way, although in the broad public it is not yet noticed as a big bang, since it comes in form of a quiet revolution [3]. Facebook's Knowledge Graph, Google's Hummingbird and Bing's Satori are examples of improv-

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ing services through semantic search technologies, revealing the revolution's silence through incrementally improving the services in small iterations while digesting constantly information from different sources.

In the e-Government domain, the use of linked open data (LOD) is spreading, as public authorities realize its benefits – not only regarding the transparency of governmental processes, but also as a driver for economic innovation: the availability of machine-readable semantically enriched open data enables SMEs and other entities to develop and provide new value-added services and applications. However, while public authorities in democratic countries around the globe have already or are developing a strategy for Open Government Data (OGD), only a fraction of those already take the additional step of provisioning the data as LOD through SPARQL endpoints. Take for example Switzerland: An e-Government strategy is in place both on the federal level (since 2007) as in most cantons; in addition, an OGD portal<sup>2</sup> as single point of entry for all OGD data in Switzerland has been established in February 2016. A service platform for LOD however is only available in a pilot stage with currently only a limited set of data.<sup>3</sup> One of the main roadblocks hindering a wider adoption of linked open data is that authorities shy away from the additional effort needed to convert OGD to LOD. This was also one of the key motivators to start the Fusepool P3 project.

Meanwhile, the Linked Data paradigm has fostered and propelled the emergence of numerous research projects and software products with focus on LOD [4]. Currently, the most prominent output of the LOD movement is visualized in the LOD cloud,<sup>4</sup> the core of which is formed by the data sets of DBpedia [5] and GeoNames.<sup>5</sup> Moreover, many domain-specific applications have evolved [6], often with an exploratory focus.

Inherent to LOD applications is the processing of data analogous to ETL processing in the data warehouse domain, but with more complex operations such as data extraction, enrichment, interlinking, fusing and maintenance. While these can be automated to a certain degree for a specific domain, a lot of manual work is still necessary, e.g., for mapping tasks. This data processing is part of the linked data life-cycle [7], that occurs with different complexity, among others depending on the data sources and the requirements of the target applications. In one way or another, the linked data life-cycle is integral in research projects like LOD2 [8], LATC [9], GeoKnow [10] and Fusepool [11].

In this paper we describe experiences from Fusepool P3 [12], a large scale EC-funded FP7 project with a focus on publishing and reusing linked data. The research goal was to develop enhanced products and services based on the exploitation of linked data in the context of the tourism domain. In the next section, the project goals are summarized, followed by a description of the architecture of the integrated data platform. Next, experiences from the project are pointed out, before concluding with aspects about the transfer of the research results to other application contexts.

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<sup>2</sup> <http://opendata.swiss/>

<sup>3</sup> <http://lindas-data.ch/>

<sup>4</sup> <http://lod-cloud.net/>

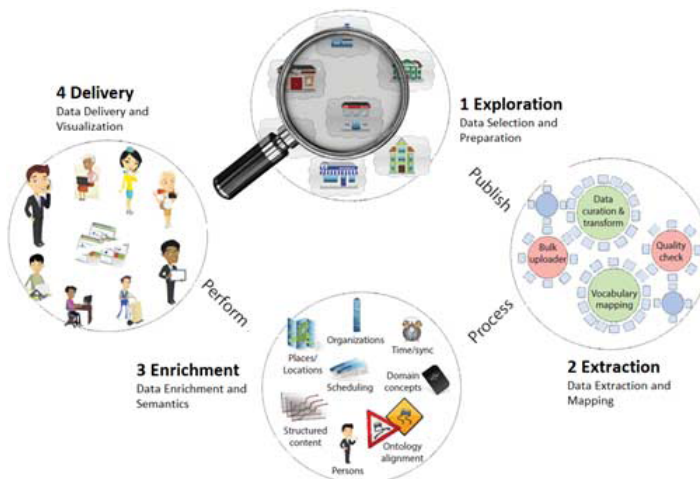
<sup>5</sup> <http://www.geonames.org/>

Of the main findings we have learned that the Fusepool platform can significantly simplify the publishing of data as linked open data. Regional authorities in Trento and Tuscany were thus enabled to provide tourism-related data that form the basis for novel applications. Reflecting several completed use cases showed that additional advice and recommendations are essential for transferring project results to other use cases. A new publishing methodology, described below, allows for recording information on completed LOD projects and helps estimating and planning new LOD use cases.

## 2. The Fusepool P3 Platform

The main goal was to facilitate publishing and reuse of linked data in a more seamless way, based on a thriving data market economy with data providers, enhancers, and component developers along the linked data value chain [11]. In order to facilitate publishing and processing of Linked Data within a single platform, a set of loosely coupled, modular software components, compatible with the Linked Data Platform (LDP) best practices [13], has been developed. These software components work closely together, supporting the multilingual data value chain, to achieve the following tasks: *revealing* data from structured and unstructured sources, *refining* data through text extraction and enrichment, and *running* the linked data ecosystem through data-driven applications (Fig. 1).

Supported by appropriate backend tools described below, and a high degree of automation in data processing, the Fusepool platform has successfully been deployed in several research projects, including the preservation of intellectual property of SMEs in the patent domain and in tourism use cases.<sup>6</sup>



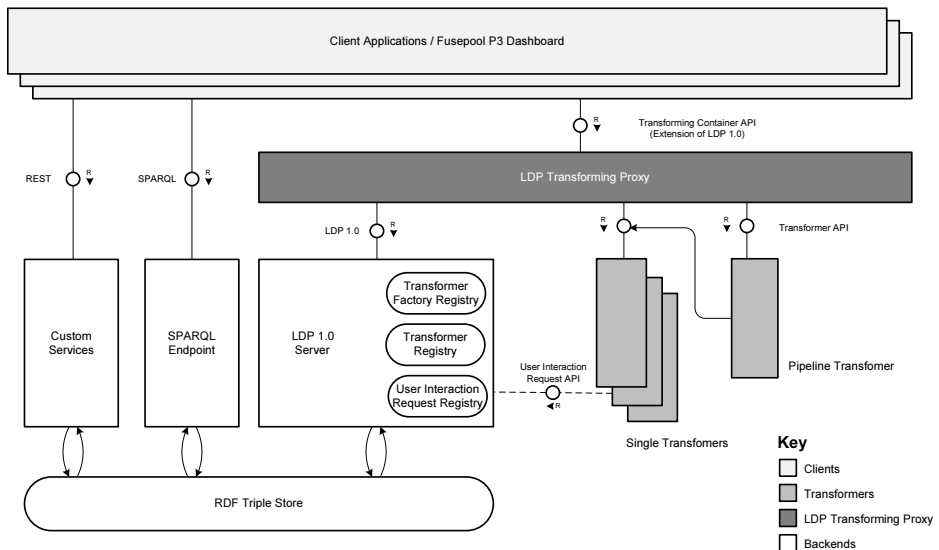
**Figure 1:** Elements of the *Fusepool P3* data value chain; *Fusepool* derives its name from the idea of fusing and pooling linked data with analytical processing on top of it, and *P3* abbreviates *Linked Data Publish-Process-Perform*

<sup>6</sup> <http://fusepool.eu/>

## 2.1 Architecture

We aim at providing a single platform for the linked data life-cycle. To achieve this, the Fusepool platform architecture is based on loosely coupled components communicating via HTTP and exposing RESTful APIs exchanging RDF [14]. This leads to re-usability of components, enables distributed development and makes it easier for developers to understand and extend the software, thus ensuring its longevity.

RESTful RDF is the platform's native interaction method, meaning that there are no proprietary data access APIs in place. Platform components, as well as third party applications, communicate using generic RDF APIs. In Fig. 2, the Fusepool platform architecture is depicted.



**Figure 2:** The P3 platform in Fundamental Modeling Concepts (FMC) Notation

The diagram shows how the Fusepool P3 dashboard – the main user interface to interact with the platform – and other clients access the Fusepool platform primarily via an LDP Transforming Proxy, an extension of the LDP 1.0 specification which uses the REST-based Transforming Container API to enable RDF data generation and annotation from input data. The proxy transparently handles transformation processes by calling the actual transformers in the background, and once the process has finished, it sends back the data to the LDP Server. The clients can also directly access transformers via their REST API (the *Transformer API*) or use a SPARQL 1.1 endpoint.

As a result, the architecture does not require a common runtime for its components. Every component, including all transformers, is by default run as an individual process acting via HTTP as the interaction interface. The exception to this are the backend related components (LDP, SPARQL, the RDF Triple Store and possible custom backend services) which may be more tightly coupled, i.e., they may be run in the same

runtime environment, due to non-functional requirements such as performance or other resource cost.

## 2.2 Components

The P3 platform is composed of three core components: transformers, the LDP Transforming Proxy and backends. Applications such as the Fusepool dashboard are external components which mainly use standard interfaces such as LDP or SPARQL. The platform components communicate with each other via REST over HTTP. RDF is used as the data model and exchange format in all communications, with the exception of the use of SPARQL. All standard RDF serializations may be used, with Turtle being explicitly supported by all components implemented to date. Besides LDP and SPARQL, the interaction between the components, as well as with external clients, is regulated by APIs and the Fusepool Annotation Model (FAM) which are briefly explained below.

**Transformers.** Data transformation components are responsible for transforming data from legacy formats (structured and unstructured) into RDF, and adding or refining annotations to input data. In the Fusepool platform there are two families of transformers: *RDFizers* and *Annotators*. The former transform non-RDF data to RDF, and the latter enrich data in any format with RDF annotations.

Transformers are identified by a URI, which is the entry point for the RESTful Transformer API defining the interaction with the transformer components. This API supports both synchronous and asynchronous transformers. While a synchronous transformer returns the transformation result right away in the response to the transformation request, an asynchronous transformer delivers its result at a later time. Asynchronous transformers may also require some user interaction in order to deliver their results.

A *pipeline transformer* invokes a list of transformers in sequence, passing the output of a transformer as input to the next transformer. This enables chaining of multiple transformers to perform more complex tasks.

The above-mentioned annotators are expected to produce annotation from textual content, either unstructured or extracted from any other structured format. All annotators produce RDF using FAM [14]. This is an important approach for piping annotators and allowing configurations using multiple annotation services. The base structure of FAM is fully compatible with Open Annotation [15], but defines some additional relations to ease the consumption of annotator results – especially the retrieval of selectors for annotations.

**LDP Transforming Proxy.** This is an HTTP Proxy that is used as a reverse proxy in front of an LDP Server. It intercepts POST requests against LDP Containers (LDPCs) which are marked as *Transforming Containers* and then it (a) forwards the request to the proxied LDP instance, and (b) sends the contents to the transformer associated with the container. Once the result of the transformation is available, the LDP Transforming Proxy will post it to the LDPC as well. In this way, the Transforming LDPC holds both the original and the transformed data. A transforming LDPC can have a pipeline trans-

former associated with it, should multiple transformers be executed over the POSTed data.

The *Transforming Container API* is defined as an extension to the LDP specification to allow special containers to execute a transformer when a member resource is added via a POST request. This allows documents to be automatically transformed when they are added to a LDPC, and having both the original data and the transformed data as a resource inside the Transforming LDPC. This process is supported via the LDP Transforming Proxy.

The *User Interaction Request API* describes how an LDPC is used to maintain a registry of requests for interaction. Its purpose is to provide support for components which require user interaction during their lifetime, such as transformers requesting a user input. According to the API, components submit a URI to the mentioned registry, and remove the URI once the interaction is completed. A UI component can then provide the user with a link to the submitted URI. The component is free to present any web-application at the denoted URI suitable for performing the required interaction.

**Backends.** The platform can use both Apache Marmotta and Virtuoso Universal Server as backends, which provide the generic LDP and SPARQL interfaces and data persistence in an RDF Triple Store. However, based on the architectural approach, any other tool which supports the LDP and/or the SPARQL standards can be used as the platform backend as well.

### 3. Experiences

Our experiences with the Fusepool platform are best explained by the example of our two initial stakeholders in the Fusepool P3 project, namely two touristic regions in Italy: Provincia Autonoma di Trento (PAT) and Regione Toscana (RET). They have been publishing open data and are supporting the development of applications and services in the tourism domain for some time. During this time both partners gained valuable experience in data creation, maintenance and publication.

#### 3.1. Limitations in Publishing Open Data

PAT and RET first started publishing data sets which were considered strategic. In Italy in general but also in the two regions Tuscany and Trentino, one of the most important businesses is tourism. This also includes linked and related industrial activities around tourism. Thus the regions are struggling with one particular question: How can they support and push tourism by changing their daily operations.

Both partners provide a CKAN based open data portal,<sup>7</sup> which aims at data publishers providing tools to find and use data. The data quality depends on the data provider. Except adding some meta information, the data that gets pushed into the system is the data which is made available to the user.

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<sup>7</sup> <http://ckan.org/>

At project start, open data from PAT and RET was only available in particular data formats like CSV, KML, XML and JSON. App developers had to download the raw data and process it using their own ETL processes. With every update of the raw data, this process had to be triggered manually for every single application using this data. If the format of the raw data changed, the process had to be adjusted and could not be automated. With every new data source, maintenance complexity of these open data sets and its apps increased.

### *3.2. Linked Data Life-Cycle*

Reducing the complexity for consuming open data requires that the necessary ETL work is done up-front, ideally by the data owner or someone with domain knowledge. Furthermore, the data should preferably be published as a service and without the need for running separate database servers and other services. This is where linked data and its RDF technology stack come into play. With its open, non-proprietary data model using W3C standards such as SPARQL and HTTP, RDF is used as Lingua Franca using well-known schemas and ontologies.

In the classic document-centric web not much is known about the relationship between two pages as links between them are untyped. RDF links far more granular entities than pages, i.e. single attributes of an object, and defines relations between data items in schemas and ontologies. Best practices recommend publishing these schemas and ontologies also as RDF, thus making them publicly available in a machine-readable form.

### *3.3. Applying the Linked Data Life-Cycle*

Experiences with applying the linked data life-cycle using the Fusepool platform were made in preparation for and during a hackathon at the Spaghetti Open Data Event,<sup>8</sup> where the initial versions of two linked open data applications based on data from the Province of Trento were developed.

In the first one, a web application called “LOD events eXplorer” allows events in the Trento region to be browsed, and information and pictures of nearby points of interests (POIs) are also shown (see Fig. 3). The developers could easily transform the original data set provided as an XML feed into RDF using the XSLT transformer provided by the Fusepool platform and store the results in the data store of the platform, making it accessible through SPARQL queries.

The most time-consuming manual task in doing so was to develop the XSLT file that defines the mapping from the XML elements to the appropriate RDF model; creation of the mapping required developer skills and was a matter of a few hours, including familiarization with the tool and environmental setting. The subsequent transformation of the data itself however took place in a matter of seconds only. RDFizing and interlinking other data such as nearby POIs and images from DBpedia turned out to be an easy and less complex task compared to the development of the initial mapping.

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<sup>8</sup> <http://www.spaghettiopendata.org/>

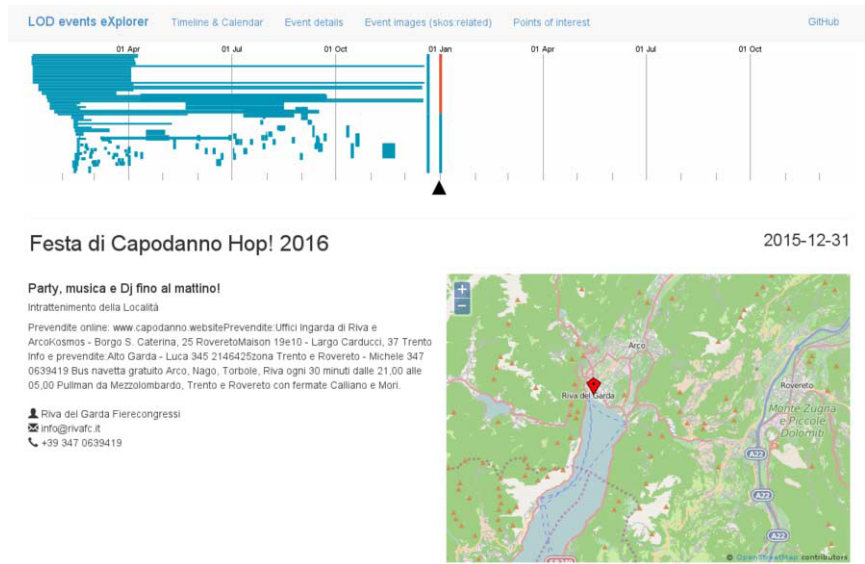


Figure 3: The LOD events eXplorer application, showing events in the Trento region

A second application enables tourists to follow the footsteps of historical figures from Trentino. They can read about these people, see where they lived and find POIs and restaurants nearby. This mobile application – available in the respective app stores for iOS and Android under the name “In The Footsteps: Trentino” – is based on several open data sets available on the CKAN site operated by the region of Trento: namely, historical characters, restaurants, architectural and artistic heritage plus POIs. These were transformed in a similar fashion to linked open data on the Fusepool platform. For additional information, data from Wikipedia and Yelp was also linked in. The development time and the necessary skills turned out to be comparable to the LOD events eXplorer application.

3.4. A Linked Data Publishing Methodology

Reflecting several LOD use cases, including those from the previous section, a common methodology could be distilled, comprising of analysis, design and implementation steps. It turned out to be very helpful to externalize the findings in a Linked Data Publishing METHodology (LIDAPUME), consisting of a methodology schema (Fig. 4) and a template for orientation and guidance (Table 1).

Compared to other publishing methodologies, such as those used in LOD2 [8] or LATC [9], non-technical steps are also under consideration here, as opposed to the solely technical data life-cycle steps which are often used in related approaches. This more holistic approach promotes the documentation of essential tasks which proved to be helpful answering questions like “How long will it take to develop a use case with this platform?” or “How many technical skills are necessary in order to achieve this?”. The LIDAPUME steps are described in more detail in [16].

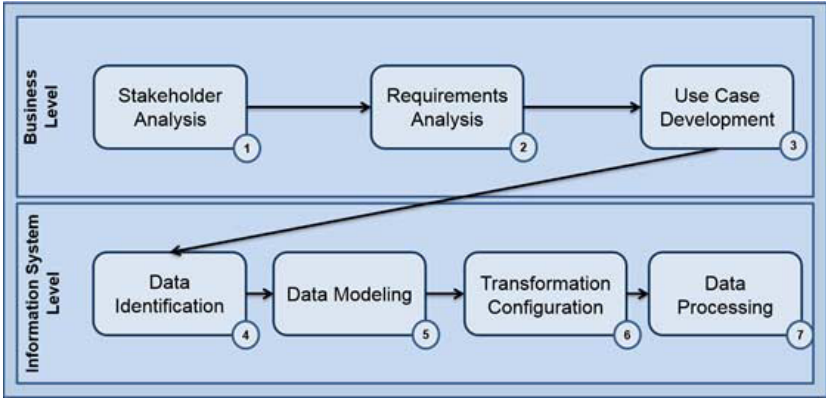


Figure 4: LIDAPUME schema, a linked data publishing methodology (from [16])

The template in Table 1 shows an instance of LIDAPUME, allowing annotations of essential use case aspects. The template has been completed in the context of the *Swiss Archive Use Case*, described below.

Step	Activities	Skills	Effort
Stakeholder Analysis	Identifying Swiss cantonal archives that want to participate in the user case. Partially given as it was initiated by some of the archives itself (5 stakeholders).	Analytical	1D
Requirements Analysis	Interviews with each archive. Identifying a topic available in all archives.	Analytical	1D
Use Case Development	Developing ideas of an initial user interface for the use case.	Analytical, prototyping	1D
Data Identification	In-place work with each stakeholder, data source analysis and data export options.	Analytical, technical	2D
Data Modelling	Identifying appropriate vocabularies. Mapping data from the data source with OpenRefine or XSLT configurations. Partially in-place at stakeholder.	Domain knowledge, modelling, technical	5D
Transformation Configuration	Enhancing data with named entity recognition and interlinking with reference datasets such as GND <sup>2</sup> .	Modelling, technical	3D
Data Processing	Execution of transformation, indexing of data. Making it available on the final SPARQL endpoint.	Modelling, technical	3D

Table 1: LIDAPUME template for the Swiss Archive Use Case (1D=1 effort-day)

Using the methodology and the template turned out to be a good starting point for LOD use case planning, with regards to completeness of the planning, necessary project skills and project duration. Having experience from completed projects at hand, allows for better estimation and shortens the learning curve.

The LIDAPUME methodology and template have been validated for several use cases which are described in more detail in [16]. Besides the above described use cases, it has been applied in enhancing the FU Berlin library content through an LOD use case, called *Library Keyword Clustering*, and in the *Swiss Archive Use Case* [17].



#### 4. Conclusion and Outlook

In the past, a lot of time and energy was invested in providing tools for converting particular sets of data to linked data. Several FP7 projects such as LOD2 [8], LATC [9] and GeoKnow [10] funded transformation of large linked data datasets which are now available within the linked open data cloud. The Fusepool platform provides additional value in the domain as it brings an integrated set of components that allow open data from various sources to be easily published as linked open data, enabling development of useful applications, like the examples described in this paper. The tools provided are not domain-specific. While the current use cases have mainly been in the tourism domain, the methods can be applied equally well to other domains; we recently used the platform to successfully transform around five million public records from the Swiss Federal Archive<sup>9</sup> and four Swiss cantons and interlink it with GND, a universal authority file.<sup>10</sup>

The most time-consuming task in order to promote data to the 5-star level [18] is in defining the mappings of the original data sets to a linked data model. This requires domain knowledge and close cooperation with domain experts. Once that one-time effort has been done, the actual transformation of data can be automated such that new data sets of the same type are to be published, they are transformed to linked data and added to the RDF triple store.

To address this one-time effort, it turned out that two basic questions have to be answered, namely “What are stable identifiers in the particular dataset?”, and “What is the meaning of the data and how does it map to existing schemas and vocabularies?”

Answering the first question will help to coin stable URIs while the second question will make data more useful for new data publishers. Integrating services like Linked Open Vocabularies (LOV) [19] in P3 transformers support domain specialists in mapping data to commonly used vocabularies. It is commonly recommended that the focus should be on reusing existing vocabularies where possible and repurposing and extending them where necessary only.

Experience has shown that the tools and technologies of the Fusepool platform for publishing and reusing linked data are well suited for data publishers with technical skills. For users with fewer technical skills additional help is necessary, whether it is in the form of advice from developers or – preferably – in the form of guidelines and more intuitive wizard-style tool guidance. Even for developers the learning curve is not insignificant, in our use cases several iteration steps were necessary in order to become familiar with the tooling environment and the data life-cycle processes.

To make sure these datasets and tools are maintainable, it is important to empower data owners to run these processes on their own. Fusepool P3 provides some of the necessary glue to integrate standalone components that were developed in the past and

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<sup>9</sup> <http://www.bar.admin.ch/>

<sup>10</sup> [http://www.dnb.de/DE/Standardisierung/GND/gnd\\_node.html](http://www.dnb.de/DE/Standardisierung/GND/gnd_node.html)

will be developed in the future. By providing *docker images*,<sup>11</sup> the Fusepool platform can be deployed within an organization within a few hours.

To have a sustainable linked data ecosystem, still more work is necessary on the user interface level. In a follow-up project, it is thus planned to work with data publishers to simplify the dashboard UI and to add a wizard-style tool guidance: For example, when the user selects an XML-based data set in a CKAN site that he wants to publish as linked data, the wizard will suggest using the XSLT transformer. The user still has the option to choose another transformer like BatchRefine (which adds batch processing capabilities to OpenRefine), but the wizard limits the possible user selections only to transformers that can take an XML file as input.

In addition, it is planned to develop a cookbook that gives non-technical users step-by-step instructions including screen casts on how to use the platform. It will be based on three typical user scenarios, considering first data and subsequently technical components:

1. Based on a concrete data set in a CKAN site. The cookbook explains the steps and the usage of additional tools that may be needed, e.g., how to create an OpenRefine configuration in order to publish data from a CSV-based format.
2. Based on a concrete data file. This is very similar to the first scenario, the difference being that the file is not retrieved from a CKAN site but available on a local drive.
3. Based on a known data structure and some sample data.

These changes and additions will hopefully simplify and improve the platform, allowing data publishers to use it without further help, hence significantly simplifying the task of publishing data as linked open data.

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<sup>11</sup> <http://docker.com/>

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# Challenges and Benefits in an Open Data Initiative – A Local Government Case Study of Myths and Realities

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**Abstract.** This paper investigates the myths and realities of open data at local government (a focused municipality) level. There are many expectations related to open government data (OGD) covering e.g. public transportation, car parks, public committee minutes and air quality measurements and the effects of more open public agencies and commercial possibilities, together with citizen benefits. Expectations are often uncritical and expressed in terms of rationalized myths. The purpose of this paper is to investigate myths and realities in a case study and to present lessons learned from focusing such dimensions in an ongoing and emerging local government OGD initiative. This study confirms previous research on open data myths, challenges and benefits from a local government perspective. The conclusions also illustrate three important findings directed to the existing body of research regarding the importance of alliances of stakeholders in OGD initiatives, aspects of heterogeneous organizations launching open data and reflections on the division of labour between public and private actors when handling different communication channels. Implications for research and practice are also outlined together with limitations and further research.

**Keywords.** open data, open government, myths, challenges, benefits, local government, municipality.

## 1. Introduction

Open government data (OGD) includes various data sets that are made available by the public sector in order to stimulate third-party (commercial and non-profit organizations) development of new information technology (e.g. apps for mobile devices) and services for a wider audience. Users may be citizens or companies. There are many contemporary efforts launching open data internationally also with the intention to create an open government (increased transparency and democracy in the form of involvement and participation) [15, 26]. The accessibility and openness that OGD is expected to achieve is expressed in several national digital agendas and policies, including the EU and Sweden. Nearly 40 billion EUR each year is expected to be the result of making the open data available from public administration. There are many expectations related to OGD applications [e.g. 12] in different areas covering e.g. public transportation, car parks and air quality measurements and the effects of more open government agencies and commercial possibilities, together with citizen benefits as expressed above. According

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to contemporary e-government research on open data, expectations are not seldom rather uncritical and expressed in terms of rationalized myths [6, 20, 23]). The visions, expectations and rhetoric about the usefulness of OGD can be mirrored in in early e-government and public e-service research of hopes and glory, not meetings expectations and benefits as planned [17, 21, 22, 27].

Efforts including OGD contains several important strategic and day-to-day choices about what data sets that should be published, commercial or democratic viable initiatives and for which user groups. Working with OGD is also a question of a division of labour between the actors from public and private sectors; what data sets public organization should be responsible, what kind of e-services based on those data sets, and for which can we rely on external actors to develop? Studying such work to examine the myths and realization of the OGD is relevant from a theoretical and practical perspective. Myths about the publication of the OGD, without restrictions, automatically creating benefits everyone can and have the ability to use are wide-spread [23]. Myths in general, and in an OGD setting, can be described as: “[...] myths are formulated to reflect on the gap between the promises and barriers of OGD. A myth is a traditional or legendary story without a determinable basis of fact or evidence. The essence of a myth is that its existence is fictional or unproven.” [23, p. 263]. In this setting it also seems to be taken for granted that there is an interest in the reuse and utilization of open data [6, 20]; for example to reduce the digital divide. However, myths also have an important role in policy-making [7, 28], so they are not only obstacles or fraudulent lies; myths can be generative in development work. But not without risks. Risks or challenges with OGD has been described as the dark side of open data by e.g. Zuiderwijk and Janssen [40] violating privacy, misuse and misinterpretation of data.

Based on that we can see that a more critical strand of OGD research is evolving [20, 31, 40]. In recent open data research the one-way traffic or street in focusing on the publishing open data (the supply side) – and not the demand or the whole ecosystem – have been questioned and discussed [12, 31]. This paper acknowledge a critical stance towards OGD, and investigates challenges and benefits when working with open data at a local government level. The local level has received less attention in OGD research, and is therefore relevant to study.

There have been several other calls for more research on open data (e.g. [23]) and challenges are put forward as one area to investigate more [31]. Following this route there is also a need to: “[...] demystify data and its importance in sharing to influence development”. [31, p. 427]. This paper is one attempt to demystify OGD and to contribute to the ongoing research on OGD in this strand.

This paper investigates an emerging OGD initiative in a Swedish local government organization. Few studies are focusing a Swedish context and a local government level [20] and there is a need to generate more knowledge in this domain. The purpose of the paper is to critically analyze the emergence of an OGD initiative focusing the role of myths, challenges and benefits in the process of triggers for the initiative, choosing data sets and publish local government open data. Research questions asked are: what is the role of myths in OGD initiatives? What lessons can be learned from this situated local government case study vs. the emergent body of literature covering OGD myths, challenges and benefits? The contributions of this paper has implications for future research on OGD as well as practice and is expressed in terms of lessons learned.

The remainder of this paper is organized in the following way: In Section Two previous research on open data are introduced and discussed. The research approach is described in Section Three. The reflexive analysis is described in Section Four (based on

empirical data in subsection 4.1-4.3 and put in the light of theory in 4.4). In Section Five the paper is concluded, followed by limitations and further research.

## **2. Previous research on open data**

Below previous research on open data are summarized, followed by a focus on myths. The literature on challenges and barriers as well as benefits and possibilities is also reviewed. This review ends with an outlook of emerging holistic approaches on OGD.

### *2.1. Open government data and myths*

Emerging research report challenges with open data in the public sector [11, 24, 25, 41] along its life cycle [4, 6] and also in ecosystems [12]. The phenomenon of open data is described by Barry and Bannister [6, p. 129] as: "All stored data of the public sector which could be made accessible by government in the public interest without any restrictions on usage and distribution".. Like OGD introduced above, e-government in general also contain significant challenges in terms of the balance between internal efficiency and citizen benefit, multi-operator problems during development, effects, digital divides and audience targeting [5, 13, 19, 21, 27] . Research on open data is emerging at present as presented in the introduction above, and are relatively few globally and clearly few if we focus on a Swedish context, and local government level, which is described by Hellberg and Hedström [20] and by actors from government and consultancy firms [33, 35].

Myths in open data are represented by simplified and sometimes idealized views (and even seductive tales) of the benefits of providing and using open data or e-government in general [7, 23]. In a study from 2012 Janssen et al. [23] confronted benefits with barriers and derived five myths in their study on the ministry level in the Netherlands. Myths discovered are describing how important open data is and how simple it is to use for everyone (ibid.). Using and practicing myths in relation to open data development is a balance because there are risks involved. An uncritical repetition of the same myths [20, 23] can result in a situation where other visions and a good potential surrounding OGD remains unrealized [6, 9].

In general, myths can inspire collective action and common-making [39], but they also "mystify" processes. Thus the myths to be double-edged sword with seductive stories and expectations to gather around or as any fraudulent based on questionable grounds (ibid). It seems to be an area, like IT field and practice in general, with a large measure of fashion, hype and "follow-john-behavior" [1, 29, 38].

The myths around open data can be summarized [23, p. 264 ff.] in the following main themes: "(1) The publicizing of data will automatically yield benefits, (2) All information should be unrestrictedly publicized, (3) It is a matter of simply publishing public data, (4) Every constituent can make use of open data, and (5) Open data will result in open government. In a later study of myths related to OGD in a Swedish context [20] the local government level is focused. They focus on efforts to realize an open government agenda using open data and propose a sixth myth; the public interest in the reuse of open data. In Hellberg and Hedström's [20] study it is concluded that commitment and incentives are major issues when focusing the reuse of OGD, and that we should not take citizens interest, resources and competences in open data for granted.

## *2.2. Challenges and barriers related to open government data*

Challenges or barriers linked to OGD are described and categorized from an institutional theory perspective for example by Janssen et al. [23 p. 261], focusing task complexity, use and participation, legislation, information quality and technical aspects. If we for example look at the institutional dimensions it is related to barriers from the supply side (the data provider's point of view), whereas task complexity and use together with participation are related to the demand side (the user's perspective). Challenges from a user perspective are also studied by Zuiderwijk et al. [41], and they describe the following: fragmentation of data, lack of access to data, lack of interoperability, and difficulties in processing data. Janssen et al. [23] also reports on the lack of insights related to the users, but from the supplier side. From the suppliers' side they also conclude that the incentives stimulating OGD and the use of it is important, together with the risks associated with the publicizing of OGD. This deserves more attention from researchers according to them.

Another challenge related to OGD is that it is hard to calculate ROI based on the fact that it hard to foresee the potential application based on the publishing of OGD – so is the “[...] possible “killer” applications.” [23] p. 260]. There is also a pedagogic challenge reported which makes open data, e.g. for decision makers, even more abstract, the value of it. A value that becomes realized first when it is used (ibid.). Studies of open data practices reports that: “Managers and other public servants often have the tendency to avoid opening their data, as this would provide the public with new insights which might in turn result in critical questions.” [23, p. 258]. This hinders new development and innovation from taking place and can be interpreted from an institutional theory perspective [23, 29]. Janssen et al. [23] also described the state of OGD as of 2012 as poor usability of open data, lack of feedback processes and improvement loops, and overall weak stewardship principles. A publishing view is also often taken, not a user or usage perspective [23].

## *2.3. Benefits and possibilities related to open government data*

As described recently by e.g. Dawes et al. [12] expectations for substantial benefits of OGD are high. Investments are also considerable in this area in terms of number of open data portals and programs (ibid.). Benefits are related to for example better decisions, new and even innovative products and services, paired with transparency and increased accountability [10, 12]. Possibilities or benefits of OGD are studied and compiled by e.g. Janssen et al. [23]. They clustered benefits in different themes: (1) political and social, (2) economic, and (3) operational and technical benefits. In this study, political and social benefits were viewed as the most important category

In the study above from the Netherlands on a ministry level most of the respondents expect that OGD can strengthen government accountability, build trust among citizens, and to improve their satisfaction with government work.

## *2.4. Holistic open data approaches emerging*

In order to realize the benefits outlined above and to overcome some of the challenges or barriers there are more holistic approaches described, such as a life-cycle perspective [4], stakeholder perspectives on open data [6] and an ecosystem approach [12] resting on a sociotechnical perspective. Dawes et al. [12] propose a model in order to try to catch

some of the complexity involved in OGD programs and its existence in a “[...] multi-actor physical and institutional environments. They combine organizational, human, material, and technological aspects in a dynamic interplay [...]” [12, p. 6 f.].

Janssen et al. [23] also broadens the scope when concluding that open data is not a homogeneous phenomenon; open data have a diverse nature, and different datasets have different benefits and different barriers. On an overall level open data is also an example of a division of work and responsibilities among public and private actors [30].

### 3. Research Approach

This research is based on a single qualitative, interpretative, case study [37] of a project 2014-2016 aiming at developing a national platform for OGD (The NODS [National Service for Open Data] Project). Several actors are involved in the project; a local government actor (a Swedish municipality) working with open data provision within the organization, but also with the intention to take a lead in the region and to stimulate national OGD development, a consultancy firm developing IT solutions for case management and secure exchange of information in the public sector, and a research partner in a triple-helix model (e.g. [16]). The dimensions of OGD studied in this paper is focused on the municipality working with and OGD initiative. The point of departure of this research paper, is to apply a critical perspective towards open data [3] focusing the municipality in the project setting.

The empirical data in the project is based on eight semi-structured interviews (based on an interview guide) and open-ended discussions, observations and participation during 15 project meetings and documents (e.g. steering documents for managing OGD). A subset of the empirical data generated in the studied project are focused in this paper. The study covers the context, process and context [32, 36] of the development of open data. Among the different roles and respondents interviewed are the following IT consultant, IT strategist, open data project leader, open data coordinators (national level), two CIOs, and four civil servants. All interviews were audio recorded and transcribed in whole or partially, depending on the focus and density of the empirical data. The analytical process has a reflexive nature [2], were performed iteratively in which the interview transcripts were analyzed several times resulting in inductive coding (e.g. themes [keywords] from OGD provision and links to triggers, challenges and benefits [34]), and then confronted with previous studies used as a theoretical lens. The role and use of the theory can therefore be classified as an ongoing process of the analysis (cf. [14, 37]). The scope for and process of the open data literature review can be characterized as a hermeneutic process [8].

### 4. Analysis

The analysis below are structured in the following overall themes; 1) triggers for OGD initiatives, 2) challenges for OGD initiatives, and 3) expected benefits of and possibilities related to OGD initiatives. For every theme respectively key aspects – keywords – are generated to summarize the content and findings. These keywords are then put in the light of the previous research as a part of the reflexive research approach (above).



#### 4.1. Triggers for open government data initiatives

The empirical data from the case study, interviews and meetings, shows that an alliance between politicians, civil servants and IT professionals within the municipality favours the OGD initiative and can serve as a trigger to start the work with open data. When this alliance is in place activities around OGD are starting to happen.

Another important trigger for OGD to happen in this case was the decision makers' willingness to create a first mover advantage. The willingness to be modern and forward thinking, and to promote an open government were considered as taking part of a competition among other municipalities. These ideals were shared, and advocated by the IT strategist and one politician taking the initial initiative and making the first move launching OGD. The initiative were launched partially to boost rankings and legitimacy as a part of an interpreted contest as stated above. The values of transparency and openness are also echoed in the interviews and linked to the aspect of visibility above – to let the municipality to “shine” from external and internal stakeholders' point of view.

The fact that a citizen timely also suggested that the municipality should work with OGD is also an important aspect that triggered the initiative and contributed to the act of creating legitimacy through this initiative. In order to make the OGD initiative happen the stakeholders mentioned also navigated the initiative through the municipal bureaucracy by plans (incl. a formal steering document) and decisions aligning with structures and processes in place. Knowing the internal structure and processes in the organization is important as a prerequisite to make things happen and “survive” within the organization. The key aspects, expressed in terms of keywords, regarding triggers for OGD initiatives are the following: an alliance of a politician, civil servant and an IT-strategist, first mover advantage, transparency, openness, external and internal legitimacy, compliance with internal bureaucracy.

#### 4.2. Challenges for open government data initiatives

The sometimes abstract external and even internal benefits described above are also a challenge with the OGD initiative to deal with within the municipality. From the different departments within the organization point of view, one common concern when investing time and money in publishing open data is the rather straightforward question:

*“Who will benefit from this?” (IT Strategist, March 09, 2015).*

This is also expressed by the project leader interpreting the internal perspective:

*“The municipality is not exited by open data.” (Open data project leader, February 26, 2015)*

There are also concerns and objections raised of OGD being possible to be misused by third parties and that a misuse will backfire against the internal organization and its genuine public values (e.g. trust and accountability). The risk for misuse is also linked to the concerns about the ownership of OGD within the organization; is a department or the organization as a whole responsible for and owner of OGD sets? What happens if anything goes wrong when third parties use OGD – who is accountable?

There were civil servants from different departments having questions and concerns early in the OGD process, but gradually more of them are beginning to identify the potentials of OGD. Based on this, challenges seems to be more evident early in the process of implementing open data initiatives, than over time – a process with inertia. Again, there is a challenge to build initiatives based on implicit and imagined needs for

OGD and there is a clear dependency on enthusiasts and supporters locally together with positive examples, or even myths, to proceed the with the work.

The process of publishing OGD, open up the organization, and make it easy for external actors to retrieve OGD is also challenging traditions and norms within the organization. This can be illustrated as follows:

*"[...] there should be 'a bit difficult' to get documents from the municipality." (Open data project leader, February 26, 2015)*

Related to traditions and norms within the organization there is also some fear to make mistakes – mistakes that are more open, when opening up the organization and making different data sets available for external actors.

Choosing OGD and open data sets to publish is also a process that is challenging and not straight forward. The decision and selection process is described as follows:

*"Sometimes an opportunity comes up [...] one must have very large eyes and ears." (IT Strategist, March 09, 2015)*

This is a challenge, but at the same time also an example of an organization having an intelligence function being responsive towards external inputs and the creation of opportunities. The opportunity here is to have this kind of intelligence implemented in roles and processes, not being dependent upon certain individuals and their OGD enthusiasm. Another challenge linked to the need for institutionalized OGD processes is the ad-hoc processes within the municipality in the early work with open data:

*"Now we shoot from the hip, keep a glow around it, and put as little time and energy on what we need." (IT Strategist, March 09, 2015)*

Again, this doesn't have to be a problem or challenge per se, it can be rational, effective and attractive when taking initial steps in OGD initiatives, but in the long run a more solid and standardized process may be needed to create sustainable a lifecycle or an ecosystem around open data.

There are arguments in the focused municipality that there is a need to focus on data that is already available within the organization and that is checked and non-controversial. This is a form of convenience sampling, choosing data that is already "washed", "cleared" and legally OK. In this sense actors within the organization consider the publishing of OGD as yet another channel for publishing data besides the information already available on their website, in e-services or apps provided. The availability of OGD is also linked to what is perceived as having a good cost-benefit ratio – to publish data with the smallest effort and produce the greatest (possible) ratio (benefits for external and/or internal actors) as illustrated in a citation above. There are also concerns related to the Personal Data Act regarding what of data that can be published or not as open data. This is a challenge making the work with open data more cautious than it may be, just to make sure to not violating rules and regulations, that also can hinder or at least postpone possible ROI. At the same time there are insights around challenges related to the present OGD work and that the work around the publishing can be more mature and less manual:

*"[...] But it is also resource intensive and it would need more resources to pursue." (Open data project leader, February 26, 2015)*

The argument goes back to the willingness to seize opportunities, trying to realize first mover advantages and have OGD available, instead of performing thorough analyses first and then publish the most attractive and "best possible" data sets. Based on this the possibilities identified by the dominant actors in this cases and the focused municipality overrules the challenges.

Another interesting dimension is the system owners who are worried about their internal IT systems. Their worries are connected to the operations and performance of

the systems when OGD are exported. In this challenge, the system owners concerns about the load and overall performance (e.g. the risk of longer response times for users when OGD export from the same systems are frequent) together with concerns about security opening systems for external use.

Another challenge is related to the IT system portfolio within the studied municipality with technical platforms that often are locked to certain IT suppliers and unique formats. The goal is rather the opposite in the long run; to have open systems and standards for providing OGD.

For some departments there are also commercial counterarguments for working with the publishing of OGD. This is evident when e.g. GIS data is sold in other channels (and open data is at risk of a reduction in revenue for the business). There is also a huge variety within a municipality taken into account that different departments are specialized in their line of work and handling different types of errands (linked to e.g. education, care, roads, environment etc.) so the organization is diversified and heterogeneous. There are also companies run by the municipality that have a clear business oriented view on their work, and financed partly by data ownership, not willing to open up and publish OGD sets without commercial concerns.

Keywords from the empirical analysis regarding challenges: abstract internal and external benefits, risk of misuse, unclear ownership, accountability, opportunity seeking, ad-hoc processes, yet another communication channel, load on internal IT systems, locked IT systems, commercial counterarguments, heterogeneous organization.

#### *4.3. Expected benefits of and possibilities related to open data initiatives*

Except from creating benefits and possibilities described above related to trigger the OGD initiative (e.g. rankings vs. other organizations), being innovative, an open municipality and responsive towards citizens' needs and expectations internal benefits are expected. Besides being described in interviews and meetings this is also described in the focused agency's steering document:

*"The purpose of open data is to make data available that the municipality prevails for the general public. Companies and individuals have access to data in raw form without any restrictions. The hope is that open data will result in the municipal business advantages, utility and value for citizens and businesses."*

One example of expected internal benefits are the creation of the possibilities of using internal day-to-day and development resources more efficient based on communication channel strategies. Through the OGD initiative there is an intention to reduce the load and administrative burden on other communication channels, e.g. questions from journalists and citizens regarding statistics etc. to street level bureaucrats so fewer contacts (external, e.g. by telephone) is expected, but not yet proven. This leads to expected cost savings based on fewer contacts above, but also less investments in other channels such as e-services handled and provided by the municipality covering the same area and addressing similar needs from external parties. The other side of this coin is that OGD initiatives internally are competing of the same development resources as other projects and is said to have an even more uncertain ROI than other IT based initiatives. This side of the coin also represents a challenge for this OGD initiative.

One recurrent theme in the interviews and discussions within the municipality is the reuse of open data from an internal point of view. To get value back – possibly refined – by publishing OGD available for a third party, that refine the data and adds value and then use within the municipality again. One example is the air pollution measurements

where external actors adds value linking OGD to other data sets which represents a more multifaceted view of the phenomenon. There is also a consensus that citizens can benefit from publishing and making OGD available. There are arguments that citizens even can be empowered by OGD. There are also expected benefits that part of the information (or data) management will move from the municipality to the citizens and their interests and purposes. A kind of outsourcing model – a different division of labour. Last, but not least, there are expectations that business opportunities for local and regional entrepreneurs and innovation will appear.

Keywords summarizing benefits/possibilities for OGD: transparency, openness, productivity and efficiency, reuse, citizen empowerment, outsourced data management, and the creation of business opportunities (internally and externally) and innovation.

#### 4.4. Concluding analysis – findings

Below the analysis is concluded highlighting the findings and putting them in the light of previous research on open data. Table 1 shows that the findings are in line with much of the previous research on open data from other national contexts (such as the Netherlands and the U.S. referred to in the theory section).

**Table 1.** Case study triggers, benefits and challenges in the light of previous research

Aspects of OGD initiatives	Case study key aspects (keywords) (4.1–4.3)	Previous research	Comments
Triggers	An alliance of a politician, a civil servant and an IT-strategist, first mover advantage, transparency, openness, external and internal legitimacy, compliance with internal bureaucracy.	First mover advantage (legitimacy) in line with several other studies of open data benefits [23] and studies of legitimacy in general [1, 29, 38] from an institutional theory perspective.	An alliance between stakeholders important, not found that evident in previous studies, together with the compliance with internal bureaucracy to “survive” as an initiative.
Challenges	Abstract internal and external benefits, risk of misuse, unclear ownership, accountability, opportunity seeking, ad-hoc process, yet another communication channel, load on internal IT systems, locked IT systems, commercial counterarguments, heterogeneous organization.	Barriers and challenges are reported in other studies on open data; also in terms of myths. The abstract benefits and abstract ROI [20, 23, 31, 40]. Fragmented OGD on local level can also be related to general studies on central government level [41].	This study reports the load on internal IT systems as on challenge not found in previous literature as well as the highlight on a heterogeneous local government organization (with functions of an authority and at the same time including profit companies).
Expected benefits and possibilities	Transparency, openness, productivity and efficiency, reuse, citizen empowerment, outsourced data management, and the creation of business opportunities (internally and externally) and innovation.	In line with several other studies of open data benefits [10, 12, 23], for example the latter study representing political and social dimensions, economic as well as operational and technical.	The rhetoric or even myths around OGD is evident in the studied municipality in a Swedish context. This study highlights the view of OGD as an alternative to e-services (a part of a service channel choice).

The comments made in Table 1 above can inform previous open data studies. One finding is the alliance of actors and the compliance of the OGD initiative with the internal

bureaucratic structures within the municipality. An alliance of a politician, a civil servant and an IT strategist at the local government level can nuance and complement the picture described by Janssen et al. [23] saying that managers would not publish OGD. It is also important to highlight the fact that an organization handling OGD are heterogeneous. So is the open data as such [23]. This is evident in this case on local government level.

On a general level open data is also a question of private and public actors together with how to divide the division of labour. Who should develop and control the e-services and apps based on OGD? The municipality (as is the case with traditional e-services) or external parties (a market solution). In some sense, based on the case study, public production of a service is outsourced to private actors, when choosing not to develop internal e-services when choosing to launch OGD sets instead. On one hand this is a source and an opportunity to make business opportunities and commercial sustainable services for citizen and society. On the other hand it can be viewed as a way of outsourcing the production of services, and partially the responsibility from services and apps based on OGD sets to happen – a market solution.

Several of the myths investigated by Janssen et al. [23] are echoed in this study (Table 1) on a local government level as opportunities and found evident.

## **5. Conclusions**

This study confirms several myths, benefits and challenges described in previous studies on open data as described above. This is interesting since that there are few studies so far of OGD initiatives in a Swedish context and on a municipal (local government) level. The rhetoric, myths, benefits, and challenges seems to have a pattern, not linked to a particular national context or governmental level – the ideas travels around and is a part of an open data fashion wave, hype and “follow-john-behavior” [1, 29, 38]. What this study also highlight and contribute with, besides confirming studies above, and putting it into a Swedish local government context, are three major lessons in terms of:

- The importance of alliances between actors to trigger and realize OGD initiatives and to move beyond myths, to search for opportunities and to overcome challenges as a part of turning OGD into a reality.
- The government organization handling OGD is heterogeneous.
- OGD is also a question of private and public actors together with how to make a certain division of labour when developing e-services or apps based on open data as a part of a channel strategy.

One implication for research from this study is that the pattern that managers and public servants have a tendency to avoid opening data and new structures [23] can be partially questioned, or at least nuanced, based on this case study. The studied local government organization is heterogeneous and contains both supporters and opponents for OGD, depending on their position, type of department, norms and values and line of business. This organization being located on the local level is rather different than e.g. ministries, more focused in certain areas, studied by Janssen et al. [23]. At the same time different data sets are heterogeneous as concluded above, so this also goes for the type of data, which is line with previous studies describing open data as diverse [23]. There are also examples of the reuse of OGD that can change structures and division of labour on one hand, but there are also examples of OGD initiatives not changing structures – rather reinforcing them [23].

One implication for practice based on the present study is that earlier reported myths, challenges, and possibilities on OGD are confirmed in general, and in a Swedish context and at a local government level in particular. Based on a life-cycle perspective on open data it is also important to discuss different phases of open data provision [4]. There is a challenge to know the user demands and value beforehand, and therefore a provision perspective on providing open data may be necessary – at least in early steps, and later on focus on ROI, value and selection. A life-cycle perspective is not explicitly applied in this paper, but is an opportunity for further research also based in the findings above highlighting the large dependency on certain individual supporters and alliances from an institutional theory perspective. This opens up for future stakeholder oriented OGD studies within the e-government field [5, 6, 18] and applications of ecosystem approaches described by e.g. Dawes et al. [12]. Another limitation in this study is the focus on a single case study in Sweden. It is a strength to focus a single case when doing in-depth and longitudinal studies, but the comparative dimension is therefore weak besides to the analysis based on previous studies. Explicit comparative studies can definitely inform studies like this and provide important insights. To focus actors who use open data is also important when broadening the scope. Many studies have a supplier perspective as reported above. Further research in the project that this paper is a part of is to study external parties using or not using municipality generated OGD.

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# Evaluating eGovernment Evaluation: Trend and Issues

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**Abstract.** Evaluating e-government has proven difficult. Reasons include the complex nature of e-government, difficulties in measuring outcomes and impact, and the evolving nature of the phenomenon itself. Practical and effective evaluation methods would be useful to guide the development. To gauge the state of the art in the field, a review of contemporary literature investigated the status of research on e-government evaluation. We found the issues involved to be described by five critical factors: maturity levels, evaluation object, type of indicators, evaluation timing, and stakeholder involvement. The review suggests that there is no best model but rather that e-government evaluation must be situated and take a formative approach to guide the next step. However in doing so there is a need for a clear perspective on where e-government development is going. On this point research is more in agreement, and we provide a model to conceptualize this development.

**Keywords.** E-government, evaluation, e-government models, evaluation models, literature review

## 1. Introduction

Adoption of e-government has often been based on the hope of achieving benefits like less corruption, increased transparency, greater convenience, revenue growth, and/or cost reductions [1]. In order to know the realized benefits, there is a need to conduct evaluations of efforts on e-government.

Evaluation can be defined as ‘a series of activities incorporating understanding, measurement and assessment’ [2]. There are many e-government evaluations conducted by different organizations, like the UN or the EU, by think tanks like the Economist, and by individual researchers or research groups [3], [4]. These evaluate a variety of aspects like websites [5], e-readiness [6], or achievement [7].

Conducting e-government evaluation has been closely linked with a variety of models defining the phenomenon of e-government. One of the most cited early models is a growth model for e-government by Layne and Lee [8] comprised of the four stages: cataloguing, transaction, vertical integration, and horizontal integration. Many more models continued to be developed [3], [9], [10].

Evaluation of results of investments in ICT, in general, has proven challenging Hanna, Zhen-Wei-Qiang, Kimura, and Chew-Kuek [11, pp.89] find that “even most

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developed countries have done only limited assessments of how well ICT investments have been used". This same challenge has been observed for e-government [12] expressing the need for improved methods for evaluation due to lack of metrics and indicators. Evaluation frameworks at the organizational level were found to be one of the challenges to the success of e-government in Sub-Saharan Africa [13].

One complication is that some of the expected positive impacts cannot easily be expressed quantitatively. Therefore, qualitative aspects should complement the quantitative ones [9]. Challenges can also be linked to the complexity of e-government itself; it has political, social, technological, and organizational aspects [10], each of which requires a different set of indicators and measures.

In order to contribute to understanding issues related to e-government evaluation, there is a need to have a clear understanding of all the evaluation patterns, how it is conducted, what it focuses on, and related implications. The main research question of this paper is hence, what is the status of research on e-government evaluation? For this, we investigate the main foci of the contemporary literature on e-government evaluation and discuss the implications for future research.

## **2. Method**

The review was conducted following the guidelines by Webster and Watson [14]. The first article search was conducted in Scopus. Journals first considered were those recommended by Scholl [15] as the core for e-government publications: *Electronic Journal of e-government*, *Government Information Quarterly*, *Information Polity*, *International Journal of Electronic Government Research*, *Transforming Government: People, Process and Policy*. Further three journals recommended by IFIP EGOV and ePart Conference (<http://www.egov-conference.org/journals-1>) were included: *International Journal of Electronic Governance*, *Electronic Government*, an *International Journal*, and *Journal of Information Technology and Politics*. A second search was conducted in the EGOV Reference Library [16]. Well-reputed conference proceedings are also recommended [14], so the ICEGOV and conferences were included. Keywords used for searching the above-given sources were "evaluate", "assess", "monitor", "measure", "value" and "e-government". Peer-reviewed articles in English, published 2010 – 2015 were chosen. The models of e-government were also reviewed, their review extends from 2001.

The searches in the EGOV Reference Library [16] and Scopus yielded 175 and 659 articles respectively. From titles and abstracts 14 and 28 articles respectively were retained. The low retention is due to the fact that the search found many articles related to the keyword but not to e-government evaluation. In addition ICEGOV and EGOV provided nine articles. After removing duplicates, thirteen articles remained. Considering the references to the retained articles and the e-government models an additional twenty articles were added. In total, twenty-six articles and seven reports were used. The articles were analyzed focusing on concepts [14, pp. xv]. Similar elements from papers were grouped into concepts which were defined and discussed.

### 3. Results

Five concepts were found representative; maturity (level), evaluation object, indicators, evaluation timing, and stakeholder involvement (see Table 1).

**Table 1.** Identified concepts and related literature

Concept	Authors of literature
Maturity levels	Accenture (2014); Layne & Lee (2001); Andersen & Henriksen (2006); Lee (2010); Abdallah & Fan (2012); Al-Nuaim (2011); Government Accountability Office (2010); United Nations (2008)
Evaluation objects	Janssen (2010); West (2007); ActiveStandards & WelchamPierpoint (2012); Accenture (2014); United Nations (2014); Government Accountability Office (2010); Kaisara & Pather (2011); Lőrincz et al. (2012); Mates et al. (2013); Papadomichelaki & Mentzas (2012); Rama Rao et al. (2004); The Economist Intelligence Unit (2009)
Types of indicators	Janssen (2010); West (2007); ActiveStandards & WelchamPierpoint (2012); Accenture (2014); United Nations (2014); Abdallah & Fan (2012); Al-Nuaim (2011); Government Accountability Office (2010); Kaisara & Pather (2011); Lőrincz et al. (2012); Mates et al. (2013); Rama Rao et al. (2004); The Economist Intelligence Unit (2009); Castelnovo (2013); Chutimaskul & Funilkul (2012); Gupta & Jana (2003); Hellang & Flak (2012); Hsieh et al. (2013); Irani (2010); Jukić et al. (2013); Karunasena & Deng (2012); Lin & Fong (2013); Luna-Reyes et al. (2012); Shan et al. (2011); Siskos et al. (2014); Stragier et al. (2010)
Evaluation timing	Janssen (2010); Castelnovo (2013); Chutimaskul & Funilkul (2012); Irani (2010); Jukić et al. (2013); Berger (2015); Sorrentino & Passerini (2012); Irani & Love (2008)
Stakeholders' involvement	Janssen (2010); Gupta & Jana (2003); Lin & Fong (2013); Berger (2015); Irani & Love (2008)

#### *Maturity*

E-government has increased its scope over the past decades. The number of people using services has increased, technology has matured and diversified, the number of services has increased and the quality improved. In the mid-1990s the focus was on websites, today it is about integration, infrastructure, and open data.

Many maturity models try to capture this development in terms of distinct “levels”. Early examples include the Layne and Lee [8] four-level model: catalogue, transaction, vertical integration, horizontal integration; and the Andersen and Henriksen [9] model with cultivation, extension, maturity, and revolution. The UN maturity model with five levels (emerging, enhanced, interactive, transactional, and connected) may be one of the most widely used ones. Lee [17] presents a common frame of reference using five metaphors: presenting, assimilating, reforming, morphing and e-governance. Stanimirovic, Jukic, Nograsedk and Vintar [18], departing from evaluation methodologies, developed a framework for comparative analysis which focuses on evaluation levels (national, political-sociological, organizational, project, infrastructure) and development levels (conceptual framework, pilot application, practical application). Misra and Dingra suggest six maturity levels (closed, initial, planned, realized, institutional-

ized, optimizing) [19]; and a website evaluation model has five development stages (web presence, one-way interaction, two-way interaction, transaction, and integration) [20]. Accenture [6] defines three service maturity levels: publish service, interact services and transact services while the Enterprise Architecture (EA) Maturity Management Framework (EAMMF) includes seven maturity stages [21].

These models have been conceived at different times, each striving to improve on the previous ones by better describing “steps” in the general development towards greater scope (from websites towards integrated service production) and tighter integration (e.g. more automation, more user involvement, closer monitoring) on which they generally agree.

Because a general, if not straight-forward, development path can be discerned, Figure 1 uses “maturity” as the e-government dimension which all the others relate to.

### *Evaluation object*

E-government evaluations tend to focus mostly to the front-end of services. Examples include Kaisara and Pather [23], the US E-Government Website Quality Report [5], West [4] who focus on websites. Some front-end focused evaluations include users'/citizens' perceptions of sites [26]. The UN [7] use stakeholders groups to categorize government interactions based on the different groups of users, G2G, G2C, and G2B. Mkude and Wimmer [45] add G2E, Government to Employees. Rama Rao et al. [27] subdivided G2C into government to citizens-rural (G2C-R) and -urban (G2C-U). Further elaborated categorization was suggested by Mates et al. [25] who grouped European e-government projects in ten categories and suggested corresponding assessment indicators. Accenture [6] updated the view of e-services in comparing digital government performance across countries by the category of “proactive”; the extent to which services predict what citizens would ask for and provide it upfront. Moving from the front-end, Janssen [3] focuses on organizational and technology infrastructure aspects of the back-end. The Enterprise Architecture Maturity Management Framework takes a step further by presenting a comprehensive view of the entire infrastructure in government [21].

Moving beyond individual organizations and even inter-organizational integration, Hanna, Zhen-Wei-Qiang, Kimura and Chew-Kuek [11] consider the national level in a management perspective. They chart the ways in which nations have institutionalized their e-government efforts. In different countries, control and responsibility for the e-government development are placed in different arms of government. Their model [11, pp.91] finds four different locations which suggest four different types of management and control: policy and investment coordination, administrative coordination, technical coordination, and shared or no coordination.

The UN [7] survey evaluates e-government development status at a global level, for its 193 member states. This model also concerns the national level and measures both aspects of e-government services and preconditions for their use, including telecom infrastructure and user capacity to use them. Elaborating on the preconditions, the Economist Intelligence Unit [28] ranks e-readiness by a quite comprehensive model including factors like business climate and national policies. The European Commission also developed a framework for evaluating the e-government action plan [24].

### *Type of Indicators*

Clearly different evaluation objects require different indicators. E-government maturity leads to increasingly complex evaluation objects and simultaneously increasing integration of these object with various service processes (Figure 1 pp.130), all of which affect what is interesting to measure. Twenty-six of the thirty-three papers discuss different indicators. Indicators used depend mostly on the evaluation object and on evaluation timing.

Early phase indicators focus on input, during implementation the focus is on performance, and in later phases output, outcome and impact are in focus. Stragier et al. [41] found outcome and impact to be the more interesting indicators for both experts and researchers than input and output. However, inputs and outputs are more easily measured, and hence not surprisingly the most common evaluation models, such as the United Nations' [7] focus on these.

One challenge in comparing evaluations is that many indicators are locally or not clearly defined [32]. Indicators can also be grouped from political, technological, organizational and social perspectives [10]. However, many evaluation models mix indicators of e-government efforts with measures of preconditions. For example, the United Nations biannual survey, based on the e-government development index (EGDI), surveys the state of the art in online services so as to produce the online service index (OSI) and adds data from national statistics measuring prerequisites, including the telecommunication infrastructure index (TII) and the human capital index (HCI) [7]. The two latter are not part of e-government efforts but of general technical and human development. This way the EGDI mixes e-government development with general development in a way that on the one hand is reasonable as both technical infrastructure and literacy are prerequisites for use of e-government services, on the other hand, makes it difficult to discern the e-government component in development.

More clear-cut in this respect is the Economist Intelligence Unit model for measuring e-readiness which includes 38 indicators, 81 sub-indicators with together over 100 quantitative and qualitative criteria in six categories [28].

Many evaluations focus on more easily discernible evaluation objects, often websites. The US E-Government Website Quality Report [5] has 26 compliance checkpoints in relation to key areas of online quality: accessibility, search engine optimization, and usability. The Brown University website evaluation assesses features related to information availability, service delivery, and public access [4]. Accenture [6] adds to this by including citizen satisfaction and citizen service delivery experience in addition to measures of "service maturity".

Beyond web site evaluation, i.e., measuring output, Capgemini focuses on outcomes in terms of political priorities of the European Union e-government action plan: user empowerment, digital single market, efficiency and effectiveness and pre-conditions [24]. Focusing on the back-end of services and interoperability issues the US Government Accountability Office [21] assesses Enterprise Architecture (EA) using 59 core elements related to critical success attribute representations: EA Management Action Representation, EA Functional Area Representation, Office of Management and Budget Capability Area Representation, and EA Enabler Representation.

### *Evaluation Timing*

Different evaluation objects become interesting at different times in the development (Figure 1 pp.130). While a website can be measured in terms of output, outcomes and impact of e-government depend on many other factors such as infrastructure and public sector business models. So when different objects should be assessed? And what are the purposes of evaluation at different times?

Focusing on investment evaluation, Irani [34] developed a four-step phased life cycle approach: ex-ante evaluation, metrics, command and control, and ex-post evaluation. The author takes evaluation as a process in the life cycle of a project. Lin and Fong [37] in developing an evaluation management model considered the phases performance planning, performance executing and applying performance result. Jukić et al. [35] suggest that ex-ante evaluation has an impact on the success of e-government. Sorrentino and Passerini [43] suggest moving from summative to formative evaluation as the latter allows to reduce uncertainty and to correct or re-orient initiatives. Formative evaluation is considered to allow elimination of barriers to adoption [42] and lead to seeking improvement [3]. There are also efforts to evaluate the impact of an initiative or a phase thereof. Castelnovo [29] showed that the goals of the national action plan for the diffusion of e-government at the local level in Italy were still far from being realized after 50 months from the conclusion of the first phase of the plan and 30 months from the beginning of the second phase.

One reason for being careful with timing is that while outputs of a project can be measured at the time it is completed, for example when a service is in operation, it is difficult to decide the right time to measure outcomes of it in terms of use, citizen satisfaction, or cost/benefit analysis.

Evaluations are not only done for the purpose of measuring the objects of evaluations, it is also for the purpose of keeping initiatives running. Many e-government projects are long-term in the sense that quantitative effects are not expected until much later. E-government aims at grand effects such as reorganizing the public sector, making government more open, more effective and more efficient. There is a need to keep initiatives going even though many effects can only be measured partially, at best, during the process. In order to achieve this, the many parties who have a stake in e-government development must be involved somehow, which brings us to the next point discussed.

### *Stakeholder Involvement*

At any e-government maturity stage, there are stakeholders. However, the amount increases the more to the right we look in Figure 1 (pp.130) as the evaluation object is more complex and less under the direct control of the government. As e-government becomes more integrated, stakeholders become more directly involved in terms of technology as well as operations, business models, and legal and contractual regulation. Stakeholders include service users but also investors and providers. Some services are outsourced to the private sector, in others private companies act as intermediaries in service processing. In many cases, private companies co-invest because they see other benefits for themselves, for example in infrastructure development or in cloud services where the government can be an additional user among others.

Therefore, stakeholders need to be involved in different ways at different stages of e-government development. Involvement in planning and implementation contributes to creating ownership of initiatives. Involvement in evaluation adds different perspectives to the process and the results.

In their performance evaluation management model aiming at accelerating the development of e-government in China, Lin and Fong [37] highlight the importance of key performance indexes (KPIs) together with five participant roles (leader, public, performance office, appraisal object, and responsible unit) and three phases. They suggest that considering those roles improves the interaction between different roles.

Gupta and Jana [31] note the possible existence of the diversity of views of different decision makers and stakeholders. In line with that, Rowley [44] discusses different stakeholders of e-government, their roles, and interests, taking her study as a step towards an understanding of benefits of different stakeholders. Janssen [3] and Berger [42] have taken a step further, from the conceptual suggestions to practical use. In [3] a participative self-assessment tool was developed and used in evaluating organizational and technology aspects of the back-ends of fifteen organizations. This led to understanding the status of their respective organizations and seeking improvement.

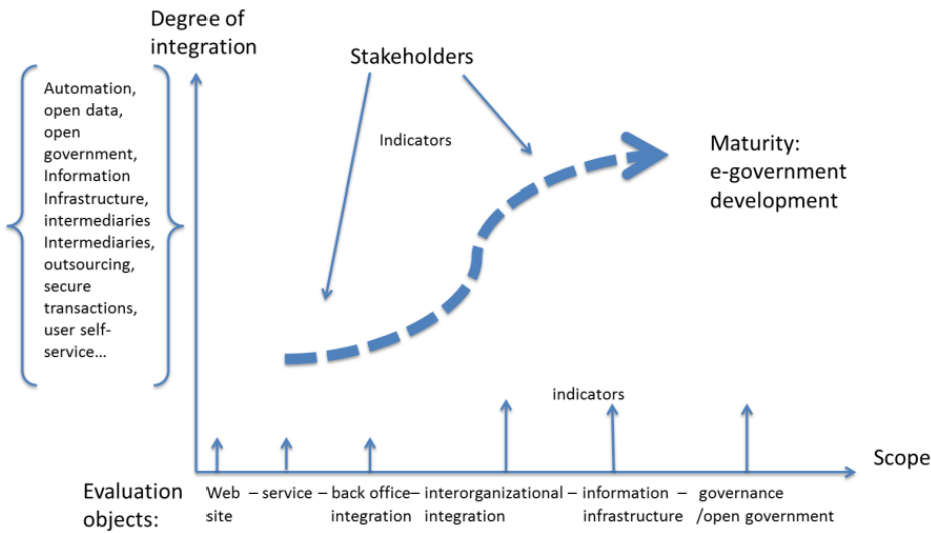
#### 4. Discussion

This literature review aimed at providing an overview of the main foci of e-government evaluation in the current literature discussing their implications and presenting the research gaps. We found five main concepts: *maturity* (levels), *evaluation object*, *type of indicators*, *evaluation timing*, and *stakeholder involvement*. Figure 1 puts the factors discussed in context. E-government maturity generally extends over time in terms of scope (horizontal axis) and depth of integration (vertical axis). Over time, different evaluation object becomes more or less interesting. The complexity of these objects increases over time. Development is not straightforward, it comes in bits and pieces and does not happen the same way in every country, hence the curved and dotted development arrow.

Indicators used for evaluation partially emanate from these evaluation objects themselves, and partly from stakeholders. The number of stakeholders also increases as e-government matures and the objects involved become larger and more complex.

Hence also stakeholder requirements, ambitions, and expectations increase, as do the number and complexity of indicators. “Scope” is discussed by many e-government models and typically starts with websites, moves over vertical and horizontal integration to government-wide issues like information infrastructure, governance and open government. The “degree of integration” includes several factors which to some extent follow from the increased scope but also from general technical development and new government business models.

Early e-government factors include user self-service and outsourcing. More recent ones include open data and automation, both of which call for considerable integration of data sources in service production, administration, and reporting; and suggest important changes in user roles. The factors on the vertical axis are not ordered (hence the brackets); they all contribute to increased integration but in different and often complex ways.



**Figure 1.** A general e-government maturity model based on the factors from the literature; moving towards wider scope and deeper integration

In view of Figure 1, and in terms of the five concepts by which we have categorized the literature, we can distinguish different types of evaluation models.

Many, if not most, of the papers surveyed in this study, take a development perspective. Many try to define certain stages in that development; they are “ladder models” [8] is one example. These have developed over time, adding new “steps” and new criteria. These models define criteria of “good” e-government.

“Level models” measure e-government maturity based on general models of e-government but without specifying steps. These include the UN [7], the Economist [28], the Accenture models [6], and more, which are rather to be seen as formative benchmarks of what is considered a positive development, usually without a close definition of what is good. Sometimes these models borrow criteria from stage models (e.g. vertical integration) sometimes from political agendas (e.g. user empowerment).

While both these types focus on e-government development in general, another type focuses on individual projects. Unlike the general e-government agenda, projects have a deadline and can be assessed posthoc. Such evaluations often indicate failure [46] but often with narrow criteria such as project budget or timeline. They typically measure output rather than outcome or impact. Still they can be useful and are obviously often necessary from a contract point of view, but the relation between project evaluations and the overall e-government development is not clear. Clearly it might look better if all projects succeeded, but in terms of a longer development it may in fact be good that ill-conceived projects actually fail as this helps avoid getting stuck in dysfunctional systems. There is a problem of aligning short-term evaluation of projects with long-term evaluation of e-government development.

One of the problems with all types of models is that they are mostly used to measure the state of art at a certain time, not so much with understanding the reasons; “there is a need for a better understanding of not just how, but why e-government evolves in the way(s) that it does” [47].

There are some models that indeed do try to look into reasons. The Economist model is one such, comprised of a large number of measurements of factors assumed to influence e-government positively. While there is no study comparing the performance of the various e-government evaluation models, the Economist model scored best in predicting the effect of e-government on the reduction of corruption [48].

This brings us to another set of evaluations which is not covered by this literature review, namely that on effects of e-government. Research on corruption is one such example. This literature is not included as it does not model e-government per se, only takes measures of it as one factor in measuring something else. Yet this kind of literature may be interesting for those who want to assess e-government in a more general development perspective.

Another set of literature largely not included is that trying to measure economic effects of e-government. This literature is not included because economic evaluation is typically not done using e-government models but economic ones. There are examples of e-government economic models, such as the eGEP [49], but there is not much literature on use.

## **5. Conclusion**

This paper has presented a number of different models of e-government evaluation. We presented a simple conceptual model to be able to organize the criteria for evaluation discussed in the literature; maturity, evaluation object, indicators, evaluation timing, and stakeholder involvement. We also found different types of models; ladder models and level models try to measure output while preconditions models, or “reason” models, try to explain what makes e-government happen.

Each model represents – often implicitly – a theory of what e-government is. Our review shows that there is great variance, and one strand of future research could be to identify those theories. Arguably more interesting from a practical point of view would be to compare the effectiveness and the efficiency of the different models. How good are they at predicting to what extent our course of actions will lead us to the desired goals? After all, most e-government evaluation is not conclusive but serves to inform the next step in the development. Such research of formative models for e-government development would be useful as it would advise practitioners and help compare evaluations.

In practice, people tend to take most notice of the evaluations that are most widely used. In this case, this would include the UN model, the EU model, and the US’ EAMMF. Such models tend to serve as benchmarks due to their wide use, and they also serve as formative evaluation; governments look for ways to improve their index on them. Because of that, they also contain risks as their definition of e-government is based on what can be fairly easily quantified, often technical factors, rather than more



complex organizational or social factors which many other models find equally or even more important. Research on formative e-government development should hence avoid falling into such traps but instead look for reasons behind developments.

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# First Choice, Free Choice or No Choice

## Differences in Secure Digital Post in the Scandinavian Countries

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**Abstract.** As part of their e-government plans, many countries aim at digitizing their communication with its citizens and the business sector. The effects of e-government depend on particular policy and design decisions. The aim of this paper is to compare the enactment of particular policies in supposedly similar contexts. The comparative case constitutes digital communication between public sector and citizens in the Scandinavian countries. From a grounded approach, we have described the policy, design and effects elements of the three case settings. Our study indicates that apparently similar solutions in comparable contexts may be enacted in rather different ways and have quite different effects. The three countries operate on a scale of coercion from mandatory (Denmark), over nudging (Norway) to voluntary (Sweden).

Keywords: e-government, digital communication, policy, design, effect

## 1 Introduction

Digitization of communication between public administration and citizens seems to be a global trend in societies' developments. Personal meetings and ordinary mail are replaced by digital channels for communication. There are great challenges in designing and implementing digital communication, often labelled as "digital by default" or "digital first choice" [14,22]. The ambitions are that citizens and businesses should choose digital means first. It must however be questioned if "digital first choice" always is a real choice. What is the effect of different national strategies for implementing digital communication? We want to address these questions through a comparative study of strategies and architecture for digital post in the three Scandinavian countries.

Denmark, Norway and Sweden have rather similar political systems, it is lot of cooperation between them, and they are actively participating in the European Information Society projects. We would expect that their ICT policies resemble a lot. However, there are a number of differences, related to their specific history and distinct traditions. This is also reflected in their different digitization strategies [see 14, 19, 22]. Although the overall goals in all three countries are similar in that digital communication should be the preferred channel, each country has defined rather different digital channel strategies.

### 1.1 Research framework "From policy to design and effects"

Our research framework departs from a simple model for e-government research consisting of three notions: policy, design and effects [10]. Central in the model is

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design process and designed products of e-government artefacts. Design is in this context considered to be a process of policy implementation, following a distinct strategy, where the policy background is seen as essential context to the design process. The third element; the effects are the specific results (of e.g. use) of and corresponding consequences for actors involved. The analysis in this paper will focus on three levels:

1. The national policy level, including identifying goal, legal and organizational measures, but limited to what is relevant for the specific cases.
2. The design level, meaning how digital channel strategy is implemented as e-government architecture and the supporting information infrastructure, including analyzing technical and organizational characteristics, business model, etc.
3. The effect level, comprising citizens' and public institutions' responses to the policy and implementation through their adoption, use and the consequences.

These three projects are analyzed in our study: “*Digital Post*”<sup>i</sup> in Denmark, “*Sikker Digital Post*” (English: Secure Digital Post)<sup>ii</sup> in Norway and “*Mina meddelanden*” (English: My messages)<sup>iii</sup> in Sweden. Other solutions exist; however, these projects constitute the major national initiatives. Our research framework is depicted in figure 1.

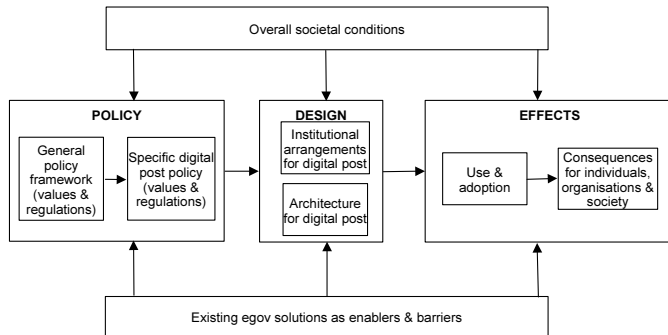


Figure 1. Basic conceptualization of study domain

Our research is on the whole based on a qualitative approach, including analysis of policy documents, strategies and project descriptions as well as relevant revisions in laws and regulations, etc. We have adopted a sort of “grounded” approach as no specific theories or propositions guided the analysis [6]. However, we have used a set of factors related to policy and design as show in Table 2 & 3 below in comparing our three cases.

## 2 Policy

### 2.1 Denmark

The policy papers that regulate digital communication with public sector in Denmark comprise: 1) the national e-government strategy, 2) legal regulations and 3) legal agreements between the Danish government and subordinate public institutions.

The Danish national e-government strategy 2011-2015: *The digital path to future welfare* [22], underpins a new e-government paradigm. According to Jæger and Löfgren [13] Danish e-government has developed since the 1990ies from “Danish values” like democracy, citizens’ IT rights, transparency, button-up experimental approaches, citizens’ empowerment and social inclusion, to more centrally controlled e-government,

primarily to increase public sector efficiency. The current 2011-2015 strategy carries the slogan that “those that can, must [be digital]” and it is clearly stated that “it will be mandatory to use digital solutions in written communication with public sector” [22, p. 5] for both businesses (from 2013) and citizens (from 2014). The coercive strategy is a result of lack of tangible benefits from former e-government strategies.

## **2.2 Norway**

Norway is a rather sector-oriented and decentralized, but unitary state where the municipalities have autonomy within the national legal framework. One implication is that Norwegian reform processes might be more segmented and sector-oriented than in other countries. The Minister for Modernization, which coordinates public sector reforms, launched a new digitization program in 2016, focusing on efficiency and user-oriented services, but also on innovation in private sector, continuing former strategies.

The new program is strengthening “Digital as first option” as an overall principle, meaning that “Digital communication is to be the general rule for contact with the public sector. Paper-based solutions will still be an option, but communication will be digital by default” [14]. All citizens and businesses will receive mail from the public sector as certified digital mail, using secure eID for authentication.

## **2.3 Sweden**

The initiative for digital post in Sweden did not come from a political-ministerial level. It was a public authority initiative around 2009: The Swedish Tax Agency, which had extensive communication with tax payers on tax declarations and other taxation issues. The cost reduction for switching to digital post was estimated to be high.

This initiative was discussed within an authority committee for “business set up and operation”, consisting of several public authorities. These authorities had become responsible owners of the Swedish national business link portal *verksamst.se*, which was launched 2009. There was an interest (from the Agency for Economic and Regional Growth and the Swedish Companies Registration Office) to have digital post as an integrated part of this business link portal, but the Tax Agency had a strong incentive in getting one digital solution that covered both citizens and businesses. Instead, a separate digital solution was chosen called “Mina meddelanden” (my messages). The development of this joined-up digital communication service has been influenced by different policy statements on e-government development in Sweden.

# **3 Digital architecture**

## **3.1 Principles for digital post architectures – certified mail systems**

In 1999, the standardization sector of the International Telecommunication Union published the recommendation X.400, which defines the generic system architecture of Message Handling Services, MHS [20]. This architectural model has been adopted with minor changes by many mailing systems today, including most CMS (Certified Mail Systems). It includes a generic infrastructure: Mail Transfer System (MTS) that contains Message Transfer Agents (MTA) and can connect with User Agents (UA); furthermore Message Stores (MS) and Access Units (AU), which can be devices that convert digital messages to physical mail. The functional model of the generic X.400 MHS is illustrated in figure 2 below.

### 3.2 Denmark

All public institutions can register as sender and recipient. All persons age 15+ are automatically registered as recipients based on their unique person ID (CPR). Citizens can apply for exemption. Citizens can register phone no. and e-mail for notification. Public institutions send messages from various application systems (UAs). The citizen can initiate messages through the UA, which the MTA delivers as a secure e-mail or via a web service to the public institution. There is one authorized MTS-provider.

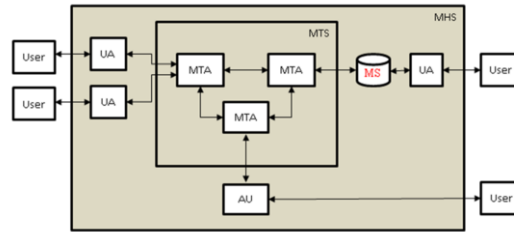


Figure 2. Systems architecture of the generic X.400 MHS, called CMS (from Tauber [20] )

The citizen UA consist of the national eID, the citizen portal (Borger.dk) and the Digital Post front-end system. The recipient has the responsibility to provide access to a device that can run the national portals, Internet access and an active eID to be able to communicate with public institutions, and to be able to receive messages that may have legal or economic consequences. The government made it mandatory for public institutions to offer Digital Post as a communication channel for citizens already in 2010. Digital Post was launched in 2010, but by the time the Law was passed in 2012, almost no businesses had registered and less than one of five citizens.

### 3.3 Norway

The Norwegian CMS is based on a simplified and asymmetric version of the generic MHS model. The citizens that accept to use a digital communication channel are offered the option to choose between two mail boxes: Digipost by Posten Norge and e-Boks by e-Boks AS. The intention is that they shall receive mail from public agencies in the same mailbox as from private senders. Receipt and storing of digital mail from public agencies are free of charge for the citizens, as are the use of ID-portal to log on.

A citizen may however interact with public agencies in different ways. The most typical scenario is when a citizens complete a “digital form” available from a public agency, normally by using a secure login/authentication service provided by the national eID. If the citizen is registered in the exemption register, a paper-based message shall be sent. All public institutions have to register as sender in CMS. All persons age 15+ can register as recipients based on their unique person ID, but they do not have to.

### 3.4 Sweden

Public institutions that qualify can register as sender in My Messages. Businesses (legal entities) and citizens can register, based on their unique business/citizen ID as recipients. Recipients must register a phone no. and e-mail for notifications. Public institutions send messages from various application systems (UAs) to MTA. These messages can be dispatched from these application systems (e.g. case handling systems), using different techniques, into the message transfer system. The Tax Agency is responsible for this architecture and the provision of the main infrastructural components). There are procedures of organizational, contractual and technical

affiliation. The specific type of message needs also to be registered. National agencies and municipalities can be affiliated to this message transfer service. There is one mail-box (“Min myndighetspost” administered by the Tax Agency) that handles only messages from the public sector. Besides this mail-box, there exist at the moment two commercial digital mail-boxes that are certified to distribute messages from the public sector. A citizen can choose to receive messages from the public sector digitally or by ordinary mail. The digital choice must be an active choice. If no such choice is registered, the default option is ordinary mail. The citizen can also choose which mail-box operator to use for digital post; i.e. the public digital mail-box or one of the commercial ones. It is also possible to choose not to receive messages from some dispatching public agencies; i.e. deselecting some public agency from digital post

## 4 Adoption and effects

### 4.1 Denmark

The number of registered citizens and yearly messages are shown in table 1, showing clearly how mandatory e-government boosts adoption and use. An evaluation of the Digital Post business case for 2013 and found that public institutions had realized less Digital Post, thus less postal cost reduction than expected, see Berger and Andersen [4]. Since the State budget was reduced beforehand, the authors estimated that public institutions had had a direct deficit of more than 100 Million DKK. The business case was also evaluated for 2014 for local governments and showed again a direct deficit of 38 Million DKK (79 Million DKK in 2013). Especially small business owners were frustrated about the implementation process, the complexity of the solution, and that they had to pay to be supported along with the lack of support resources. Civil servants experienced increased workload with Digital Post due to its complexity, lack of interoperability and the increased demand for assistance from especially vulnerable citizens [1]. Civil servants report that citizens lose welfare rights and benefits because they are not able to access Digital Post. Elderly and vulnerable citizens, that depend on public benefits, may also suffer from techno anxiety [e.g. 11]. Social workers stated that forcing citizens to be digital worked against their treatment of the client.

The public institution that handles child support started sending confirmation letters in 2013 to single parents in Digital Post. More than 300 single parents did not see the Digital Post, subsequently they lost child support. The Council of Appeal ruled, on behalf of several complaints, that the decision should be reversed [21]. The turbulence of implementing Digital Post were criticised in Danish media [12].

### 4.2 Norway

Some state agencies have offered a simple digital post service to citizens, based on uncoordinated and rather unsecure solutions. The Tax directorate has used the digital mail service offered by Altinn since 2005 to inform citizens about the assessment of taxes. In 2015, 93 % of all tax payer received digital notice from through Altinn.

DIFI put its first version into operation fall 2014 and has the overall responsible for operating the solution. In municipal sector, a common digital mail service has been offered since 2013, based on a solution developed by Bergen municipality in 2011. The Contact and reservation register and Digipost were put into operation late 2014, while E-Boks was available spring 2015. By April 2016, 21% are users of CMS, while 2.3 % are registered for exemption. However, about 90.5 are registered in the CRR, and will



receive “unsecured” digital messages, but not necessarily by SDP. Other state agencies use their own mailbox system for unsecure mail. Table 1 below show some data on the adoption of Digital post in the three countries.

Table 1. E-government policy attributes for the Scandinavian countries

		2010	2011	2012	2013	2014	2015
DK	Citizens registered (%)	n/a	16%	21%	30%	89%	89%
	Citizens exempt (%)	n/a	n/a	n/a	0%	11%	11%
	Public institutions (#)	171	165	152	202	216	205
	Messages G2C (Million per year)	2,57	6,89	8,47	12,61	32,15	88,52
NO	Citizens registered with SDP (%) In CCR)					n/a	21 % (90%)
	Citizens exempt (%)					n/a	2.1 %
	Public institutions (state + municipal)				Some	5+10	121+ 200
	Messages G2C (Million per year)				n/a	n/a	2.3
SE	Citizens registered with SDP					n/a	260 K
	Public institutions (state + municipal)					n/a	9+2

4.3 Sweden

The existence of the digital infrastructure of My Messages is mandatory. The Tax Agency is the single, obliged provider of this infrastructure. The use of it is, however not mandatory for either public organizations or citizens/businesses. The deployment of this digital post solution in Sweden has thus been highly dependent on the interests by public organizations, citizens and businesses. However, the numbers of sending and receiving users are progressing fairly slowly. By Dec. 2015, there were only 9 national authorities that use My Messages. In 2014 a deployment process started for the municipalities. At the moment there are only few municipalities that use My Messages.

5 Comparative analysis

The digitization approach of the three Scandinavian countries has proven to be rather dissimilar, which is clearly depicted in the three slogans for the e-government strategies: DK: “Those than can must”; NO: Digital as first choice; SE: As simple as possible for civil servants and citizens. Below, we compare the three different approaches related to policy, design and effect.

5.1 Policy

The Danish, Norwegian and Swedish e-government policies can be placed on a continuum from mandatory to voluntary. Denmark exerts a mandatory strategy, centrally controlled by the Ministry of Finance in a much closed manner, primarily seeking central government cost reductions by legal means towards citizens.

Norway, other the other hand exerts a softer strategy; digital communication is the default option, but citizens can still choose to communicate by physical mail. In Sweden, the citizens may choose freely whether the will receive digital mail or not.

Table 2. E-government policy attributes for the Scandinavian countries.

	<b>Denmark</b>	<b>Norway</b>	<b>Sweden</b>
<b>Characteristics</b>	Centralized, top-down, government-centric.	Centralized, top-down/ bottom-up, citizen-centric	Centralized, bottom-up, institution-centric.
<b>Political anchor of e-gov. strategy</b>	Ministry of Finance, Dig. Agency (DIGST)	Min. for Modernization& DIFI +Min of Finance	Ministry of Trade, the Tax Agency.
<b>Goals of strategy</b>	Reduce public sector costs.	Efficiency, effectivity and innovation	Reduce public sector costs, improve security.
<b>Means</b>	Legal means towards citizens and businesses.	Mix of legal means and nudging of citizens.	Nudging of public institutions.
<b>Citizens' rights</b>	Digital by default. Citizen cannot choose.	Digital by default, but citizens can choose	Digital is voluntary. Citizens can choose,
<b>Citizens' demands</b>	Cannot demand digital communication.	Conditionally yes; if digital com. is supported	Cannot demand digital communication.
<b>Implementation</b>	Rapid, fixed period, specific targets.	Slower, no fixed period, no specific targets.	Digital comm. evolves incremental, dynamic.

The public institution has the responsibility to ensure that the digital message has been communicated and every public institution is obliged to comply with the digital communication strategy. Even softer, the Swedish approach has been developed bottom-up through the needs of public institutions to reduce costs communicating with citizens. This strategy has been that digital communication should be voluntary and simple to use for both public institutions and citizens.

While citizens cannot demand digital communication in Denmark or Sweden, Norway has a more citizen-centric approach, where citizens actually can demand digital communication if this is supported by the individual agencies. Denmark has chosen a rapid implementation period, aiming at digitizing 80% of public communication within 3 years. Further, Denmark has reduced central (state) funding of public institutions according to anticipated cost reductions prior to the implementation period. Norway has chosen a softer implementation strategy: comply or explain why not; whereas digital communication in Sweden evolves dynamically according to needs and opportunities.

## 5.2 Design

The design choices may also be partly grounded in the overall approaches of the three countries, depicted in the three slogans above. While exemption for citizens can only be granted in the Danish case if citizens actively meet at town hall and declare that they do not possess a computer, Norwegian citizens can be exempt only by omitting to register their email address. Contrary, the Swedish citizens that want to communicate digitally actively need to register. For the businesses sector, in both Denmark and Norway, businesses are obliged to communicate digitally without possibility of being exempt. A recent Danish investigation of user-friendliness of business-oriented digital solutions revealed that big companies find Danish Digital Post (e-Boks) too restricted for instance due to lack of internal operations of messages and lack of role-based user profiles; whereas one-person companies find the solution to complex [25]. The Norwegian Government has followed a more transparent approach, specifying the requirements in the legal documents. The private company e-Boks A/S (that operated the Danish MTS) was authorized in Norway, but had to adjust the Danish version of the solution to be able to comply with Norwegian requirements [15]. The Swedish solution lacks requirements' transparency since the development was an in-house project.

Table 3. E-government design attributes for the Scandinavian countries

	Denmark	Norway	Sweden
How many digital solutions must citizens cope with	Few other solutions. The Ombudsman has that only one SDP is promoted.	2 Secure solutions A variety of different unsecure solutions.	A variety of different solutions.
Degree of choice	Citizens have no choices, only one MTA, UA and eID	Citizens can choose between 2 MTAs, 4 eIDs	Citizens have no choice of MTA, but choose 3 UAs
Exemption for citizens to receive digital messages	Citizens are registered as digital by default; they must apply for exemption	Citizens must actively register to be digital and can be exempt.	Digital communication is voluntary so no need for exemption.
Business model, public institutions	Central gov. provides support by reducing State fund. Fee for using CMS.	Each institution has to pay for implement. costs for integration with CMS	Each institution has to pay for implement. Cost for integration with CMS.

5.3 Effects

The three countries have progressed differently in the implementation processes. Hence, a comparison of effects cannot be made directly. The adoption in Denmark developed slowly the first years, as shown in table 1. The majority of public institutions were registered in 2010, however the number of sent messages were low initially, but have increased in the two last years. The Norwegian development resembles somewhat the first years of the Danish implementation process, see also table 1. However, there has been initiated a public campaign to accelerate the adoption rate. Similarly, Sweden has a fairly slow pace of uptake due to voluntariness.

The direct economic benefits of the Danish Digital Post project has not been officially evaluated, but since the Government has reduced the State funding of public institutions from beforehand, the project has reduced public costs from 2013 to 2015 by more than 800 Million DKK. An evaluation in 2013 found a direct deficit of more than 100 Million DKK due to public institutions not being able to send as many digital posts as anticipated. The Norwegian or Swedish projects do not have this automatic reduction of State funding and benefits from the digitization project has not been estimated.

A recognized problem in the Danish case is that citizens and businesses do not access their digital communication. For instance, the share of non-held mandatory vehicle inspections was raised by 50% when Danish Police started using digital communication and plate-removal of vehicles doubled [17]. Civil servants report that citizens perceive both positive and negative consequences, and that some civil servants find the digital service to citizens so poor that they refrain from using it [5]. Even in 2014 civil servants perceive an increased work load due to digital communication.

6 Conclusions

The continual shift to digital communication in societies is apparent in the three Scandinavian countries. Digital post solutions have been implemented to push communication between public institutions and citizens/business to such digital channels. There are similarities between the three countries, but as has been shown in this paper, there are also significant differences. All three countries are driven by the idea of a “digital first choice”, which means that citizens should primarily use digital means for their communication with the public sector. But when such a “choice” is made mandatory, as in Denmark, there is actually no choice. In Norway, there are policy and infrastructural arrangements to make the use of digital post as a first, but still real choice. In Sweden, there are only non-coercive policy declarations about digital

first choice. An infrastructure for digital post has been rolled out, but the strategy is to let public institutions and external users to choose freely how to communicate. To choose digital post in Sweden must be an active choice.

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<sup>i</sup> See <http://www.digst.dk/Loesninger-og-infrastruktur/Digital-Post>

<sup>ii</sup> See <http://www.norge.no/nb/velg-digital-postkasse>.

<sup>iii</sup> See <http://www.minameddelanden.se/http://www.minameddelanden.se/mm/digitalpostfranmyndigheter.html>

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# Governance

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# Decision Making and Value Realization in Multi-Actor e-Government Contexts

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**Abstract.** In the last two decades, governments around the world have been implementing electronic services in order to create a range of public values and meet new demands from a variety of stakeholders. Such activities fall within the scope of the e-Government research field. Developing large-scale information systems has proven to be a challenging task and many initiatives have ended in failure. This paper explores uncertainty in the e-Government context. How is it related to the various actors in the public sector, and how can decision making be adapted here to improve value realization? Using actor-network theory as an analytical lens, the collaboration of five Swedish municipalities in creating common e-services is examined as a case study. The results indicate that factors beyond decision makers' control, such as relations outside of a project, create a high degree of uncertainty. This uncertainty can be reduced by creating durable relations between local and global socio-technical actors. Inscribing values into generic software that has a high grade of interoperability should help to strengthen these networks beyond projects and regional borders.

**Keywords.** E-Government, complexity, decision making, public values, actor-network theory.

## 1. Introduction

Electronic government, or e-Government refers to the public sector's use of information and communications technology (ICT) to deliver electronic services [1]. With its heritage from the information systems (IS) discipline, e-Government research is characterized by multiple scientific approaches that employ a variety of methods. E-Government, as well as the IS research field are sometimes described as theoretically weak [2, 3]. While methodological and theoretical pluralism might result in conceptual vagueness and a lack of common definitions, one advantage might be that different disciplines can learn from each other [4, 5]. Markus and Robey have suggested that careful examination of the causal structures of the IS field could improve its theory [6].

A common argument in favor of using ICTs in the public sector is increased efficiency at lower costs. E-Government can also be seen as a paradigm for how governments are supposed to work. This new paradigm is a networked, multi-sectored, power-sharing and collaborative government. Government acts as a guarantor of public values, which it co-creates with its citizens [7]. Values in e-Government can be seen as a synthesis of previous public management paradigms, such as Weberian bureaucracy and New Public Management. Examples of such values include accountability, transparency and citizen-oriented approaches [8]. However, the definition of public values can be ambiguous. Bozeman (2009) argues that a single definition is not needed,

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and that it is instead a question of normative ideals and consensus about the benefits, obligations and principles that exist between a government and its citizens [9]. In developing a theory concerning how public managers should behave, Moore argues that two basic issues must be resolved: what managers need to do in order to produce values and how to measure whether value has been created [10]. Deploying ICTs requires decision makers to prioritize between (sometimes conflicting) expected values [11]. Many e-Government solutions have vast target groups, which may include the majority of a country's population. The variety of stakeholders that stand to be affected puts great pressure on those involved in making related decisions. Implementing large-scale ICT solutions has proven to be a challenging task that has often resulted in many failures and wasted public funds. The literature mentions a number of factors that add to the complexity of information systems implementation. This complexity is increased as a result of e-Government's unique characteristics, which include organizational diversity and large groups of heterogeneous stakeholders [12, 13]; for similar issues in the IS field, see [14, 15]. New technology adds a further dimension of complexity when a decision maker is expected to have full knowledge of a system that may consist of multiple layers of hardware and software [16, 17].

Normative decision making methods are based on axioms that presuppose a rational decision maker who can base his or her choices on preferences that are aligned with specific goals and objectives. Many decision problems involve making decisions under uncertainty due to incomplete data and/or unknown consequences. Studies have shown that managers are seldom rational in their decision making [18]; instead they often make decisions based on their intuition and "gut feeling" [19]. Furthermore, unlike laboratory decision making contexts, real life situations are often complex and involve a number of motivating "social" factors, such as habits, emotions and subconscious reactions [20]. When decision making is seen as an event that precedes action, we are in danger of having a reality that is configured by linguistic intervention. A better way of approaching such social phenomena may be to instead ask ourselves why some actions appear to "succeed" in creating large-scale effects [21]. According to Larsson and Grönlund, decision making is a key factor in decentralized e-Government contexts, but current practices and structures are ill suited to meet the new challenges being faced by the public sector [22].

This paper explores uncertainty in the complex, multi-actor e-Government context. How is it related to the various actors in the public sector, and how can decision making be adapted here to improve value realization? Neither technological nor social factors are given a prioritized position as causal agents; they are instead seen as parts of a network in which many factors co-exist as equals.

This paper proceeds as follows. Section (2) presents a description of the analytical framework, namely the actor-network theory (ANT). The method and material used are then described in section (3), followed by the results of a case study in section (4). Finally, conclusions and implications for further research are presented in section (5).

## **2. Analytical framework: Actor-network theory (ANT)**

Ontologically, it is difficult to justify a world in which properties such as "technology" and "the social" are separated and one is given a privileged causal status. A world without such differentiation could prove appalling, however, as it may mean that we lose explanatory power; with technological and social "causes" are seen as equals, entangled

in a web of **actors** and **relations** that shape each other over time. These hybrid entities are fundamental components of the Actor-network theory (ANT) [23, 24]. By using ANT as an analytical lens, this paper avoids the dualism between technology and society. According to ANT, all actors who interact with a phenomenon being studied shape the relations in a reflexive way. Be they technologies, individuals or organizations, actors are defined by their interplay with other actors and not necessarily by their roles. This interplay can be described as "relational materiality" in which heterogeneous materials build up large and complex **networks** [25]. Actor-network theory presupposes materialism, but its main concern is how material is organized and ordered. Simply put, "the social" refers to patterned networks of heterogeneous materials (which could include people, animals, texts, money, architectures and technological artifacts). Some relations and materials are more **durable** than others [26], however, networks are never static and always unstable Law and Callon (1992) distinguish between **local** and **global** networks. A local network is a set of relations necessary to the successful production of any working device; these relations can be seen as "the project." In contrast, a global network is a set of relations that is built up; generates space, time and resources that facilitate innovation. Such a network, which is essential for any project, includes actors outside of the project. A project's capacity to impose itself as an obligatory passage point (**OPP**) between a local and a global network is beneficial for reaching a successful outcome. When the OPP is reached, actors are forced to converge around a certain topic or objective. [27]. A central question addressed by ANT is which relations are stronger than others, which suggests that a period of stability during which actors co-evolve can occur. Such a period usually takes place after a process of **translation** in which one actor convinces the others to align their interests towards an established network [26]. In relation to technological artifacts, it is important to note that they can be understood through the different factors (e.g. beliefs, relationships, uses and assumptions) their innovator embodied in them through the process of **inscription**. The literature suggests that the dynamics of complex, sociotechnical processes such as e-Government implementation can be better understood through ANT [23, 28, 29].

3. Method and material

The case study presented in this paper focuses on a collaborative e-Government project between five Swedish municipalities.

The empirical data stem from:

- Interviews with ten informants who were involved in the project (Table 1); and
- Over 700 project documentation files (Table 2).

Table 1. Overview of the interviews conducted.

Role	Duration
Project leader 1 (A)	75 m
GIS* engineer (B)	45 m
Head of the steering group (C)	70 m
GIS coordinator (D)	45 m
Project leader 2 (E)	50 m
IT resource person (F)	55 m
Software developers (G)	45 m
IT architect (H)	55 m
Executive director (I)	60 m

\* GIS = Geographical Information System

**Table 2.** Overview of the documentation reviewed.

Document scope	Quantity
Guiding and steering documents	68
Meeting documentation	296
End-reports	17
Accounting	263
Follow-up	25
External monitoring	27
System management	7

In order to maximize variation within the interviews, informants with differing expertise were selected (Table 1). All interviews were conducted in person, with the exception of interviews B and D (which were conducted via telephone). Interview G involved two informants. A snowball sampling method was used in order to gain access to informants and increase trust. This entailed asking the informant(s) to recommend other informants at the end of each interview. Interviews were recorded, transcribed and printed. Follow-up e-mails were sent to solicit post-project implementation data on e-service usage in each municipality. The level of analysis is a mix of individual actors, groups and organizations. Actor-network theory was operationalized by a) identifying relevant local and global actors and b) interpreting “causes” (in the form of translations, inscriptions and durable networks that have led to value realization).

#### **4. Results and analysis**

##### *4.1. Local and global actors*

The case study concerns a collaboration project (hereinafter referred to as Regional Digitization Initiative, RDI) between five Swedish municipalities that was partly financed through the European Union’s (EU) structure fund for regional development. Sweden comprises 20 county councils and 290 municipalities, each with a relatively high degree of autonomy vis-à-vis the central government. The county where this case takes place is characterized by low population in relation to its geographical area. The purpose of the studied case was to make it easier for businesses and citizens to access geographical data and apply for building permits; the proposed solution was a series of e-services that would be connected to digitized maps. The idea for RDI arose from a separate project that aimed to promote innovation and digitization in the EU. Inspired by a project in Ireland, one of the project coordinators suggested that the participating municipalities submit a joint funding application to the EU for a similar project. In order to demonstrate that the municipalities would contribute funding as well, each city council needed to provide a decision in writing. The request for this decision was treated differently in each municipality, depending on whose desk it landed on. No strong network was initially established and it was up to each of the responsible employees to convince the head of that particular city council that the project was a good idea. In the end, five of the county’s seven municipalities agreed to finance half of the project costs if the EU funding was granted. The application was subsequently made, and the EU agreed to supply half of the project’s SEK 23 million budget from its structure fund. RDI started as a project in 2011. Many of the informants noted that they had not fully realized the large scale of the project until it had been underway for some time. RDI was guided

by a steering group that included a representative of each municipality and a project group with additional members that was later divided into subproject groups (each with operational responsibilities). The project group was described as being creative and having a broad range of ideas. However, two issues soon became clear: too few resources had been invested in project management and the municipalities had little related experience with these types of collaborative projects. As a result it was difficult to find the proper competences. An external steering group head (informant C) and additional project leader (informant E) were later hired. RDI was initially unstructured, with no match between resources and activities. However, the situation improved over time as clearer routines for steering the initiative and managing change emerged.

*In time, the steering group did what they were supposed to do: govern. All too often a steering group becomes a group of people who are looking in the rear mirror, asking themselves what happened with the project. (Informant C).*

No formal decision making process was used. Decisions were made largely depending on the specific competences found within the steering group. Many informants described the formation and formalization of the steering group as a success factor, and uniting members through a commonly used project model enabled the network to grow stronger. Beyond RDI, project members' networks and relations were also extended to their respective municipalities. The nature of these relations, which varied to some extent, affected the members' performance in the project. The two smaller municipalities that were involved provide good examples. One had weak internal networks with heavy stove-piping, especially within the department that worked with building permits. That department's manager showed little interest in the RDI, which made it hard for those from that department involved in the initiative to prioritize it. In contrast, the other small municipality had a flat organization and stronger internal networks. Furthermore, the executive director of the department responsible for building permits (informant I) was a steering group member and hence could continue to strengthen the network at home.

Since RDI incorporated EU funding, it was necessary to describe how the project would meet the overall objectives set for structure funds, such as equality and sustainability. While the project's relation to EU was kept alive through a demand for continuous documentation, the informants describe the result reporting being time-consuming and somewhat contrived. Up to that point, while the RDI project had created a local network, the process of extending it to actors outside of the project remained slow and ongoing. Furthermore, two years into the project, no technological actor had been created.

#### *4.2. Translations and inscriptions*

Before creating the required e-services, a number of existing software platforms were evaluated before procurement. However, when a generic platform that would support the creation of 10 dynamic e-services could not be found, a new platform had to be developed. A small local firm (informants G) that was known to one of the municipalities was contracted. When the developers met with the project group, they suggested that an alternative to hard-coding e-services would be to develop a generic open-source platform (which would allow project members to code dynamic e-services themselves):

*The project group had created a long list of processes...a long line of papers we used to refer to as the "Dead Sea Scrolls"...we said "stop", we will create a platform where you can build the e-services yourselves. (Informants G).*

The steering group reportedly approved the initiative quite easily (which indicates an easy translation), and the developers began creating the platform. Many of the actors inscribed the same values into open-source technology, such as increased efficiency and maintained flexibility. The use of generic software was mentioned early in the project documentation. A software platform that the project group could use to create and fine tune the suggested processes was built. The building permit process was divided into several separate e-services, and the project group created numerous versions of each service in the platform prior to finalization.

*Initially we thought that we were going to make use of something that already existed. However, we ended up developing something entirely new. (Informant A).*

RDI was extended for six months beyond its original timeframe of three years. User feedback about the e-services was gathered through dialogue and seminars with local entrepreneurs during the last year of the project. Towards the end, much effort was put into determining how to manage the e-service platform. During the extension period, it became clear that one of the municipalities would join another network for future collaboration and that some issues related to hosting and management costs needed to be resolved. The informants describe the reason for and activities during the extension differently, which could be interpreted as a weakening of the project network's durability. One idea that was discussed but ultimately could not be implemented was to integrate the e-services with the municipalities' internal systems for case handling. The suppliers of the internal systems did not want to open them for integration. As a translation between the open source promoters and the licensed software suppliers could not be found, no relation between these two technologies proved possible at the time. The e-services were launched in spring 2014.

#### *4.3 Obligatory Passage Point*

As of the time of writing, RDI's results have not been formally measured. The percentage of building permits issued through e-services varies between the five municipalities, ranging from 3-4% to 12-15%. E-service users are described as satisfied with the ease-of-use, unlike the building permit administrators (who were generally not satisfied with the RDI's results). Since the e-services were not integrated with internal systems, these administrators had to manually print and process incoming cases. Hence, even though some values were inscribed into the created artifact, value realization suffered since no relation with other technological actors could be established.

However, RDI did yield some unexpected values outside of the project. Since the created software was a generic open-source solution that was licensed under AGPL v.3, other actors (including additional government agencies) could use it as well. An e-service created by one agency could hence easily be exported and used by other actors. National agencies as well as other municipalities soon started showing interest in the new software platform's functionality. After RDI's launch, additional initiatives of collaboration with other involved actors are planning future development and more e-services.

*The county borders are no longer relevant...if it were not for them [the borders], additional municipalities would probably have joined RDI when the project started. (Informant F).*

While the previous RDI network has changed and fragmented into several follow-up projects for both managing and developing the software and integrating internal case management systems, additional actors (such as the Swedish Association of Local Authorities and Regions) are also starting to use the new software for integrating national and municipality e-services and systems. Hence, the network that developed RDI collapsed and re-formed in different configurations. The current empirical material does not reveal these networks' strength. However, when municipalities export and share e-services, the stage is set for increased collaboration and streamlined processes. Instead of reinventing the wheel, municipalities can share a ride on a global, socio-technical network. When the local network of RDI ceased to exist, additional actors converged around common topics. Rather than necessarily being derived from RDI objectives, these topics stemmed from the unexpected benefits that were established through the open-source platform. In light of the results, a question for ANT is whether it is meaningful to talk about OPPs in projects or if it would be more suitable to look for a point of no return. When a local network creates such large-scale effects that it would be contradictory not to take them into account, the effects become a natural part of the global network and the local-global difference disappears.

## 5. Conclusions

This paper has explored uncertainty in the complex, multi-actor e-Government context, including how it is related to the various actors in the public sector and how decision making can be adapted here to improve value realization. Using ANT to examine a collaborative e-Government case study enables some preliminary answers to be identified. Factors outside of decision makers' control, such as inscriptions and translations between social and technological actors in the global network, create a high degree of uncertainty. This study confirms that a strong local network accompanied by durable relations to the global network appear to contribute to the success of an e-Government project. However, it is important to acknowledge that these relations include technological actors. When these actors are granted the same causal status as human actors, a logical prerequisite for value creation would be to focus first on the inscription process, then on a translation step in which technological actors interoperate. Using generic software with a high grade of interoperability should be beneficial for creating such relations. Further, decision makers need to focus beyond traditional limits such as projects and regional borders when planning for value realization. Given that value realization occurs when socio-technical actors are connected through durable networks, some interesting paths for both further research and improved practice arise. One such path would be examining value inscription in artifacts: How can the values from relevant stakeholders be included in decision-making processes and then further realized through integrated socio-technical networks? These may be key questions for any decision maker aiming to fulfill the promises of co-created values in e-Government to answer.

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# Towards Efficient EGovernment: Identifying Important Competencies for EGovernment in European Public Administrations

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**Abstract.** In an attempt to enhance efficiency, public administrations around the world and in particular in Europe are increasingly relying on information technology (IT) to improve their performance and service delivery. This growing use of IT results in a changed set of competencies demanded from civil servants. In order to find out the concrete competencies that are required for successful implementation of eGovernment initiatives and that, consequently, need to be included in the education of future professionals, a European-wide survey was conducted (n=697). This paper reports on the first results of this study, revealing that there is a strong need for professionals with socio-technical, organizational and managerial competencies.

**Keywords.** eGovernment, Competencies, Survey, Europe, Workforce

## Introduction

The ever-increasing demands public administrations must fulfil concerning social, economic and political challenges, have raised the pressure to respond appropriately to this environment. Efficiency in terms of the joint creation of public value beyond national borders is therefore at the heart of European political debates and “requires holistic responses, which in turn call for the transformation of public administrations” [1]. In this respect, information technology (IT) and technological innovation can serve as primary drivers since they provide effective and complexity-diminishing tools to deal with the plethora of requirements. They can contribute significantly to the amelioration of the performance and efficiency of the public sector and improve the service delivery [2]. Under the umbrella term *electronic government* (eGovernment), IT and technological innovations that allow public administrations to collaborate more efficiently with all stakeholders are summarized. The stakeholders include private actors, citizens and other

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organizations. Efficient collaboration makes it possible for public administrations to address diverse and constantly increasing needs of stakeholders. According to European Commission (2006), eGovernment means “the use of information and communication technologies in public administrations combined with organizational changes and new skills” with the objective to “improve public services, democratic processes and public policies” [3].

EGovernment initiatives, however, highly depend on the employees' expertise and qualification in this area [4]. To fully leverage the potential of eGovernment, it is important to have a workforce with the right competencies to perform the necessary tasks. The term *competence* can be defined as a combination of work-related knowledge, skills and abilities held by an individual [5]. It has to be ensured that civil servants are trained to be able to deal with new technologies and, thus, to guarantee customer satisfaction and efficient service delivery [6]. Studies show that a high number of eGovernment projects have failed [7], which emphasizes that it is not sufficient to have the technology available; expertise and commitment of qualified professionals are crucial. IT has to be designed and adjusted to the respective context in which it is applied and it needs the right professionals, who are capable of exploiting the new potentials of IT as far as possible [8]. EGovernment is not only about new techniques; it is much more about the people implementing it who need to have the right competencies [9].

Due to the lack of a comprehensive overview, what competencies are required by public administrations for a successful implementation of eGovernment initiatives at all levels, a European-wide survey was set up with the aim to provide such an overview. Awareness about the demanded competencies is of value for both educators to improve existing curricula and training programs and (future) professionals who would like to enter or advance in the eGovernment field. The survey was conducted between January and February 2016 and resulted in 697 usable responses from participants in 34 countries. This paper is focused on the presentation of the survey results and their implications for the development of eGovernment education in Europe.

The remainder of this paper is structured as follows. In the next section we review related literature and introduce the eGovernment competence framework applied in the study. Then, we describe the study method, followed by the presentation of results and their discussion, highlighting constraints and limitations. In the concluding section, we provide a short summary of the work done, together with the areas for future research.

## 1. Research Background

One way of increasing efficiency of public administrations is to have the right employees in the right positions doing the right things and to train them accordingly. Therefore, it is of utmost importance to define the competencies that are necessary for a successful eGovernment education in the European context. However, research on education of eGovernment in order to identify these competencies has been neglected for a long time: for instance, eGovernment education was not identified among future research topics within the roadmapping for the eGovRTD2020 project [10] and it remains under-researched [11].

Identification of the right competencies for eGovernment has started to attract increasing attention among scholars. A first attempt by [4] identified a first set of competencies and structured an academic debate around developing an eGovernment curriculum [12]. Apart of this eGovernment specific approach, a more generic approach

was developed on the European Union (EU) level. The European e-competence framework (e-CF) was established in 2014 as a means for describing the skills and knowledge requirements of IT professionals [13]. The framework is supported by the European Commission and forms part of the EU strategy for e-skills in the 21st century. The e-CF was developed with the objective of offering a one-stop shop for needed competencies in an IT environment and provide decision support concerning competency requirements and their implications for training, career development and so on. Yet, this framework provides a rather generic reference system, given that it is focused on IT professions in general, and does not take into consideration the peculiarities of different domains. On the one hand, this framework makes a valuable orientation in terms of classifying different types of competencies; but on the other hand, its suitability for the eGovernment domain is limited.

In search for a suitable framework, we decided to orient ourselves closely around the study by [14] for the purpose of designing our questionnaire. In light of the lack of profound examination and classification of eGovernment competencies in the academic field [9], this study is especially valuable, because it offers a comprehensive framework compared, for example, to the e-CF framework, because it is comprised of five different categories of eGovernment competencies, namely technical, socio-technical, organizational, managerial and political-administrative. The dimension of **technical** competencies encompasses all IT-related skills like the fundamentals, strategy and design of Information Systems. **Socio-technical** competencies refer to all the skills that are at the interface of technical system and human beings and involve both of them. Examples for such competencies include framework requirements on the impact of IT/eGovernment. **Organizational** competencies concern the organizational integration of IT/eGovernment, organizational structures, process management etc. The next category of **managerial** competencies deals with business and management skills in the context of IT/eGovernment, such as project-, change and financial management. The fifth category of **political-administrative** competencies addresses all skills that deal with the environment that IT/eGovernment is embedded in, such as legal conditions and policies. These five categories represent the multi-faceted composition of eGovernment and its requisites, beyond purely focusing on IT knowledge as in earlier publications.

## 2. Research Method

In order to gain an understanding of the competencies demanded by public administrations in Europe, an online survey was conducted among the representatives of public administrations and other organizations working in close cooperation with public administrations (target respondents). The framework by [14], presented in the previous section, acted as a basis for the questionnaire development. On top of that, it was decided to include in the survey several additional questions about the organization location, type, number of residents in the area of responsibility, number of employees and number of implemented eGovernment projects.

Once the agreement on the final set of questions had been reached by the authors, the survey was pre-tested by five experienced researchers, incorporating their feedback to the questionnaire. As a result, for each of the five categories of eGovernment competencies, namely technical, socio-technical, organizational, managerial and political-administrative, questions about the importance of three to five exemplary competencies in each category were asked about (Table 1a). All included exemplary

competencies were derived from the study by [14], who identified them based on extant academic literature in the field. The competence importance was measured using a 5-point Likert scale, with response options ranging from “unimportant” to “very important”.

In case a specific competence was perceived important by a respondent (was marked as “important” or “very important”), two additional questions were asked. First, it was valuable to understand whether enough professionals in the organization or on the job market offer this qualification (Table 1b). Second, the respondents were asked, whether employees in the organization have been or will be sent for an additional training to obtain this competence (Table 1c). Both additional questions were measured using a 5-point Likert scale, with response options ranging from “strongly disagree” to “strongly agree”.

The final version of the questionnaire was translated from English to German, French, Estonian, Spanish and Dutch. Thus, the survey was made understandable to target respondents in most European countries who do not necessarily speak English. The survey was then implemented using the LimeSurvey platform ([www.limeservice.com](http://www.limeservice.com)) in all six languages and tested by ten researchers, making final adjustments. Once the online survey was launched in January 2016, a link to it was sent per email to more than 12,000 target respondents, asking them to distribute the link further to relevant personal contacts. The link to the survey was active for six weeks and during this time 2,155 responses were received in total. However, only 697 of them were complete, meaning that all mandatory questions were responded to. We decided to focus only on complete cases in further analysis, which was done using the SPSS Statistics software package. The results of data analysis are presented and discussed in the following sections.

### 3. Results

Of the 697 completed questionnaires, about 84% of the responses came from Germany, due to the direct access of the authors to the target respondents in this country. In addition to Germany (n=587), Belgium (n=44) and Estonia (n=19), respondents from the following countries participated in the survey: Austria, Azerbaijan, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, Croatia, Finland, Georgia, Hungary, Italy, Kazakhstan, Kosovo, Latvia, Lithuania, Macedonia, Montenegro, Netherlands, Norway, Philippines, Moldova, Romania, Russia, Switzerland, Serbia, Spain, Thailand, Turkey, Ukraine, United Kingdom and Uzbekistan.

More than 90% of the responses came from the representatives of public administrations, out of which 38.2% came from public bodies serving fewer than 50,000 residents. Related to that, most organizations turned out to have less than 500 employees. Moreover, we asked for a general experience with eGovernment and eGovernment projects. In total 69.9% of the respondents implemented five or fewer eGovernment (or eGovernment-related) projects. Therefore, it can be stated that at the participating organizations the overall experience with eGovernment and eGovernment implementation was on a quite low level.

As the main goal of the survey was to identify the competencies sought by public administrations in Europe, the majority of questions were focused on the identification of these demanded competencies. In general, the proposed competencies in the chosen categories from the framework by [14] seem to be relevant. Only three competencies were marked by less than 40% of the respondents as “important” or “very important”

(*expertise in Information Systems design, Information Systems competencies and expertise in politics of eGovernment*). On the other side, *IT competencies, business/public management competencies, project management competencies and expertise in administrative workflows* were pointed out by more than 70% of the respondents as “important” or “very important”, and there are further competencies considered as important by more than 60% of the respondents (*process management competencies, expertise in legal framework and expertise in public policy*). It is quite interesting that besides rather basic IT and administrative workflow competencies the managerial aspects were mentioned most often. It seems that there is a special need for leadership competencies. This is also flanked by the answers in the open-ended responses, where mostly managerial, but also social competencies were mentioned (e.g., communication competencies).

**Table 1.** Relative importance of eGovernment competencies in practice and, for the eGovernment competencies marked as important, the level of perceived supply and qualification

Category of Competencies	Competencies	(a)	(b)	(c)
Technical	IT competencies	72.2%	46.3%	66.8%
	Expertise in Information Systems design	33.6%	56.8%	59.4%
	Information Systems competencies	26.7%	45.2%	50.0%
Socio-technical	Expertise in eGovernment impact	45.1%	60.5%	51.3%
	Expertise in technology and eGovernment adoption	44.6%	57.9%	47.3%
	Expertise in politics of eGovernment	39.5%	59.6%	44.7%
Organizational	Expertise in eGovernment structures	45.9%	52.2%	48.4%
	Expertise in organizational design	52.9%	39.0%	57.2%
	Process management competencies	60.0%	40.2%	60.8%
Managerial	Business/Public management competencies	71.6%	29.5%	57.3%
	Project management competencies	70.4%	33.8%	59.1%
	Financial management competencies	51.8%	23.6%	58.2%
Political-administrative	Performance management competencies	40.6%	40.6%	42.8%
	Change management competencies	54.4%	48.8%	47.0%
	E-Policy competencies	46.1%	46.7%	42.4%
	Expertise in legal framework	65.1%	22.7%	55.3%
	Expertise in administrative workflows	74.2%	27.3%	56.1%
	Expertise in public policy	60.6%	18.5%	56.9%

(a) Relative importance of eGovernment competencies in practice

(b) For eGovernment competencies marked as important: share of the respondents who stated that there are *not enough* professionals in the organization / on the job market who offer competencies

(c) For eGovernment competencies marked as important: share of the respondents who stated that employees in the organization have been/are planned to be sent for an additional training to obtain competencies

(based on the framework by [14])

Besides the general importance of single competencies, it is also valuable to understand, to what extent the employees working at European public administrations are equipped with these competencies. To address that, for each competence marked as important for eGovernment, we asked whether, from the respondent point of view, there were *not enough* employees in their own organization or on the job market skilled with this competence (Table 1b). It is surprising that only five out of the 18 investigated competencies were mentioned with a share of more 50% saying there are not enough people in the sector. These competencies include *expertise in Information Systems design, expertise in eGovernment impact, expertise in technology and eGovernment adoption, expertise in politics of eGovernment and expertise in eGovernment structures*. It is interesting that all socio-technical competencies were considered as not sufficiently supplied by more than 50% of the respondents. Furthermore, it is striking that purely

technical competencies were not demanded, but strategic/managerial aspects seemed to be of importance instead. It is noteworthy that interdisciplinary aspects are especially missing in the skillsets of people already working in the field.

As a next step, we intended to find out if, besides an awareness of missing competencies, appropriate actions were undertaken to address existing gaps (e.g., by additional trainings). For each competence marked as important, we asked, whether there were plans for employees to be sent for trainings to obtain this competence or whether they had already attended such a training (Table 1c). It is surprising that only six out of 18 competencies received less than 50% of the responses, indicating that two-thirds of the employees were either planned or had already been sent to trainings to acquire the competencies. However, it has to be taken into account that here rather basic competencies like *IT*, *Process- and Project Management* were rated with the highest shares of 60% and more. There are two possible explanations for these results: (1) there is more training offering on the market for the rather basic competencies and that is why it is easier to send employees to attend such a training, and (2) seeing it from a maturity perspective, the *basic* competencies are the first ones to acquire, leaving the other competencies to be developed and taught at a later stage.

#### 4. Discussion

From the results above, we could draw three important conclusions for modern public administrations.

First, the survey confirms the initial idea that public sector organizations are in need of *specific* competencies to be able to adopt and implement eGovernment projects and eGovernment-based service delivery in a sustainable way. This is a crucial issue, because, on the one hand, public administrations worldwide are well aware of the importance of IT and digital evolutions for their future development. On the other hand, they still seem to lack the necessary competencies to achieve this. Is that because it is difficult to find professionals with certain profiles? Or is it because public administrations lack the resources to attract the professionals who possess specific competencies? Or is it because there is a lack of specific education capable of addressing the necessary diversity of competencies in a coherent way? If the last explanation is the case, it would mean that there is an important gap in higher education in this domain, and that the higher education sector carries an important and urgent responsibility to develop those competencies.

Second, though the difference is not that large, it seems that there is more need for organizational and managerial competencies in the domain of eGovernment than for technical competencies. This fits the idea that public administrations have for decades (1) reduced the adoption of eGovernment projects to technical projects and (2) have not hired managers and leaders with sufficient specific eGovernment related competencies. Both elements are striking since public organizations have been well aware of the complexity of eGovernment implementation. As stated above, we can argue that public administrations will need to make a shift in their recruitment policy, if they want to be able to embrace the possibilities of eGovernment for a deep efficiency increase and service delivery improvement. From this perspective, it will be important to hire employees who possess all the necessary competencies – technical, managerial, as well as socio-technical and political-administrative.

Third, as can be derived from the first two elements of discussion, it is no wonder that the majority of organizations have limited experience with eGovernment projects in

general. There might even be a vicious circle that a lack of competencies within an organization to adopt and implement eGovernment projects will be an important inhibiting factor for the implementation of eGovernment projects. And, logically, a lack of experience in eGovernment projects will create a lack of internal competencies in this domain and prevent building required internal capacities. Using external know-how would be difficult in times of financial austerity [15]. This means that there might be only one possibility to break this circle: if public sector organizations would like to benefit from the potential advantages of digital evolution, they will have to make eGovernment a foundation for future service delivery. This is a major shift, since eGovernment should become more than a means, but the future of innovative public administrations, which will have to invest in acquisition and development of interdisciplinary competencies to achieve this.

## 5. Conclusion

Academic studies report that the increased need for efficiency gains drives many eGovernment projects. Hasty eGovernment implementations, combined with a lack of IT understanding and IT skills in the public sector, lead to the failure of many such projects. At the same time, there is still a lack of discussion of the competencies missing in the field.

We conducted a web-based survey with almost 700 respondents from European stakeholders hiring university graduates to work in eGovernment projects. Despite our recognized bias on Germany, the study shows a need not only in IT competencies but also in a more holistic approach that integrates perspectives on several disciplines. Our results indicate that a thorough understanding of public service delivery and information and communication technologies is required, combined with knowledge of organizational processes and political contexts entangled with managerial competencies. The results show evidence that there is a need for interdisciplinary learning which can only be addressed when considered early on in designing new curricula targeted at future eGovernment professionals. New eGovernment curricula should also address the problem of appearance of silos in public administrations. The solution need to be complemented with national initiatives such as the laudable study of eGovernment competencies by the German IT *Planungsrat* (Planning Council) [16]. The survey results confirm that looking at eGovernment projects as only technical projects and understanding eGovernment just as a technical issue does not represent the core of eGovernment. Holistic, interdisciplinary concepts and skillsets are necessary to overcome existing problems.

Further directions of our research will focus on the following aspects: (1) We will analyze the need for social competencies for future eGovernment professionals. Results show that social competencies in the fields of leadership and communication are crucial to manage the digital transformation of the public sector domain. (2) European and international eGovernment curricula and job descriptions for eGovernment professionals need to be developed, because the lack of respective competencies is not a just national phenomenon. The EU common values, guidelines and norms require that civil servants working in this field understand the transnational aspects of implementing an efficient and effective eGovernment architecture.

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# Towards Successful e-Government Initiatives: Exploring the Adaptation Strategies of Public Sector Middle Managers

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**Abstract.** Over the last two decades, research on adoption and technology acceptance of new information systems by users has provided very valuable insights. Most of this research has focused on the impact on citizens in a bid to measure the improvements in the quality and speed of the services provided. However, there is still a lack of understanding of internal users' reactions to new information systems, and in particular to new e-government systems. In light of this deficit, this research study draws on the Coping Model of User Adaption (CMUA) to examine the adaptation strategies of middle managers in public bodies when new e-government initiatives are implemented in their work place. We report on the preliminary findings of an initial qualitative case study of one such initiative. We believe that studying internal users' adaptation strategies is beneficial because these strategies influence the extent to which benefits arise from new electronic services provided by governments.

**Keywords.** E-government, adaptation strategies, Coping Model of User Adaptation, middle managers

## 1. Introduction

The rapid development in the ICT has encouraged the public sector to think seriously about implementing e-government [1]. This will lead to many changes inside organizations such as policy, processes, structure and the introduction of new IT applications that employees in the organization must use [2]. This means the way that internal stakeholders do their job will be completely changed. E-government as a system is complex and requires radically more IT changes than have previously been experienced in the public sector [3]. Employees often find such organizational change and using new information systems (IS) to be extremely challenging [2].

*The importance* of this study is to help top management in public sector departments to proactively manage IT-induced changes even before an IT event occurs. It also provides a framework that can help better understand the mechanism of internal user adaptation and better predict users' reactions. This study will help top management to encourage internal system users, particularly middle managers, to avoid negative behaviours, and hence manage them more efficiently.

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There has been much discussion in academia about e-government implementation, external users (e.g. citizens, business etc.), technology, acceptance and success factors, but behind all of this discussion, there are everyday workers whose daily routines have changed. How do they react to the new technology? Do they see the new technology as a threat or an opportunity? How do they adapt themselves when it comes to using it? These issues do not seem to have been addressed scientifically in academia, especially in the context of e-government. As a phenomenon, e-government needs more detailed analysis in terms of its theoretical underpinnings in order to explore the response and adaptation strategies on the part of middle managers during the implementation of new systems in order to increase the likelihood of success.

This paper is structured as follows. First, we show the importance of human aspects and how these aspects can influence the outcome of IS projects in the context of e-government. Then, we identify the key employees that most affect such projects. Following this, we outline and justify our chosen research model. Finally, we highlight preliminary findings from a pilot case study and discuss next steps in our study.

## 2. Theoretical Background

### 2.1. *The Importance of Human Aspects when Implementing a New E-Government System*

E-government requires big changes in work processes, policies, and structure and employees' roles, yet implementers still pay more attention to technical issues [4] or technological managerial issues and organizational issues [5] rather than the individual users. According to Zakaria and Yusof, for a successful implementation, there is a need to deal with all the factors together, including the human factors [5]. Wood-Harper and Wood asserted in their study that human aspects are considered important, and will be increasingly critical in terms of the successful implementation of IS in the future [6].

Information technology is just a tool and the difference is made by the employees and managers who will use and understand its benefits. In their seminal work on the early introduction of IT, Leavitt & Whisler concluded their study by stating firmly how important individuals are [7]. They stated that:

*"Perhaps the biggest step managers need to take is an internal, psychological one. In view of the fact that information technology will challenge many long-established practices and doctrines, we will need to rethink some of the attitudes and values which we have taken for granted. In particular, we may have to reappraise our traditional notions about the worth of the individual as opposed to the organization." (p.48)*

We argue that this statement is as true today as it was then, and that the implications of Leavitt and Whistler's observation must be investigated in the context of internal users of e-government applications. It is therefore critical to study the reaction, behaviour and values of the individuals (human factors in general) who will use these systems. Indeed, organisations that fail to understand and deal with their employees' reactions to changes associated with IS implementation have been recognised as contributing to implementation failure [8]. Neumann suggests that human behaviour issues are, in fact, decisive with regards to the success of e-government technologies [9]. Similarly,

Beaudry and Pinsonneault and Elie-Dit-Cosaque and Straub also argue that user adaptation behaviours and strategies are a key factor in the successful implementation of IS systems [10,11]. Human factors should be taken into account during the process of the implementation to increase the success level [12].

It is not always clear what mechanisms link internal users' reactions to the outcome of e-government initiatives. More investigation into their influence is essential [13], particularly when internal users are required to deal with new technologies. While it is important for organisations to understand the adaptation strategies of their key employees, there are few studies that have addressed internal users' adaptation strategies to new systems [11,14-15]. This research answers the call for more studies about this issue in different industries such as the public sector, in order to help increase the level of success of e-initiatives [10].

## 2.2. Middle Managers as Key Employees

Middle management is a particular level of employee that plays a significant role when implementing IS projects in organisations in general [16]. Caudle et al. argue that middle managers are the most critical management level in an organisation in this respect [17]. Rainey defined a middle manager as *"a person in a supervisory position below the level of vice president or assistant agency head, yet with at least one supervisory position below him or her"* (p.442) [18]. Middle managers can be the link between the highest level of the organization's management and the operations level staff [19]. Thus, their importance to the process of IS implementation is evident.

Other studies have argued that middle managers play a significant role in increasing the performance and supporting the changes that are caused by IS implementations in the organisations [20]. Fernandez and Rainey agree and argue that middle managers have important roles during the organisational changes in the public sector in particular [21]. Wooldridge and Floyd noted that some middle managers see the information technology as a way to let them become more involved in the improvement of the organizational structure [20]. According to Larsen, middle managers who have a positive attitude to the organizational changes will play significant roles in the success of the IS implementation which increases the performance of the organization [22].

However, middle managers typically face significant disruptions when an IS is being implemented in their workplace [10,23-25] which might cause a failure of the system. For example, IS implementations require a lot of changes to existing work processes, and these changes require new technologies to support the new work processes [2,24-26]. Employees, including middle managers, quite often resist using new technologies because they think their jobs will be completely different after the implementation of such systems [2,23,25]. Logically, system users (e.g. middle managers) like to continue with the routines that they have developed over time [27]. For this reason, public sector middle managers will find it hard to adapt to new systems, which will undoubtedly decrease the level of success.

As early as 1958, Leavitt and Whisler predicted that IT would reduce the number of middle managers in the organisation [7]. Another study by Pinsonneault and Kraemer argued that IT could either increase or decrease the number of middle managers [19]. Indeed, Drucker has noted that middle managers are particularly affected and risk losing jobs to new technology [28]. It has also been illustrated in the literature that middle managers are the employees most affected in any organization when implementing new IS applications [19,29]. Clearly, this may affect IS implementations leading to unwanted

results. Moreover, a study by Dopson and Neumann posited that middle managers will negatively impact on change in any organizations, especially when they resist such change [30]. For example, a change that is associated with the implementation of new IS such as e-government applications.

All of these observations provide compelling evidence that underpin our ambition to investigate the impact of e- government initiatives on public organisations’ middle managers.

3. The Research Model

This study draws on Beaudry and Pinsonneault’s Coping Model of User Adaptation (CMUA) [10], see Figure 1. Scholars have proven that internal users who adapt themselves to use information technology in order to gain the full advantages of its features will result to the most successful implementation of IS applications [16,31].

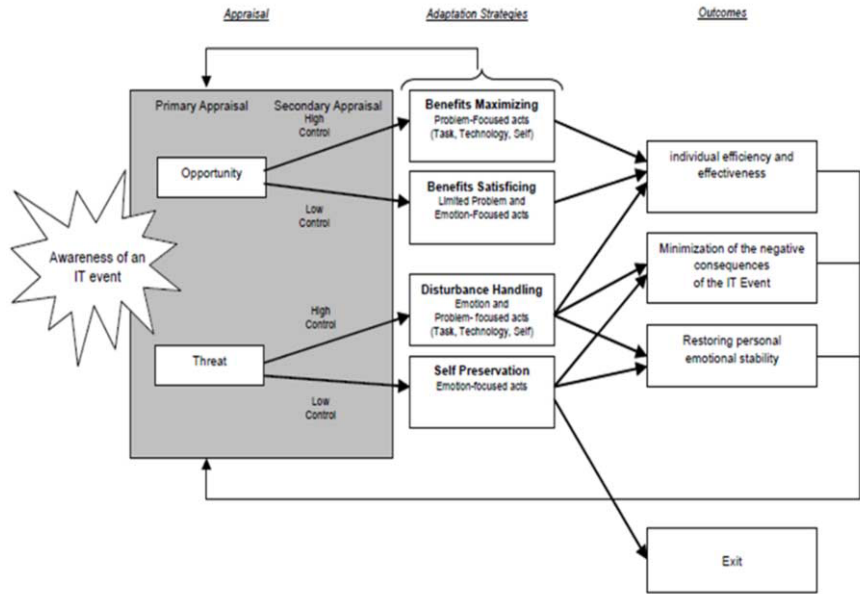


Figure 1. Coping Model of User Adaptation [10]

The fundamental idea of Coping Model of User Adaptation (CMUA) is that the introduction of a new technology or the adjustment of an existing one can bring changes and create a disruption in organizations [32]. *Coping* is defined as “the cognitive and behavioural efforts exerted to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (p.141) [33]. *Appraisals* are part of the coping theory and are divided into primary and secondary appraisals, both influencing each other [33]. Primary appraisals evaluate an event and its relevance and

importance, while during secondary appraisals individuals assess the coping options available to them [10].

After appraisals, coping efforts take place and at this stage individuals try to deal with the situation by taking different actions [10]. Coping efforts are categorized into emotion-focused and problem-focused. Problem-focused efforts aim at altering or managing the situation while emotion-focused efforts aim at regulating or changing one's emotions in response to the situation [33]. The coping process can happen before, during and/or after the impact of a disruptive event. CMUA has four adaptation strategies (i) benefits maximizing, (ii) benefits satisfying (iii) disturbance handling and (iv) self-preservation. Table 1 illustrates CMUA categories.

**Table 1.** Coping Model of User Adaptation constructs description

CMUA Constructs	Description
Primary appraisal (Lazarus & Folkman, 1984 [33]; Beaudry & Pinsonneault, 2005 [10])	An appraisal of how risky a situation is perceived to be by an individual [33].
Secondary appraisal (Lazarus & Folkman, 1984 [33]; Beaudry & Pinsonneault, 2005 [10])	Secondary appraisal refers to users' evaluation of the level of control they have 'over the technology, their work, and themselves' (p.507) [10].
Benefits maximizing (Beaudry & Pinsonneault, 2005) [10]	When users see technology as a good tools that provides opportunities to them and believe they have a good control over the situation [10].
Benefits satisficing (Beaudry & Pinsonneault, 2005) [10]	When users see technology as a good tool that provides opportunities to them, but they believe they have a limited control over the situation [10].
Disturbance handling (Beaudry & Pinsonneault, 2005) [10]	This happens "When one appraises an IT event as a threat and feels that she has some control over the situation" [10].
Self-preservation (Beaudry & Pinsonneault, 2005) [10]	This happens "In a situation where the expected consequences of an IT event are perceived as a threat and users feel that they have only limited control over the situation" [10].
Outcomes (Beaudry & Pinsonneault, 2005) [10]	There are three possible outcomes in CMUA: (i) individual efficiency and effectiveness; (ii) minimization of the negative consequences of the IT event; and (iii) restoring personal emotional stability [10].

### 3.1. Why CMUA Instead of Other Information System Models?

Understanding users' behaviour on implementation of a new IS, and how these internal users adapt and cope with new information technology accompanying the system, is not an easy task [10]. So far, there are two main directions in which the IS field has attempted to investigate this issue.

The first direction has mainly concentrated on the usage of new information technology and antecedent of adoption. These scholars have provided various acceptance models that seek to illustrate and explicate this phenomenon [34]. There are five such models that identify factors that affect user adaptation: (i) Technology Acceptance

Model (TAM) [35]; (ii) Unified Theory of Acceptance and Use of Technology (UTATU) [34]; (iii) Innovation Diffusion Theory (IDT) [36]; (iv) Decomposed Theory of Planned Behaviour (TDB) [37]; and (v) Task-Technology Fit Theory (TTF) [38]. However, these models still leave a black box that needs to be opened between usage of technology and intention to use namely the user adaptation strategies [11].

The other direction of research in this area has generally relied on a process approach and concentrated on individual adaptation [31] and the effect on outcomes caused by it (e.g. group performance) [39]. According to Kock et al., it is important to understand user adaptation strategies (or processes) in order to help understand information systems outcomes [40]. This body of research has covered many angles regarding the user adaptation. For example, how individuals change and develop their abilities, their knowledge and relationship to use information technology [41] and how they amend their work process [16,42].

These two research directions have given considerable insight into different aspects of user adaptation, but neither approach has been integrated with the other [10]. Similarly, Benbasat and Barki mention that information system scholars provide many models that study a wider range of behaviours without paying enough attention to the relation between user's behaviours when using technologies and their antecedents [43]. User adaptation strategies fall between the usage behaviours and their antecedents and play an important role [11]. Using the Coping Model of User Adaptation (CMUA) allows us to integrate the antecedents of using technology, the behaviour and the outcomes of user adaptation together. According to Elie-Dit-Cosaque and Straub, the CMUA can open the black box of user adaptation strategies [11].

#### 4. Preliminary Findings

We have already conducted a pilot case study of a new 'commercial registration' e-government initiative at the Ministry of Commerce and Industry in Saudi Arabia. We examined the adaptation strategies to this initiative of 9 middle managers by carrying out semi-structured interviews that were guided by the CMUA model. Data analysis involved coding of all data using NVivo. This analysis has already uncovered a number of early findings. It confirms the categories and the mechanisms of the CMUA model and also suggests extensions to the model.

Firstly, the data analysis suggest extensions in terms of analysing the situations before and after the implementation of the new system, namely the evolution of: (i) the roles of the middle managers and, (ii) the service processes. A number of the interviewees showed that they are having easier roles and better processes after the implementation of the new system. For instance, one of the participants mentioned that *"My role now is easier than before since the new system has been implemented, the new system also has completely changed the processes of issuing commercial register certificates to be fast and better."*

Moreover, we found evidence that there may be another primary appraisal category that is not mentioned in the CMUA model. This category can be described as "neutral" and lies between an appraisal of 'opportunity' and an appraisal of 'threat'. For example, one middle manager explained: *"I'm familiar with computers since primary school and I didn't get shocked or surprised at all about doing my job using computers and the new electronic system."*

The data also showed that the high acceptance and satisfaction with the new system among middle managers contributed significantly to its successful implementation. One participant noted: “Now it’s much better, easy work and less errors. It used to be so busy before the system was launched, it was so exhausting even though workload is greater than before.”

Furthermore, half of the participants revealed that they are not only satisfied with the new system, they need more development and improvement to derive optimal benefits from it – suggesting the possibility of a fourth outcome in the CMUA model ‘seeking IT enhancements’. For example, one middle manager described: “As a supervisor of the reception desk I’m trying to contact the developer through my boss to improve the system. Since we are the users of the system, we know exactly what improvement is needed.”

## 5. Conclusion and future steps

This work in progress highlights the need for closer examination of the adaptation strategies on the part of middle managers during the implementation of e-government initiatives. Preliminary findings from our pilot study have shown that the CMUA model provides a comprehensive lens for investigating both primary and secondary appraisals that determine these adaptation strategies. Evidence has already emerged that link positive adaptation strategies of middle managers to positive results in the implementation of at least one e-government initiative, but further studies are needed.

We also hope to extend and further refine the CMUA model through rigorously applying it in our research, but early evidence suggests that there may be an additional primary appraisal and an additional outcome not considered in the model. We plan to conduct further case studies on e-government initiatives in two more public organisations in Saudi Arabia, namely: the General Directorate of Passports and the Ministry of Labor. We hope that the particular initiatives that we have chosen in these public sector organisations will be particularly revelatory, because one of these has a fully-automated system, while the other is a semi-automated and requires some interactions with middle managers.

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# Digital Governance Challenges for ICT-Enabled Innovation of Social Protection Systems in the EU

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**Abstract** ICT-Enabled Social Innovation can help making existing service more efficient and effective, but also produce new services as a result of integration among different policy silos. Information and Communication Technologies (ICTs) can also promote conceptual innovation in the sense of changing the base (empirical and analytical) upon which policy are first designed and later evaluated. Building on extensive literature review and analysis of case studies conducted as part of the research on ICT-Enabled Social Innovation (IESI) conducted by the European Commission's Joint Research Centre, Institute for Prospective Technological Studies (JRC-IPTS), this article discusses, the results of an analysis of three selected case studies, exploring the relationship between different typologies of ICT-enabled social innovation implemented and the broader social protection system in which they are embedded in, contributing to determine if a relationship is identified between the nature and type of ICT-enabled social innovation and the modernization of social policies, considering the broader digital governance space in which they are implemented.

**Keywords:** ICTs, governance, social policy, innovation, EU

**Disclaimer:** The views expressed in this article are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

## Introduction

Across most EU countries policy efforts increasingly focus on innovation, yet more and more impinging on the concept of 'social innovation', emphasizing also the possibilities of ICTs to contribute modernising social protection systems while at the same time maintain financial sustainability of the public budget. ICT-Enabled Social Innovation can help making existing service more efficient and effective, but also produce new services as a result of integration among different policy silos. It can also promote conceptual innovation in the sense of changing the base (empirical and analytical) upon which policy are first designed and later evaluated. This is especially the case with regard to what are called Personal Social Services of General Interest, which are key means used by all welfare states to realise social, health and employ-

ment policy objectives and they are fundamental cornerstone for social protection systems as they, along with benefits, cover different types of risks that an individual can face during his/her life course. For this reason, in 2013, the European Commission launched a Communication on the Social Investment Package (SIP) urging Member States to prioritise social investment and the modernisation of their welfare systems in order to address unemployment, poverty, and social exclusion challenges brought about by the economic crisis and sustainability challenges posed by the ageing population trends. ICT-Enabled Social Innovations have come to be considered a key pillar of the SIP. Many initiatives have been launched and funds allocated, yet there is no evidence on the results obtained. In this context the European Commission's Joint Research Centre, Institute for Prospective Technological Studies (JRC-IPTS) in collaboration with DG Employment, Social Affairs and Inclusion (DG EMPL), has launched a research project, short-named IESI, to better understand how ICT-Enabled Social Innovation can support the implementation of the SIP and in turn have impact on social policy reforms in the EU.

This paper, building on extensive literature review and analysis of case studies conducted as part of the IESI research, aims at exploring the relationship between different typologies of ICT-enabled social innovation implemented and the broader social protection system in which they are embedded in, contributing to determine if a relationship is identified between the nature and type of ICT-enabled social innovation and modernization of social protection systems. For this purpose, the paper analyses the potential impact of ICT-enabled social innovation in three cases of national initiatives promoting social investment to support the modernization of Social Protection Systems in EU Member States. In doing so the analysis contribute determining what the main drivers and barriers to support the modernization of social protection systems are and what the specific impact generated by ICT-enabled social innovation initiatives promoting social investment in achieving this goal is.

The paper is structured as follows. In Section 1 we discuss the background and motivation of the analysis. In Section 2 we introduce the conceptual framework that has been used for studying the case studies, which are then presented in Section 3. Section 4 concludes outlining the conclusions and future research directions.

## **1 Background and motivations**

Innovation can be defined as the implementation of a new idea that leads to a change in practice in order to create some kind of value, where the terms can refer either to the output or the process itself [1]. In the public sector innovation can result in changing the way it functions, the way it exerts its conditioning role (e.g. from a regulatory and administrative procedural perspective), and also by inducing innovation in the private sector through its activities [2]. The latest trend is currently that of ICT-enabled public sector innovation, from e-Government to the current focus on Open Government [3]. Yet, although the number of studies on public sector innovation is growing, they do not yet represent a consolidated body of literature [4], [5]. In the majority of cases, the concepts and theories developed from the private sector are simply applied to the public sector. For example, the concept of open innovation has been recently investigated in its translation from the management research, mainly

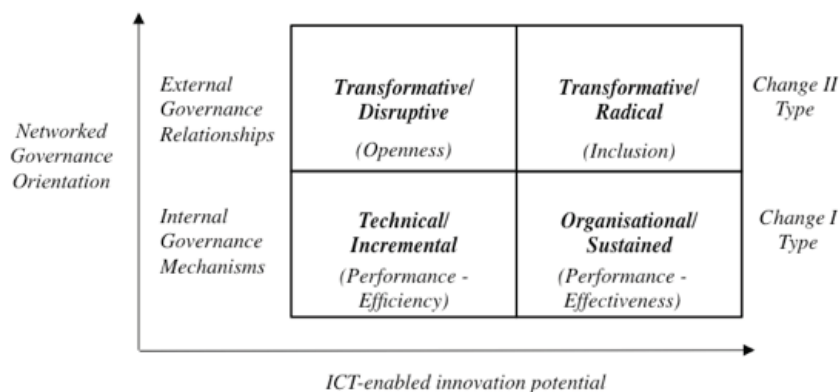
focused on the private sector, to the academic research in e-Government [6]. Considering now *social innovation*, it is often recognized as a fuzzy or a 'quasi-concept' [7], [8] and the research on the topic cannot be ascribed to any paradigm within any single social science [9], [10]. Yet, among the different definitions of social innovation, in this article we adopt the perspective of the European Union [11] on the basis of [12], which looks at social innovation as innovations that are both social in their ends and in their means, new ideas (products, services, and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships and collaborations. Strictly related to social innovation are social services, actually the focus of the cases discussed in the subsequent Sections. As for this issue, the concept of Social Services of General Interest (SSGI) was introduced for the first time by the European Commission in 2006 [8]. It identified two broad types of services: a) Statutory and complementary social security schemes covering the main risks of life; and b) Services provided directly to the person (e.g. social assistance services, employment and training services, childcare, social housing or long-term care for elderly and for people with disabilities, defined as Personal Social Services of General Interest - PSSGI). In 2007, the Commission refined its definition of PSSGI and highlighted a certain number of objectives that social services pursue –such as responding to vital human needs, contributing to non-discrimination and creating equal opportunities [8]. The Commission also highlighted the principles of organization, which are common to these services, such as solidarity, proximity, comprehensiveness, personalization and an asymmetric relationship between user and provider [8]. The diverse documents show that social services play a prevention and social cohesion role, not only helping people to live in dignity and enjoy their fundamental rights, but also to fulfil their potential and to take part in society.

Taking the above issues into account, at the state of the art a comprehensive interpretive framework bridging public sector and social innovation is missing. In what follows, we provide a contribution to the debate on the role and impact of ICT-enabled innovation to modernise public sector and social policies, discussing a comprehensive conceptual framework subsequently applied to three case studies.

## 2 Conceptual framework

In this article we adopt the conceptual framework proposed by two of the authors [13], [14] to assess ICT-enabled innovation for governance and policy-making, based on three key value drivers, *Performance*, *Openness*, and *Inclusion* and their relationship with *Governance model characteristics*, i.e., state governance system, cultural administrative tradition and socio-economic characteristics of the context of intervention. As for value drivers they can be evaluated in terms of corresponding quality dimensions [15]. The framework also considers the network governance configurations enabled by a given set of digital governance systems. The changes to digital governance systems impact on the governance configuration of the stakeholders' networks (for example, moving from e-Government to Open Government implies the entrance of new actors and a novel role to citizens in public services and data production). Thus, the conceptual model provides a 'map' for understanding which policies can be designed for an appropriate governance of digital innovation initiatives and

reforms in the public sector. Finally, the typology shown in **Figure 1** complements and exploits the outputs of the application of the conceptual framework.



**Figure 1.** Typology of changes for exploiting the ICT-enabled innovation potential

According to the typology, ICT-enabled innovations can produce changes in governance processes in various ways [13]: *technical/incremental change*, guided mainly by the *performance as efficiency* value driver and enabled by *internal governance mechanisms*; *organizational/sustained change* guided by the *performance as effectiveness* value driver and enabled by *internal governance mechanisms*; *transformative/disruptive change*, guided by the *openness* value driver and enabled by *external governance relationships*; *transformative/radical change*, guided by the *inclusion* value driver and enabled by *external governance relationships*.

In what follows we provide the reader with an application of the framework and the typology to the case of ICT-enabled innovation of Social Protection Systems in the European Union (EU), on the basis of the data from the case studies conducted by the JRC-IPTS as part of the IESI research. The three cases have been chosen out of a pool of 14 in-depth case studies, selected from the JRC-IPTS IESI Database including at present 420 initiatives across the EU, 210 of which have been analysed. The cases have been drawn for the interesting characteristics they present in terms of ICT-enabled innovation 'within' the public sector and their potential to transform the social protection systems in different welfare states in the EU.

### 3 Case studies

#### 3.1 Pôle Emploi 2015

Pôle Emploi, the public employment service in France, launched a "Pôle Emploi 100% Web" initiative to provide free personalized e-support services to its main stakeholders across France to boost employability and employment. The main benefits of the initiative are improving the access, take up, and quality of online services for jobseekers in France. Outputs from the initiative included 700 video interviews and 200 connections to e-learning courses among 1,400 jobseekers signed up in 2013.

The initiative is embedded in a long-term public strategy, aiming at (i) reinforcing counselling services to improve access to job vacancies, (ii) engaging with employers through advisors who inform them about the services provided, (iii) improving the quality of services provided by enhancing physical facilities, transparency, digital access, and access in rural areas, (iv) developing more closer relationships with the State, the regions, and social sector partners. The initiative allows users to establish a contact with a dedicated counsellor, which identifies the most appropriate service options to the user's profile. The service is based on regular and personalized interactions (web cam, mail, chat). The jobseeker also has an access to online content: information on specific trades recruiting, tips for resume writing or for job interviews.

The transformative use of ICTs and social innovations, improved beneficiaries' digital skills and increased employment opportunities, helping fight digital exclusion and reducing social isolation. ICTs, leveraging on a centred and secure use of unemployment information, contributed to an open process of co-creation of employment and employability e-services, based on the interaction between jobseekers and counsellors. ICT solution was based on information and training platforms, online services customized to needs and requests of users, and social networking technologies.

Pôle Emploi's website is the leading French job site in terms of attendance, with 5.2 million monthly unique visitors in December 2014, well ahead of Indeed or Bon Coin, thus can be recognized as a coordinator of French labour market intermediary initiatives, thus an aggregator of other market players.

### 3.2 *Crossroad Banks for Social Security (CBSS)*

Crossroad Banks for Social Security (CBSS) is a case of combination of back office integration and ePortal solution developed in collaboration amongst about 3.000 social security institutions of Belgian social security services. A network for electronic information exchange has been developed, allowing both cross-sectorial integration between public and private institutions, and vertical integrations among national-regional-local administrations. All the connected institutions can mutually consult their database and exchange up to 220 different types of electronic messages.

The objective of CBSS is to provide socially insured persons and companies with effective, efficient and user-focused services. To this end back office re-organization and integration, and a front office revision have been conducted. The key objective of the back office was to re-organize all processes and relationships with each social security institutions to obtain (i) a proactive, efficient and effective allocation of social security benefits on the bases of the characteristics of the insured person; (ii) electronic sharing of information available in one of the 3.000 social security institutions with all the others; (iii) avoidance of task duplication across institutions; (iv) provision to the policy makers of integrated statistics. The front office was re-organized (i) to deliver integrated electronic services to the target groups in a personalized way, via an access method (e.g. application to application, file transfer, portal) chosen by the user; (ii) to provide users with integrated services that comprise information and transaction which are managed through and integrated customer relationship management system; (iii) to provide personalized service which are based on the logic that the users require.

CBSS is thus conceived as a brand new ICT architecture with five main distinctive dimensions: information modelling, unique collection and re-use of information; management of information, electronic exchange of information, protection of information. Impacts produced are related to (i) significant cost reduction in messages exchange through institutions; (ii) time reduction between the query and the reply; (iii) reduction of administrative burden. The use of the network also offers the possibility and complementary benefits of an automatic granting of certain benefits (old age pensions, complementary benefits on the basis of the social security status, etc.).

### 3.3 *Italian National Institute for Social Security (INPS)*

All types of services delivered by the Italian National Institute for Social Security (INPS) are available online and payable through the corporate website, the contact centre as well as authorized intermediaries. The scope of the initiative was simplifying the administrative procedures, improving the ease of control of information by citizens, and producing savings in the management for the administration and therefore for the public sector as a whole. Among ICT enabled social innovation factors, openness has in particular enabled the institutional information system to a greater integration with the outside world, with quantifiable benefits of increasing quality of services and in reducing time and costs for service delivery. ICT was crucial for this innovation to be successful, also due to the introduction of processes of IT-demand and governance, and resulted in simplification for the end users and improvements in the welfare benefits rendered by INPS, a long chain “end-to-end” that led to achieve tangible results, through the full involvement of all functions directly and/or indirectly impacted. ICT helped to provide an inter-sectorial integration, fostering the collaboration between government and service delivery providers in private or non-for-profit sectors. Investments made in ICT provided the necessary instruments to pursue improvements in the accessibility, traceability, accountability, monitoring and controlling (which reduced undue benefits and frauds), and in the level of quality of delivered services. The processes managed electronically are now 99.8% of the overall processes.

The digitalization resulted in a reduction in management costs, registering savings in the last three years of 7% a year, and contributed to the recovery efficiency of the organisational system through a more efficient allocation of the internal staff and a decrease in workload, resulting in a savings of around 1,000 full-time equivalent. Leveraging on its capability to allow other Italian Public Administrations to benefit from its application portfolio, INPS is going to play the role of a central “hub” for the Italian Public Administrations, being the owner of the most critical data regarding citizens and users.

## 4 Conclusion

As shown in the Table 1, the cases analysed all mainly address internal governance mechanisms first. This however does not mean that they are not strongly setting the basis for a fundamental paradigmatic shift in the way these organisations operate and interact with beneficiaries. This is particularly thanks to ICTs that are used in

innovative ways in all cases. More important is the potential use of innovative approaches based on emerging ICTs, such as data analytics and predictive modelling, that are being explored that shows the promising potential for transformation of the social protection systems such initiative may generate in the years to come. This seems to be in line with the fact that innovation in the public sector is often a long-term and gradual process as shown by the Crossroads bank in Belgium and the INPS case in Italy, which are the result of over twenty years of digitalization and adaptation to the changing environment and that may now come to maturity adopting new strategies and technological paradigms. It is less so in the French Pôle Emploi, which seems to have a more user-oriented approach, although results of the impact of the initiative is not yet clear with regard to the contribution to the modernization of social protection in the respective countries. In this regard, it is interesting to note that different *Governance model characteristics* (i.e., state governance system, cultural administrative tradition and socio-economic characteristics of the context of intervention) seem to play a subsidiary role with respect to the potential played by ICT-enabled innovation in supporting reforming Social Protection Systems.

**Table 1.** Comparison among countries and projects’ characteristics

Initiative	Country	State Govern- ance System	Cultural adminis- trative tradition	SocioEconomic characteristics (OECD Life index 2016)	Value driver	Networked Governance Orientation	Type of change
Pôle Emploi 2015	France	Central- ized	Civil law	6.4	Perfor- mance <i>(Effective- ness)</i>	Internal governance mechanisms	Organiza- tional/ Sustained
CBSS	Belgium	Federation	Civil law	7	Perfor- mance <i>(Effective- ness)</i>	Internal governance mechanisms	Organiza- tional/ Sustained
INPS	Italy	Central- ized Regional- ist	Civil law	5.2	Perfor- mance <i>(Efficien- cy)</i>	Internal governance mechanisms	Tech- nical/ Incre- mental

Some preliminary conclusions however can be formulated. The analysis of the cases in fact shows that ICTs play a crucial role in promoting social innovation and social investment, identifying possible solutions to cope with the increasing complexity of social services delivery. The new technologies support public authorities, working with a smaller amount of resource, in rethinking of the service management and service delivery models, and integrating service providers in order to gain efficiency, help in closing the gap between supply and demand, enhancing skills and capabilities and broadening the range of demands. In this respect, the development of a policy framework supporting the objectives of reform initiative and their sustainability is key, and should go along with defining partnership and commitment between the stakeholders at different levels. At a more operational level, the simplification and

the automation of the procedures increases access to the services, fostering a direct relationship between the providers and users. From the experiences analysed it is thus clear that the active involvement of the beneficiaries and end users enhances the performance of the services delivery system, contributing to the continuous improvement of the services offered. Yet, ICTs are a necessary but insufficient requirement for the achievement of the greatest effect of social innovation and social investment. ICTs development and implementation must go along with an organizational reshaping and re-engineering that can enable organizational structures to cope with the innovations brought by ICTs within the portfolio of services and the service delivery model.

In this connection, although this article provides a first attempt to assess the relationship between different typologies of ICT-enabled social innovation and the broader social protection system in which they are embedded in, further research is needed to better understand the potential impact such initiatives promoting social investment could have on the modernization of Social Protection Systems in EU Member States. For this purpose, the proposed next step of the research is to extend the application of the framework considering more in depth the social investment perspective, as well as enlarging the scope of the research to all European countries and also including non-European welfare models in the human and social services sector.

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# Governance and Online Service Delivery: The Danish Case

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**Abstract.** ICT enabled public sector reform and service delivery is actively researched in both classical Public Administration, Information System Management, and eGovernment literature. Multiple studies, research projects, and benchmarking efforts nonetheless highlight gaps in the current literature, not least in the eGovernment maturity models. Research points to a limited understanding of public service delivery technology as well as the role of governance, cross-governmental decision making, and cooperation when introducing ICT solutions and online services to citizens. Summarising the weaknesses, this article develops a qualitative multi-country case study methodology and applies it to Denmark. Initial findings highlight the strength of the Danish cross-governmental and consensus seeking approach to eGovernance. The article concludes with suggestions for an adapted methodology and aspects requiring further research.

**Keywords.** eGovernance, eGovernment, eService, inter-governmental corporation, case study, Denmark.

## 1. Introduction

International benchmarking research [1-3] and case studies [3-6] have long examined the introduction of information communication technology (ICT) in public administration (PA). PA literature, particularly on ICT-enabled public sector reform [7-11], information systems (IS) management research [10, 12-16], and the field of electronic government and governance - that is, eGovernment and eGovernance [17-19] - have all looked at role of governance and inter-governmental cooperation when introducing ICT solutions and online services (eService).

Several authors, however, have stressed the failure of this research to address specific issues, including blindly digitising current processes [20-22]; technology and supply [23-25]; and the outcome and impact of ICT use [9, 26, 27]. Similarly, in his 2016 review of public sector reform, IT governance, and eGovernment literature [28], Meyerhoff Nielsen found that research on the role of governance and cooperation in ensuring the successful supply and use of online eServices is not adequately addressed, and that current maturity models only address supply-side, technological, and organisational issues [25, 28].

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This article sets out to develop a methodological framework for a multi-country case study and presents the initial findings from analysis conducted in Denmark. Following a brief outline of the background to the research and Meyerhoff Nielsen's 2016 findings (section 2), a methodological framework for a multi-country case study is developed in section 3. The initial analysis of the Danish governance model for eGovernment is presented in section 4, before the article concludes by associating the country findings to the original research questions and the appropriateness of the methodology in section 5.

## **2. Background**

In his 2016 review of governance and cross-governmental cooperation in relation to national eGovernment strategies and online citizen services, Meyerhoff Nielsen [28] identified a number of gaps in the three strands of the academic literature. Focusing on ICT-enabled public sector reform in the PA, IS management, and eGovernment, he identified a number of shortcomings in relation to governance and outcomes including [28]:

1. The majority of models are technology- and supply-oriented without any focus on outcomes or use [29, 30]. Key exceptions include Andersen and Hendriksen's PPR model [27] and Waseda's [31], which build on existing models while seeking to address outcomes and governance issues.
2. Most models show no real understanding of core government service concepts, e.g. individual service elements (information, transaction capability, and personal data) are not separate maturity levels but elements in a given service request and subsequent delivery.
3. Front-office service provision and back-office integration are mixed in many models, e.g. one-stop shop portals should not be seen as a form of transaction, but indicate the degree to which authorities cooperate and strive for integration in providing services via portals [25].
4. No model addresses governance directly, although some like Waseda highlight management and coordination issues [31]. and cooperation is manifested in many in terms of vertical and horizontal integration, the existence of one-stop shops, and information sharing among authorities and governmental levels, even private and third-party stakeholders [32, 33].

The highlighted weaknesses are summarised in two research questions. First, does a strong governance model and high level of intergovernmental action lead to the successful supply and use of online citizen services? Second, can success factors be mapped and developed into a governance model for successfully digitising public sector service delivery and eService take-up?

## **3. Methodology**

To answer the two research questions, an exploratory, qualitative multi-case comparative study is used [34, 35]. The case study method follows Plummer's [36] structured approach to allow for interpretation during the data analysis and its positivist epistemologies in the conceptual framework. The aim is to build a hypothesis answering

the two research questions. A framework enables with-in case process tracing and analysis to establish the governance mechanism in play in each of the selected cases.

The with-in case findings enable a cross-case comparison. The objective is to determine the correlation (i.e. the more of Y, the more X) between a strong cooperative governance model (cause) and the decision to introduce eServices (effect 1) and subsequent citizen use of this service delivery channel (effect 2). The cross-comparison will enable the author to build a hypothesis based on the findings. The unit of analysis will be the eGovernment governance model [37].

For the case selection, the site of analysis is a given country, or region, which has either considered or subsequently chosen to introduce eGovernment strategies and eServices. Based on past research and access to key stakeholders, this article focused on Denmark in the period from 2000 to 2016. Later research will contrast Denmark with other national perspectives, levels of experiences, population size, administrative systems, and complexity, for instance in countries like Canada, Colombia, Estonia, Faroe Islands, Finland, Georgia, Japan, Oman, Singapore, and South Korea.

The process tracking framework (in relation to the unit of analysis) will focus on the decision making process for the introduction of eServices (or not) and the key topics emerging in the political and public debate (during decision making, implementation and use, reference periods above).

Causalities may be:

- Governance model in place (formal and informal) including: National institutional framework and governance; decentralisation of government authority; responsible authority for eGovernment strategy, responsible authority for action plan; responsible authority for initiating and coordinating new eGovernment strategies and action plans; chairperson organisation; hosting organisation and secretariat; member organisations
- National eGovernance and cooperation model
- Process of eGovernment strategy and action plan development and approval (from idea to approval by government) including: eGovernment strategy legality; Action plan (i.e. is the strategy underpinned by an action plan? Is it legally binding?)
- Citizens' level of trust in political establishment (over time)
- Citizens' level of trust in public authorities (over time)
- Citizens' level trust in the individual service delivery channels (over time)

Several quantitative effect measurements on availability, and the use of eIDs and a basket of eServices can provide an empirical basis for the effect of a given governance model. Background indicators may serve in a similar manner. Key indicators and effect measurements are the eService solution in place (based on a basket of potential service areas in several or all case study countries) and service delivery volume and channel distribution including eService channels (over time).

Background indicators, in turn, include digital literacy; Internet access (%-of population, income, and educational level segments) and use (ibid.); eBanking (ibid.); eCommerce (ibid.); and eService use (ibid.).

The key primary sources include semi-structured stakeholder interviews including organisations responsible for electoral governance bodies; authorities responsible for eGovernment strategy and IT use; political decision makers; and other stakeholders.

Effect measurement and background indicators within the chosen cases will be national and international statistical services (e.g. EuroStat, ITU, OECD, UNDESA), as well as relevant academic and international references (e.g. EU, OECD, OSCE, UN). Where data cannot be identified, the author may revert to estimations based on past analysis.

The country study will guide the author when attempting to address governance and the use of eServices in eGovernment stage model discourse started by Meyerhoff Nielsen's literature review [28].

## 4. Findings

Countries offer different perspectives and levels of experience when it comes to eGovernment and online service provision for citizens. Income levels, population size, administrative systems, and complexity varies, so it is therefore important to put things in context.

### 4.1. Socio-economic background

Socio-economically, Denmark is a small (population 5,581,503, territory 43,094 km<sup>2</sup>); high-income (estimated GDP €260.74 billion and GDP per capita € 46,715 in 2015) nation state; with an open-export lead economy with low GDP and productivity growth (estimated GDP growth 1.6%, imports €75.12 billion, exports € 84.32 billion); and an ageing population [38].

### 4.2. ICT use in public administration

ICT has long been used in Danish public administrations. As a strategic plan to maximise the ability of management to achieve a set of organisational objectives [11], Danish eGovernment strategies have followed a trajectory similar to most countries around the world. While the focus has shifted from defining and implementing relevant standards, infrastructure, and services to benefit realisation (Table 1), the key objectives of the Danish eGovernment strategies have been to make Denmark a leading information and knowledge society, and to increase efficiency and productivity while preserving the welfare-state model and associated values [39, 40].

The Danish eGovernment policies have evolved over time (Table 1). Since 2011, two focus areas are of particular interest: cost-savings and benefit realisation through mandatory self-service and the business case model, plus the strengthened cross-governmental cooperation and management in IT projects – not least to ensure data exchange, a high degree of interoperability [41].

The 5<sup>th</sup> eGovernment Strategy for 2016-2020 (published 12 May 2016) builds on previous strategies. The focus is on public sector productivity and efficiency, user-friendliness, and security. More specifically, the effectiveness and value added of eServices are highlighted, as is private sector growth through public sector digitization and administrative burden reduction. Themes includes: automation of public administrative procedures; improved usability; welfare and primary care; data sharing and reuse (incl. once only principle); a more coherent eGovernment framework (i.e. less silos); maintaining and improving the IT infrastructure; privacy and data protection (incl.

cyber security); and improving the management of IT projects and common public programmes and efforts (incl. minimizing risk of failed IT projects, joint development and use of common infrastructure, components and data) [42, 43].

**Table 1.** eGovernment in Denmark from 2000-2020 [40-42]

<b>2001-2003: Digital collaboration</b>	Allowing citizens to send e-mail to the public sector and authorities to adopt digital channels of communication. Examples: Digital signatures.
<b>2004-2006: Internal digitalisation and efficient payments</b>	Focus on secure e-mail between authorities, joint government standards, and portals. Examples: eFaktura (eInvoice), NemKonto (single bank account for government use), Virk.dk (business portal), Sundhed.dk (health portal), and digital document and archive systems.
<b>2007-2010: Shared infrastructure and one point of access</b>	Mandatory use of shared infrastructure; components and standards; increased cooperation; value added services; and efficiency. Examples: Borger.dk (the citizen portal), NemID (digital signature), NemLog-in (single, sign-on), eIndkomst (electronic income registry), Digital Post, NemSMS (SMS service component), and business case model.
<b>2011-2015: The path to future welfare</b>	Focus on benefit realisation; mandatory use of Digital Post and selected eServices; reuse of data; increased cooperation. Examples: Data distribution, investment in IT and digital teaching aids, tested welfare technology, digital literacy, and campaigns.
<b>2016-2020: A stronger and more secure digital society</b>	Focus on better, more coherent, user-friendly online services, ICT led growth and efficiency, security, cross-government cooperation, and benefit realization. Examples: User-journeys for e.g. moving, business reporting and company registration, administrative burden reduction, once-only-principle, data driven growth, SMART cities, legal framework, security, cloud computing, ICT support and joint service center for portals and joint-government components like NemID, Digital Post, etc.

#### 4.3. Internet access and use

Access to, and the skills to use, the Internet are prerequisites for successful eGovernment and particularly the use of the provided eServices. Denmark, like the majority of countries, had an initial focus on ensuring the interconnection of government authorities, their systems, and the rollout of Internet broadband to citizens and businesses.

Denmark has successfully facilitated access to the Internet with 93% of households choosing to buy broadband Internet access, mobile phone penetration at 125.89%, with 42.34% have broadband subscriptions in 2014 [47]. OECD figures show that the 2014 price range for broadband connection is relatively low (US\$ 22.24-62.68 adjusted to purchasing price parity) compared to income levels [44-46].

Similarly, government policies have facilitated the development of a digitally literate population and society, with the number of individual using the Internet increasing from 39.17% in 2000 to 95.99% in 2014 [47].

#### 4.4. Key enablers, citizen eServices, use and impact

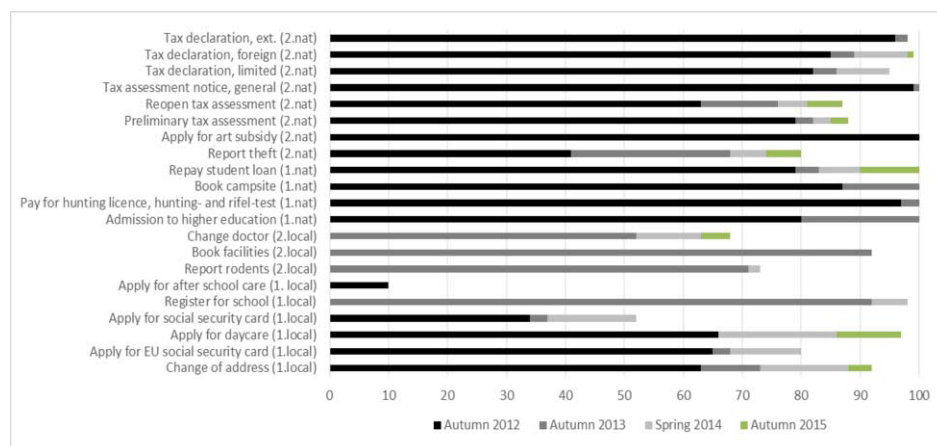
With an IT literate population and the Internet infrastructure in place, what does actual use and value added of online service look like? Looking at the proportion of citizens who use of online banking (eBanking) or shop online (eCommerce) and their level of interaction with public authorities online (Table 2), the Danish context shows a clear discrepancy between the use of private and public sector transactional services online in 2010. By 2015, this discrepancy has decreased by four percentage points.

**Table 2.** Citizens use of eBanking, eCommerce, and interaction with public authorities online 2000-2015 (at least once per year), selected years [48]

	2010	2015
Online banking	71%	85%
Online commerce	68%	79%
Interacted with government online	78%	88%
Obtained information from a government website	76%	86%
Submitted a complete form (eService)	51%	69%

Looking closer, data show that the number of active eIDs and digital signatures increased from 79.1% to 89.2% in the period 2012-2015 – and with 390.35 million logins in 2015, use is very high. Similarly, 89.2% of Danes have a digital postbox – with 10.6 million logins, 88,863,683 messages sent, and 819,936 received in 2015.

Online service use as a percentage of overall service delivery volume – referred to as the degree of digitisation in Denmark - for selected areas has also increased in the period. In fact, the introduction of the “mandatory” digital communication and eService use (Figure 1) have lead to dramatic changes in user behaviour with high volume, high-frequency service areas experiencing degrees of digitization well above the 80% mark.



Key: 1 = first wave of mandatory service areas 1 December 2012. 2 = second wave made mandatory 1 December 2013. Nat = services areas for which national authorities are responsible, Local = services areas for which municipalities are responsible. NB: Wave 3 and 4 not included.

**Figure 1.** Growth rates since the introduction of “mandatory eServices use”, 2012-2015 (selected services) [49]

#### 4.5. Governance models and institutional frameworks in place

Intergovernmental cooperation, management, and governance of eGovernment policies and initiatives are prioritised differently around the world, and with different results. In Denmark, a centralized institutional framework and governance model is in place. Three levels of government exist here: national, regional (5 regions) and local government (98 municipalities). Government authority is nonetheless decentralized with a large degree of local autonomy and decision-making including tax and budget spending. Approximately 70-80% of citizen services are provided by municipalities, although a degree of central control is enacted via the annual budget negotiations between the Ministry of Finance and ministries, regions and municipality stakeholders [50, 51].

The Danish Agency for Digitisation (DIGST), the specialized ICT agency under the auspices of the Ministry of Finance, is responsible for daily coordination and overall responsibility for past, current, and future eGovernment strategies and action plans. This includes a mandate to initiate and ensure benefit realisation and compliance. The current framework was introduced following the 2012 merger of the key government players including the Digital Taskforce (established in 2005) and hosted by the Ministry of Finance, the Agency for Governmental Management, and the eGovernment related standards, infrastructure, and platforms from the National IT- and Telecom Agency. The aim was to improve the efficiency and effectiveness of the governance model [39-41]. Table 3 summaries the Danish governance of eGovernment strategies and action plans.

**Table 3.** eGovernment governance and cooperation models [39, 50-52]

Responsible authority for eGovernment strategy	Ministry of Finance (MoF), Danish Agency for Digitisation (DIGST) including steering committee for Joint Cross-Government Cooperation (STS) and steering committee for the eGovernment Strategy.
Responsible authority for action plan	DIGST.
Responsible authority for initiating and coordinating new eGov strategies and action plans	DIGST.
Chairperson organisation	DIGST on behalf of MoF.
Hosting organisation and secretariat	DIGST.
Member organisations	Representatives from MoF (i.e. DIGST), key ministries like economy, taxation, justice, science, health and interior, Danish Regions (DR) and Local Government Denmark (LGDK).
National eGovernance and cooperation model	Centralised with mixed features, i.e. process driven by DIGST but representatives from all levels of government, initiatives from all stakeholders, consultative and consensus based with a strong mandate.
Process of eGovernment strategy and action plan development and approval (from idea to approval by government)	Centralised process coordinated by DIGST but consultation with all relevant stakeholders incl. key ministries, DR and LGDK, private and civic interest groups.
eGovernment strategy legality	Yes, part of the government programme.

Action plan (i.e. is the strategy underpinned by an action plan)

Yes.

Action plan legally binding

Yes, is part of the government programme and annual budget negotiations between all levels of government.

Decisions are generally made in the Steering Committee for the eGovernment strategy. The steering committee meets 10-12 times annually, is chaired by DIGST, and consists of representatives (generally directors and key unit heads) from key ministries plus Danish Regions (DR) and the Local Governments of Denmark (LGDK) (Figure 2) [39, 41].

The strategy, action plan (including individual programmes and projects), budgets, and final reports must be approved by the Joint Committee for Cross Government Cooperation (STS). The STS is chaired by the Ministry of Finance. It meets approximately four times a year and consist of permanent secretaries sitting in the cabinet committees for coordination and the economic affairs as well as the management committees of DR and LGDK. The STS members thus represent the advice of the individual ministers in the cabinet before The Ministry of Finance (on behalf of the government) presents an eGovernment strategy for parliamentary approval. For national strategies and reform programmes, there is a tradition to have broad parliamentary support including from opposition to ensure continuity in the strategic direction of the country [39, 41].

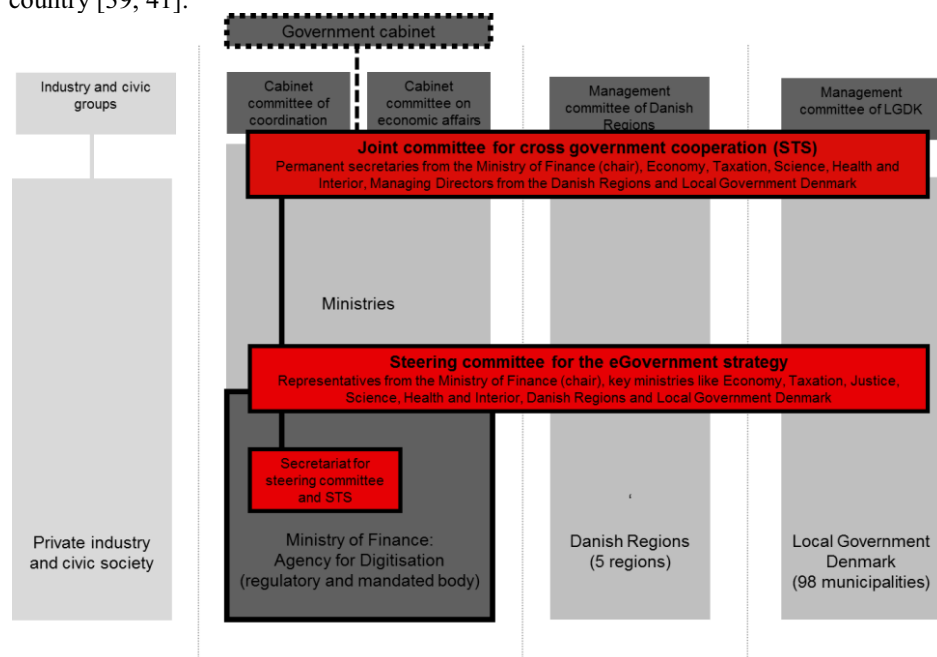


Figure 2. eGovernment governance and coordination model in Denmark.



## 5. Observations and conclusions

The Danish case highlights that a strong governance model and high level of intergovernmental action has not only lead to the successful supply of government services online, but has, since 2012, lead to a high level of citizen eService use. Early eGovernment strategies have ensured that Internet access, the cost of broadband access, and digital literacy are no longer barriers to the successful introduction and subsequent adoption by citizens.

The Danish cross-governmental model revolves around the STS and joint-steering committees in DIGST and Ministry of Finance. STS creates horizontal connections across the central government agencies as well as vertical connections among the central government, regions, and municipalities. The joint national strategies and action plans ensure that all levels of government move in a coordinated and common direction. The joint initiatives and cooperation between public authorities at all levels of government creates the join standards, launches the key enabling infrastructure, and gives citizens and businesses a sense of government institutions speaking with a “single voice” to provide recognizable and user-friendly online solutions.

The Danish model has continuously proven its worth, not only in providing the strategic direction, but also in delivering real and measurable results of digitization. While public-private cooperation and projects exist, notably the digital postbox, eID, and eSignature, there could be civil society and private sector representation in the joint-steering committee to ensure that public sector cost savings also benefit citizens and businesses e.g. through administrative burden reduction and user-centric and proactive service delivery.

It will require further analysis to determine whether the Danish success factors can be mapped and developed into a governance model for successfully digitising public sector service delivery and eService adoption. First, a validation of the Danish findings through a number of stakeholder interviews will be carried out. Second, the experiences of a selected number of national eGovernment models will be identified, analysed, and contracted to the Danish to identify the key factors affecting their respective successes and failures.

For future research, there is a need qualify the methodology further. As the individual countries have followed different trajectories and timelines, it may be required to contextualize the timeline of each case in distinct periods, e.g. decision making period (i.e. period during which public and political debate took place before deciding on the potential introduction of eGovernment strategies and eServices), development period (i.e. period of development), introduction period (i.e. introduction and roll-out of eServices), and normal period (i.e. eServices now a given option and focus on benefit realisation).

The initial Danish findings highlight the importance of process tracing to establish the actual mechanisms behind the individual cases of specific governance and cooperation models, as well as their respective strengths and weaknesses.

The availability and quality of background and quantitative effect indicators has proved to be lacking, of varied quality, and with variation in definitions. Flexibility in data collection and data analysis is therefore required and the methodology will thus be adapted in line with Van Maanen [53] and Glaser and Strauss [54] – particularly in relation to the lack of background and effect measurement data.

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# Exploring the Notion of a National Data Infrastructure and the Governance Issues Surrounding It

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**Abstract.** A national data infrastructure (NDI) provides data, data-related services and guidelines for the re-use of data as an easily accessible service to citizens as well as public and private organizations. As such, it allows the efficient sharing of data between providers and consumers, supports new business models, and is thus a key enabler for the digital economy, societal collaboration and political processes. The paper relates to an ongoing project, discusses prevailing concepts on (data) infrastructure development and proposes a classification scheme for conceptualizing national data infrastructures in a given context. The discussion in particular focuses on governance issues related to establishing and maintaining a national data infrastructure that goes beyond the focus on open government data.

**Keywords.** E-government, government data, open data, infrastructure development, governance of networks, role of the state.

## 1. Introduction

In order to develop their full potential for the digital economy and society, data need to be provided extensively and systematically. As the OECD study on data-driven innovation observes, data play the role of an *infrastructure resource* in that they generate value when used as inputs into a wide range of productive processes the outputs of which are often public and nonmarket goods that generate positive externalities [1]. Managing infrastructure resources in an openly accessible manner may be socially desirable when they facilitate such downstream activities [2]. This principle has been recognized by the application of the "open data" principles to government data and research data.

In the era of big data, opening up datasets is however not enough: in order to be able to effectively extract value by gaining new insights through recombining data, data need to be enhanced in a way that they can easily be connected to data from various sources. Both the process of data publication and stewardship as well as data enhancement are costly undertakings, which potentially benefit a large number of downstream users. Data governance understood as the guiding of collective action therefore not only needs to address the question of who gets access to what data for what purpose under what conditions, but also to assign responsibilities and retribution

mechanisms for data maintenance and enhancement in order to ensure the sustainability of the common infrastructure.

Building shared (open) data infrastructures has become a priority of governments around the world. Just as electricity, streets, and water are core infrastructures that serve citizens, companies, and governments alike, so too can a data infrastructure be understood as a community-wide need respectively a public good, similar to education, human resources, healthcare, and public services [3].

The present paper relates to an ongoing research project aimed at fostering the debate on the establishment and governance of a national data infrastructure (NDI) in Switzerland. Since the project is still in its initial phase, the goal of the present paper is to present basic considerations on data infrastructure development. Its main contribution is a preliminary framework for characterizing NDIs based on a literature review.

The paper is structured as follows: In the next section we provide a brief outline of the project. In section 3 we present a frame of reference for a NDI by discussing relevant literature in the field. Section 4 builds upon the literature review and provides a classification scheme for clarifying the notion and characteristics of a NDI. The paper closes with a discussion of the main considerations and an outlook to the next activities.

## 2. Description of the Research Project

The considerations presented in this paper relate to the ongoing project «Governance for a National Data Infrastructure in Switzerland»<sup>1</sup>. The *goal of the project* is to identify and address governance issues related to establishing and maintaining a national data infrastructure. While several countries have made first experiences regarding the establishment of a NDI, a corresponding project in Switzerland has still to gain contour. The first step of the project is therefore to foster a common vision of a national data infrastructure and to sketch out a draft model for its realization. The *research questions* to be tackled are:

- What are the elements of a national data infrastructure?
- Who are the key stakeholders and what is their expected role in this context?
- What are the main challenges and important governance issues?
- Which activities should a roadmap for creating an NDI address?

The *methodological approach* of the project is based on an analysis of literature in relevant areas (infrastructure resources, prevailing concepts of (data) infrastructures, developing and governing of shared infrastructures), three case studies on existing initiatives in other countries (UK, Denmark and the Netherlands) and around 15 semi-structured interviews with (potential) key stakeholders (public administration, the private sector, civil society, and academia). The selection of stakeholders follows an ecosystem approach [4] and has been guided by the concept of stakeholder salience, i.e. power, legitimacy, and urgency [5].

The project adopts a holistic, *multi-disciplinary view* on the issues at stake (technical, semantic, economic, societal, and legal aspects), promotes a shared understanding of infrastructure development and provides the basis for concretizing and coordinating activities in that respect. It is based on the assumptions that the

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<sup>1</sup> The project is funded by the Hasler Foundation as a pre-project for a submission in the National Research Programme «Big Data» at the Swiss National Science Foundation.

provision and the realization of the benefits of a national data infrastructure relies on collective action [6], [7] and that an open, co-productive approach to its governance will foster sustainability (cf. [8], [9]).

The project is in its *initial phase*. The interviews have been conducted; their analysis and the development of the draft model for conceptualizing the Swiss NDI are however still outstanding. The paper thus presents results from the literature analysis.

### 3. Reference Frame for a National Data Infrastructure

#### 3.1. Data as an Infrastructure Resource

Data and data analytics have become an essential driver of innovation, and it has been argued that data should be considered as one of our society's central infrastructure resources [1]. From an economic point of view, infrastructure resources are fundamental resources that don't get consumed when being used and generate value when used as inputs into productive processes. As their outputs are often public goods that generate positive impacts for society, it is often socially desirable to manage them in an openly accessible manner [2], [10]. This has for instance been recognized by the application of the "open data" principles to government data and research data.

According to a classification provided by Frischmann [2], data relate to non-traditional infrastructures (information resources, internet resources) that – just as traditional infrastructures – have the potential to generate positive externalities and result in social gains. Data meet the following characteristics of infrastructural resources: 1) they may be consumed in a non-rival fashion for some appreciable range of demand; 2) the social demand for data as resource is driven primarily by downstream productive activities that require data as an input and 3) they may be used as an input into a wide range of (private, public or social) goods and services.

#### 3.2. Interrelations Between Prevailing Concepts of (Data) Infrastructures

The notion of a national data infrastructure is not straightforward, but bears connections to and overlaps with other concepts dedicated to infrastructure development in a digital environment. This includes concepts on developing *e-government infrastructures*, *national information infrastructures*, or *open data infrastructures*.

Irrespective of the given focus of interest, the different concepts have in common that there is usually no common understanding of what an infrastructure comprises (cf. [11], [12]). Research in the field stresses that infrastructures comprise both *technical elements* (hardware, networks, services, etc.) and *social elements* (management, governance, standards, agreements etc.) [13], [11]. In that respect, Jetzek distinguishes between an *IT infrastructure* and a *regulatory infrastructure* [14]. Typically, infrastructures are or should be flexible [13] and evolve over time in accordance with the needs of their multiple users [15].

##### 3.2.1. E-Government Infrastructures

Infrastructure development is a core issue for improving public service-provision in the context of *e-government*. The focus is on *shared infrastructures* for enabling inter-

agency collaboration [13], [12]. A common e-government infrastructure lays the ground for interoperable and re-usable solutions that allow for providing *public services* seamlessly. Among other requirements, this necessitates the exchange and re-use of data that are often stored in multiple information systems held by different actors. Janssen et al. propose the following hierarchy of interoperability requirements in e-government, ensuring the interoperability of data being the most basic task to be accomplished [16]:

- organizational interoperability (collaborating, designing cross-agency processes and supply chains);
- interoperability of services (sharing, re-using services or components);
- interoperability of applications (integrating applications);
- interoperability of data (sharing information from heterogeneous systems).

The relevance of interoperable data and information sharing is also stressed in the *European Interoperability Framework* (EIF), which provides a conceptual model for public services and considers data-related services as a basic component for service provision. The focus is on *base registries* that are legally controlled and maintained by public administrations and provide authentic sources of information on items such as persons, companies, vehicles, licenses, buildings, locations or roads. The European Commission recommends making this information available for re-use while installing appropriate security and privacy measures for managing access and control [17]. With view to e-government development, authentic sources are a key enabler for enhanced service provision as they are a necessity for improving user experience and administrative efficiency [18], [19].

### 3.2.2. OGD Infrastructures

Infrastructure development is also a major issue for fostering *open government data* initiatives. The focus is on *shared infrastructures*, which allow third parties to *make use of OGD*. OGD initiatives – with a focus on the development of policies and central data portals or data catalogues – are usually considered as a subset or an extension of e-government [20]. While a clear demarcation between e-government infrastructures and OGD infrastructures is not always possible, distinguishing features typically relate to the type of government data (public data vs. *open data*) and the associated goals of data sharing (improving public service provision vs. stimulating service innovation by third parties).

Most contributions on open data infrastructure development are concerned with guiding strategies and the existence and functionalities of open (government) data portals. OGD benchmarks often assess data provision against the widely acknowledged open data principles [21] or the G8 open data charter [22]. Besides measuring data availability (range of data) and accessibility (data formats, licensing, costs, etc.), user support and functionalities for stakeholder engagement are receiving increased attention (e.g. [23], [24]). Availability of data mostly relates to coverage of sectoral data (education, health, finance, etc.) [25], while the provision of basic government data (key registries) is hardly a topic. One reason for this might be that OGD strategies' focus on the open data principles tends to foreclose the integration of government data that are unlikely to be governed by these principles (e.g. in terms of licensing or access control). Thus, basic e-government data and open government data tend to be dealt with separately. This is also reflected in existing governance structures: As a recent

study shows, the vast majority of national open data portals have been developed by governmental actors, but implemented independently from existing national government portals [23].

### 3.2.3. National Data or Information Infrastructures

Compared to the common understanding of open data infrastructures, the notion of a *national information infrastructure (NII)* – or similarly – a *national data infrastructure (NDI)* is more open with regard to data, implementation options, fields of application and goals. Data infrastructures can comprise data that is owned by governments, businesses or non-profit organizations, the data can be openly licensed, it can be made available for re-use by specific stakeholders or be closed [26]. The goal of establishing a data infrastructure is to make data available and re-usable as far as possible in order to realize social, environmental or economic value generation. To this end, relevant data should be identified under a strategic framework in order to improve data governance [26].

Several countries have adopted the concept of a national data or information infrastructure in order to effectively share core government data sets within and outside government and stimulate their use across boundaries [26]. Thereby it can be observed that the adopted initiatives or policies conceptually strengthen connections between government data held in base registries and OGD. This is the case for instance in the UK [27], [28], [29], in Denmark [30], [31], [14] and the Netherlands [19].

### 3.2.4. Consolidated View on Data Related Infrastructure Development

The terms "information infrastructure" and "data infrastructure" tend to be used synonymously. We propose to use the term "national data infrastructure", as it is closer to the terminology used in the OGD context and more elementary in terms of an information hierarchy [32]. Regardless of the terminology used, the type of infrastructure at hand is characterized by a range of components and the involvement of various actors with different requirements. Accordingly, the governance of such infrastructures needs to be developed by the stakeholders collaboratively [33].

## 3.3. Infrastructure Governance and the Role of the State

Seizing the benefits from data driven innovation requires collective action and the willingness of collaboration in order to create economic and public value [34]. While company-wide data governance frameworks have been a topic in information science for decades [37], the big data era confronts us with the same task, but worldwide and in a setting where power structures are less regulated. Against this background, political actors are confronted with a need to think about the roles the state should play in the data economy and how to concretely fill them in. The development of shared data infrastructures in which the state is likely to be involved can therefore be defined as a *governance challenge*.

Generally, governance can be described as the process of horizontal coordination in which heterogeneous actors are involved in creating a shared understanding and definition of the problems they are confronted with and of the measures to be taken to resolve them [13]. A governance framework needs to focus on the key elements that are relevant for a cross-boundary common view of the reality [38] and should support a vision that satisfies all relevant stakeholders [39] who may act according to different



rationalities, i.e. a legal, economic and/or technological one [13]. In particular, it should be noted that data driven value creation may heavily rely on activities by non-governmental actors.

When seeking to establish a NDI, coherent policies are needed to encourage investments, promote sharing and reuse, and reduce barriers to cross-border flows that could interrupt global data value chains. Core elements to be addressed include considerations on data access and reuse, portability and interoperability, linkage and integration, quality and curation, “ownership” and control as well as data value and pricing (cf. [1], [35]). To facilitate the creation of public and economic value, incentive systems for collective action and collaboration are required, covering the entire data life-cycle [13], [34]. Thereby it is important to strike the right balance between the social benefits of enhanced reuse and sharing of data, and individuals’ and organizations’ concerns about such openness, including the protection of privacy [36].

As for the latter aspect, the state clearly plays a crucial role as regulator. Policies on the usage of data are however only one aspect of data politics. With regard to developing and maintaining a NDI, the state can potentially adopt a range of roles. Shin for instance distinguishes between the role of government as a *direct intervener* (strategist, builder, regulator, and producer) and the role as an *indirect facilitator* (guider, leader, and integrator) [3]. With view to the data value chain potential roles of governmental actors can further be differentiated and extended, e.g. as data collectors, data users, operators of a system or infrastructure, as service providers or administrators [1].

4. Conceptualizing a National Data Infrastructure

Based on relevant literature on e-government and OGD infrastructure development, we propose the following classification scheme for discussing the establishment of a NDI in the form of a *morphological box*. The goal is to provide a basis for developing and testing implementation scenarios and to structure possible policy elements during the iterative research process of the ongoing project [41]. The selection of variables is based on a team-internal discussion and has been guided by the idea of describing the *main* characteristics, instead of detailing all possible sub-characteristics (e.g. regarding data provision, cf. [42]).

The first cluster of characteristics relates to fundamental considerations on a NDI, i.e. its nature, value and scope. The second cluster relates to considerations related to governing infrastructure development, i.e. its basic elements, strategic foundation, architecture and governance. The third cluster focuses on the data to be made available for re-use through a shared infrastructure, i.e. the stakeholders involved in the data process and the type of data under consideration.

Table 1. NDI Classification Scheme for Characterizing NDIs

Characteristics	Basic Notion of the NDI			
General perspective	ideational / guiding	strategic / controlled	functional / operational	technical / physical
Value orientation	public-value-oriented		business-oriented	mixed
Scope & expected impact	local issues		national issues	global issues
Role of the state [3]	proactive intervener		facilitator	

Characteristics	Infrastructure Perspective						
Infrastructure elements [13],[11]	technical				social		
	hard-ware	soft-ware	net-works	agree-ments	stan-dards	manage-ment	gover-nance
Strategy [42]	yes				no		
	top-down				bottom-up		
Strategy orientation	open data Principles [21]	G8 charter [22]	PSI OECD [43]	open government partnership [44]	other		
Responsibility [42]	legislative authorities		executive authorities		administrative authorities		
	central government		state/province		municipality		
Government roles [3]	controller		builder		regulator		investor
	strategist		guider		leader		integrator
Governance view [13]	legal rationality		economic rationality		technological rationality		
Management expectations [26]	sustain-ability	authority	trans-parency	openness	commit-ment	agility	
Infrastructure ownership & financing	public		private		mixed model		
Infrastructure architecture	central				decentral		
	dependent (closed)				emergent (open)		
System interrelations[14]	autonomy		belonging		connected		diverse
Data Governance [42]	data policies		standards	copyright	terms of use		licensing
Characteristics	Data Perspective						
Data stakeholders	creator		collector	owner	publisher		user
Data users[42]	citizens		companies		NGOs		government
General source of data	national				international		
	government		business		other organizations		
Source of government data (cf. [42])	base registries				sectorial registries		
Data publication	based on request		proactive		required by law		
Accessibility of data[26]	closed		shared (specific org.)		openly licensed		
Characteristics of data [42]	raw data		linked data	aggregate data		other	
	marginal costs		free of charge		market price		
	processing	costs	formats	description	granularity	timeliness	

The preliminary classification scheme serves as a basis for conceptualizing the Swiss national data infrastructure. It will be used for analyzing the stakeholder interviews, i.e. for identifying salient characteristics of a future data infrastructure and its governance. Conversely, the stakeholder input will help us concretize the classification as a basic model for strategy and governance decisions.

## 5. Conclusions and Outlook

Understanding data as a resource requires considerations on establishing shared infrastructures for facilitating re-use of data. The notion of a national data infrastructure serves to foster an *integrated view* on data-based value generation, thereby accounting for developments in the areas of data-sharing in e-government and through OGD-portals. It relates to the idea of making data available for re-use under a *common framework* that is generally open with respect to data ownership (state, private) or usage conditions (shared, open).

The concretization of such a framework is likely to differ across countries and is depending on existing structures and cultures. Based on a literature review, a preliminary *classification scheme* for characterizing NDIs has been presented. It will

serve for the description of different stakeholders' conceptions of a NDI and the governance issues at hand in the case of Switzerland. The classification scheme is meant to be generic and requires further validation. It could be used and tested as an instrument for analyzing and discussing the conceptualization and development of NDIs in other national contexts or for conducting cross-country comparative studies.

The goal of the *ongoing project* is to facilitate the development of a common *vision* of a NDI and the identification of challenges that need to be taken into account when developing a governance framework. The main issue to be addressed is the identification of stakeholder roles in the *ecosystem*. As for governmental actors, we are interested in clarifying the role of the state in two respects: as an enabler for the development of new data-based services by third parties and as a facilitator for modernizing public service provision. In both cases, the design of sustainable business models for data provision, enhancement, and stewardship, as well as the overcoming of collective action problems will be crucial.

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# Smart Cities

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# Smart City: A Rigorous Literature Review of the Concept from 2000 to 2015

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**Abstract.** This paper provides a thorough review of publications on smart city from 2000 to 2015 aiming at clarifying the concept. Grounded theory principles are used to systematize and understand the different meanings arising from initiatives in the area. Results have shown that smart city settings in the analyzed period allow the expansion of knowledge on the subject and a better understanding of the concept in its semantic and structural dimensions from the use of coding techniques. The concept of smart city has evolved from an initial emphasis on the technological aspect to a current approach, more focused on human, social aspects and participatory governance aiming at sustainability and quality of life. There have also been efforts to define the theoretical core of the smart city phenomenon due to the prevalence of qualitative and exploratory studies in the period and in recent publications with insufficient definitions to the concept.

**Keywords.** Smart city, Grounded Theory, Literature review.

## 1. Introduction

Studies show that more than half of people lived in urban areas in 2010 [1] and this number may increase 75% by 2050 [2, 3] as a consequence of population growth. This scenario points to the rapid urbanization of society and the emergence of challenges related to the management of cities in order to find ways to treat and solve problems related to population growth, such as traffic, air pollution and increased crime [1].

The concept of smart city arises in the search for innovative solutions to these management challenges. It brings a new approach to address these urban problems aiming at a sustainable city and quality of life [1, 4]. It has an extended meaning since it represents an alternative and sustainable way to these problems in urban areas.

The concept of sustainability covers aspects related to the economy, governance, environment, people, mobility and the way of life in its framework developed for smart cities [5]. There are also other initiatives adopting different definitions of smart city in various research fields, characterizing it as multidisciplinary.

It is relevant to broaden the understanding of the concept of smart city. This study intends to contribute conceptually to the debate on this issue, reviewing systematic publications from 2000 to 2015. It employs analysis principles of the Grounded Theory (GT) [6] looking for a possible answer to the following question: what are the different definitions and meanings adopted in these publications to the concept of smart city? The results of this study may contribute to this multidisciplinary management

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approach to cities' urban problems as it can brighten and systematize the concept of smart city from previous publications on the subject.

Besides this introduction, the paper is organized in four sections. Section 2 deals with the concept of smart city. Section 3 presents the methodology adopted here while section 4 shows the analysis of valid publications for the scope of this study and its results. In section 5, final considerations about the study are presented and discussed.

## **2. Smart City**

The smart city theme has its origin in the search for quality of life among citizens living in urban areas. This challenge involves practices and initiatives to improve the services offered by public management and sustainable urban development. As a result, a number of initiatives and projects are being developed worldwide [7].

In the literature on this topic the concepts of digital city and ubiquitous city (U-city) can be found; however, the concept of smart city is regarded as more comprehensive than the others, although they are all linked and have semantic similarities since they require specific settings for the understanding of each of the concepts [7].

Smart city in turn has a similarity with the concept of digital city [27]. Although there is an overlap with the concepts of digital and ubiquitous cities, smart city may be considered a broader concept, aiming to unite, promote and encourage dissemination of information and, therefore, quality of life for all citizens [7]. It differs due to the collaborative aspect among stakeholders of the city, including citizens [8].

The broader scope of smart city is evident when analyzing its origin and stages in the evolution [9], mainly, from 2010, when the concept is seen as an opportunity to increase quality of life, emphasizing both hardware and software. The concept de-parts initially from a point of view restricted to technology infrastructure, evolving in recent years to a systemic view, which considers all the parties involved and their relationship, an approach now focused on sustainability and improved quality of life.

However, it appears that there is still no consensus on the definition of smart city in the scientific community [4, 10, 11, 12, 13, 14, 15, 16, 17, 18]. The concept is adopted internationally with different terminology, contexts and meanings and also with variation around the word smart, which has been adopted as digital and as smart [4]. Alawadhi et al. [1] report extensive discussion about definitions of smart city with different emphases being placed on natural resources and on technology. Another study suggests a knowledge-based conceptual vision of the smart city [16], centered on people's information and knowledge of people, in order to improve decision-making processes and enhance the value-added of business processes of the city Meijer and Bolívar [18] point out that smart cities governance approaches have ended up reproducing fuzzy and inconsistent literature on the concept of smart city.

Remarkably, in one of the first publications on the topic already represented an expanded concept, mobilizing different forces, multidisciplinary aspects and agents looking for an innovative and sustainable solution to the various problems of cities urbanization: "smart city is a city well performing in a forward-looking way in these six characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens" [5, p.11]. In addition to the digital and technological perspective of the city, it includes the active involvement of stakeholders through an interactive and participatory urban environment favoring co-creation.

Smart city can be regarded as an instance or exercise of e-Government (e-Gov), being a part of this domain. As much as e-Gov, the concept of smart city is still under development and far from reaching maturity, being considered underdeveloped in many areas [19], within its scope and understanding, deals with lack of organization, standards and more systematic academic studies [20] being an emerging field [18].

### 3. Research Methodology

This is a qualitative and exploratory study [21]. It carries out a review of the literature aiming at providing a systematic account of the concept of smart city [22] and applying principles of analysis from GT [23, 24, 26]. It allows an in-depth and theoretically relevant analysis of the research topic [6] resulting in a greater contribution. Data gathering criteria included scientific articles published between 2000 and May 2015 from ProQuest, Science Direct, Scopus and version 10.5 Egrl databases [25] which contained the keywords "Smart City/Smart Cities" or "Digital City/Digital Cities" in their abstracts. Non-academic studies or incomplete texts were excluded.

All 168 articles identified in this stage were stored in digital repository and the files named with the title with no special characters to avoid the occurrence of duplicate work in the initial sample. For refinement, the introductory sections and theoretical basis of these articles were read in order to extract the smart city concept adopted and further spreadsheet cataloging of each study selected. In this refinement, 107 articles were discarded because they did not contain such a concept and 32 previous studies cited in the collected publications were added to the final survey sample.

Content analysis of the final sample articles involved the application of analysis principles from GT [23, 24, 26], by means of open coding, axial coding and selective techniques in the concepts extracted from these publications [6]. Introductory sections and theoretical basis of the articles were examined again in depth, with the goal of identifying codes that represented the meaning of smart city to the authors.

Categories emerged from the identified concepts and codes and were arranged in dimensions: semantic and structural. The Semantic Dimension (SD) refers to the meaning and the role that the concept of smart city expresses in the categories "what?" and "what for?" respectively. The Structural Dimension (ScD) is concerned with smart city components and refers to the way the concept is formed or structured, represented by the category "how?". Full analytical framework resulted from encodings [6] and each identified code was described in detail in a memorandum with excerpts of the concepts in the dimensions and categories already mentioned. The description and the codes in the analytical framework were refined and adjusted in each article of the sample. Qualitative analysis here differs from previous studies by analyzing various concepts in these two dimensions and by employing principles of analysis of the GT [23, 24, 26] in a rigorous literature review [6].

### 4. Data analysis

The articles analyzed were categorized by year, and 2013 and 2014 contain the highest number of publications. Following the criteria adopted no article was found between 2008 and 2010. The analysis identified 37 definitions, distinguished in DS and ScD,

which demonstrates the academic effort to create a definition for this new urban phenomenon, in development since the first definition found in 2000.

Table 1 presents the ten most cited definitions in an analytical framework resulting from the application of coding techniques. The contents of the "What?", "What for?" and "How?" were listed considering the settings shown in the definition and presented under "Cited by". The analysis of different definitions in the literature using the principles of GT enabled the identification of a multi-dimensional nature to the concept, which can be seen in the semantic and structural dimensions shown in Table 1.

**Table 1.** Semantic Dimension (SD) and Structural Dimension (ScD) of smart city

Ten most cited definitions
<b>Definition:</b> A city that invests in human and social capital and traditional and [...] [28]; <b>SD: What?</b> Participatory city; <b>SD: What for?</b> Sustainable economic growth, Quality of life, Management; <b>ScD: How?</b> ICT, Social and Human Capital, Participatory Governance; <b>Cited by:</b> [3, 4, 15, 18, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54].
<b>Definition:</b> A city well performing in a forward-looking way in economy, people, [...] [5]; <b>SD: What?</b> Combined city; <b>SD: What for?</b> Performance, Independence, Awareness; <b>ScD: How?</b> Citizen actions; <b>Cited by:</b> [3, 4, 7, 8, 13, 14, 15, 17, 18, 31, 32, 34, 36, 37, 42, 46, 47, 49, 50, 51, 53, 54, 55, 56, 57, 58, 59, 60, 61].
<b>Definition:</b> [...] territories with a high capacity for learning and innovation, which is [...] [11]; <b>SD: What?</b> Evolved city; <b>SD: What for?</b> Politics, Inclusion, Equality, Innovation; <b>ScD: How?</b> Advanced technologies; <b>Cited by:</b> [3, 14, 15, 18, 30, 31, 33, 36, 41, 42, 43, 45, 49, 50, 53, 54, 59, 62, 63, 64, 65, 66, 67].
<b>Definition:</b> A city that monitors and integrates conditions of all of its critical [...] [70]; <b>SD: What?</b> Monitored city, integrated city; <b>SD: What for?</b> Optimality, Planning, Preventive maintenance, Monitoring, Public services; <b>ScD: How?</b> Infrastructure; <b>Cited by:</b> [3, 4, 14, 15, 35, 43, 50, 53, 54, 59, 68, 69, 59].
<b>Definition:</b> An instrumented, interconnected and intelligent city. [...] in the [...] [71]; <b>SD: What?</b> Monitored city, Connected city, Virtual city; <b>SD: What for?</b> Visibility, Monitoring, Integration, Provision of services, Optimality, Decision-making; <b>ScD: How?</b> ICT; <b>Cited by:</b> [4, 13, 14, 32, 53, 54, 55, 59, 68, 69].
<b>Definition:</b> The use of Smart Computing technologies to make the critical [...] [72]; <b>SD: What?</b> Connected city; <b>SD: What for?</b> Provision of services, Interconnection, Efficiency; <b>ScD: How?</b> ICT; <b>Cited by:</b> [1, 4, 13, 14, 18, 55, 59, 68, 69].
<b>Definition:</b> A city combining ICT and Web 2.0 technology with other organizational [...] [73]. <b>SD: What?</b> Combined city; <b>SD: What for?</b> Sustainability, Life quality; <b>ScD: How?</b> ICT, Web Technology 2.0, Organizational efforts; <b>Cited by:</b> [4, 15, 20, 39, 63, 68, 69].
<b>Definition:</b> [...] as the organic integration of systems. The interrelationship between a [...] [74]. <b>SD: What?</b> System of systems; <b>SD: What for?</b> Integration; <b>ScD: How?</b> Systems; <b>Cited by:</b> [4, 47, 52, 59, 77, 81].
<b>Definition:</b> A city striving to make itself "smarter" (more efficient, sustainable, [...] [75]; <b>SD: What?</b> Effort; <b>SD: What for?</b> Efficiency, Sustainability, Equality, Livability; <b>ScD: How?</b> -; <b>Cited by:</b> [4, 13, 55, 59, 68].
<b>Definition:</b> [...] city well-performing in a forward-looking way in various [...] [76]; <b>SD: What?</b> Combined city; <b>SD: What for?</b> Performance, self-government, Awareness; <b>ScD: How?</b> Citizen actions; <b>Cited by:</b> [13, 14, 20, 69, 77].

It also shows the evolution of the smart city concept from a restricted technological infrastructure perspective to a systemic perspective [9]. In recent years, however, the concepts have considered all parties involved and their relationship, emphasizing sustainability and improved quality of life through participatory governance. This evolution in definitions resulted from the evolution of society itself, which has started to value information and quality of life in cities more. Problems with traffic, crime, energy, for example, have demanded incremental needs and, as a consequence, innovative solutions with citizen participation on the part of government and industry.

In DS the significance of the city is expanded to a geographical area with a high level of development and capacity for learning and innovation from the effective participation and people's actions [11]. In this sense, smart city is shown as a new paradigm of intelligent urban development and sustainable socio-economic growth. When analyzing the concept of function in DS, one confirms its broader scope, encompassing various departments and areas of the city. This characteristic suggests a

possibility of implementing smart cities initiatives with direct and indirect benefits to the city, its inhabitants and visitors on a larger scale and even beyond their initial expectation.

As far as the way or the means by which the concept can be operated in ScD, one finds that there is no fundamental centralization in ICT as in early publications. Therefore, in this dimension of concept analysis, structuring of a smart city initiative depends and can be complemented by other factors besides technological ones such as effort and effective participation of city citizens.

An extensive, multidisciplinary literature on smart cities is found in the sample with publications in various fields, when examining the areas of knowledge and sources of articles whose concepts were extracted and analyzed. The diversity of research fields in the analyzed publications may help explain the fuzzy characteristic of the concept and the various definitions found for smart city. Since it is a multidisciplinary literature, each research field adopts their perspective to interpret and give meaning to the concept. This multidisciplinary character and the multidimensional nature of the concept identified in coding and in the use of analytical principles of GT, can account for the inaccuracy of the concept as well as for the difficulty in recognizing a unique concept in this field and its related scientific production.

There are some definitions often mentioned in publications, which, in the final sample, can be considered as established definitions [5, 11, 28]. There are also recent works, self-defined, with few or no quotation [3, 37, 78] and other less cited that were removed due to space limit. These works provide a conceptual contribution on this issue and represent an ongoing effort to define the concept in the scientific community.

## 5. Final remarks

Other similar literature reviews were made also with different search criteria and methods [79, 80]. However, this work contributed conceptually to the debate on smart city through a rigorous literature review based on principles of analysis of the GT [6]. It shows a possible answer to the question guiding this study, consolidating and systematizing different definitions and meanings in Table 1, which was built from a review and rigorous analysis of the content of relevant and recent publications on the subject. The results obtained here corroborate the findings by Chourabi et al. [4], highlighting the fact that the smart city conceptualization is still underway in the scientific community, considering different definitions of this concept in this research.

There is a need for in-depth studies of a unique initiative of smart city [1] and this practice can also be found in most publications analyzed in this study. The focus and goal of research prevalent in these publications are associated with qualitative approach and exploratory objective, an academy effort to define the theoretical core of the smart city phenomenon. The criterion adopted for the selection of initiatives is not shown in the analyzed publications and neither was the concept of a smart city initiative identified in the content. This can be evidenced by the volume of discarded publications of the initial sample and may be due to the maturity level concerning the topic, suggesting the need for academic research on a continuous basis to broaden understanding of the concept and of the phenomenon.

Further research may be carried out on the content of these publications in order to identify research gaps. A comparative analysis of concepts in relation to the approach or theoretical framework adopted as a basis here and the type of research goal can also

be conducted for trend identification and research opportunities. An expansion in the scope of analysis to include definitions from the industry and other bodies.

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# Dealing with Imperfect Data in “Smart-Cities”

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**Abstract.** As a new form of sustainable development, the concept “Smart Cities” knows a large expansion during the recent years. It represents an urban model, refers to all alternative approaches to metropolitan ICTs case to enhance quality and performance of urban service for better interaction between citizens and government. However, the smart cities based on distributed and autonomous information infrastructure contains millions of information sources that will be expected more than 50 billion devices connected by using IoT or other similar technologies in 2020. Real-time data generated from autonomous and distributed sources can contain all sorts of imperfections regarding on the quality of data e.g. imprecision, uncertainty, ignorance and/or incompleteness. Any imperfection in data within smart city can have an adverse effect over the performance of urban services and decision making. In this context, we address in this article the problem of imperfection in smart city data. We will focus on handling imperfection during the process of information retrieval and data integration and we will create an evidential database by using the evidence theory in order to improve the efficiency of smart city.

**Keywords.** Smart Cities, ICT, Real-time data, Imperfection, Evidential database, Theory of belief functions, IoT, IoE, Crowdsourcing

## 1. Introduction

The emergence of Internet of Things (IoT) and Information and Communication Technology (ICT) promoted several concepts, “Smart City” is one of these concepts. It has been quite fashionable in the policy arena in the last few years [1] and holds today the world through its nature of research and its specific dimensions that include the *people, economy, mobility, natural environment, ICT infrastructure, lifestyle and public administration* [2]. This concept has been adopted since 2005 by a number of technology companies [3] (such as: Cisco, Microsoft, HP, IBM, Siemens, Oracle, etc). IBM described the smart city as “*one that makes optimal use of all the interconnected information available today to better understand and control its operations and optimize the use of limited resources*” [4] and Cisco defined the smart cities as those who adopt “*scalable solutions that take advantage of information and communications technology to increase efficiencies, reduce costs and enhance quality of life*” [5]. Therefore, the Smart Cities consist to use the ICT to be more intelligent and efficient in the use of resources in order to maximize the life quality of city’s population. However, with a distributed and autonomous information infrastructure characterized by an open database, a distributed information system and an advanced technology, a particular attention was given to the validity and the reliability of the information circulated in smart cities. Several analytical criteria used to select the sources of information (such as: the reliability of the sources, the objectivity of the information, the exactitude of data). But, all these criteria are unable to estimate the reliability of the information sources. In fact, Real-time data generated from the different information sources can be for the most part, imprecise, uncertain, incomplete or ambiguous, which influences the efficiency of smart cities. In order to ensure a smart information infrastructure, we address in this paper the problem of imperfection in smart cities data. We model all the forms of imperfection by using the belief functions theory and we create evidential databases contains perfect and imperfect data where the imperfection is modeled with the Dempster-Shafer theory. In this context, we organize our article as follows: In section 2, we will draw a description of “Smart cities”. In section 3, we will describe the problem of imperfection in smart city data. Section 4 will contain a description of



our proposed method to deal with imperfect data and we will prove the steps of our approach in section 5. Finally, conclusion will draw.

## 2. Concept of "Smart Cities"

As a new form of sustainable development, the concept "Smart Cities" has attracted a lot of attention in the recent years [1]. Several definitions have been proposed to describe this concept. But, it still a vague or a fuzzy phenomenon [1], [6,7,8,9,10,11]. In this section, we aim to describe the Smart Cities and we aim to provide our own definition of this concept that we will hear a lot in the coming years.

### 2.1. Literature review: Definitions of Smart Cities

The definitions of smart cities are various and there are several researchers explored this area. Caragliu *et al.* believe that a city will be smart when the investments in human and social capital fuel a sustainable economy and a high quality of life, with a wise management of natural resources [1]. Harrison and Donnelly indicated in [3] that "*it's a new policy for urban planning.* [6] presented the smart cities by the utilization of ICT infrastructure, human resources, social capital and environmental resources in order to guarantee the economic development, the social sustainability and to ensure a high quality of human life. Vanolo considered the Smart city in [7] as an efficient city uses advanced technologies. Hollands mentioned in [8] that the smarter cities based on the utilization of network infrastructure to improve economic and political efficiency in order to guarantee the urban development. Ojo *et al.* described the smart cities in [9] as an urban innovation aim to harness physical and social infrastructures for economic regeneration, social cohesion and infrastructure management. Chourabi *et al.* indicated in [10] that "*the new intelligence of cities, resides in the increasingly effective combination of digital telecommunication networks (the nerves), ubiquitously embedded intelligence (the brains), sensors and tags (the sensory organs), and software (the knowledge and cognitive competence)*". Nam and Pardo [11] defined the concept of "Smart cities" as an "*organic connection among technological, human and institutional components*" and Schaffers *et al.* mentioned in [12] that it's a "*multi-dimensional concept. It is a future scenario, even more it an urban development strategy. It focuses on how technologies enhance the lives of citizens*". Generally, we can deduce through the current literature of Smart cities, two main definitions have been proposed to describe these cities. The first characterizes the smart cities by the wide use of ICT for traditional infrastructures for improving the active participation of human and social capital [1], [4,5,6,7,8]. The second defined the smart cities as the cities with smart physical, social and economic infrastructure while ensuring the centrality of citizens in a sustainable environment refer to the key characteristics defined by distinct factors (e.g., smart economy, smart mobility, smart people, smart environment, smart living, smart governance) and focus on the strategic use of new technology and innovative approaches to enhance the efficiencies and the competitiveness of cities [2], [9,10,11,12]. Therefore, we can define the concept "Smart City" as "*a modern city uses smart information infrastructure (contains perfect data) to ensure the sustainability and the competitiveness of the different urban functions by integrating different dimensions of urban development and investments in order to reduce the environmental impact and to improve the quality of citizens' lives*".

### 2.2. Smart Cities Applications

It all started in 2005 by several models of cities consists to implement complex information systems in urban infrastructure (such as buildings, transport, electricity, ...) in order to improve the quality of citizens' life. The first model of smart cities was proposed by Cisco in Dubai<sup>1</sup>. Cisco en-

<sup>1</sup>Cisco (2005): Smart City in Dubai. [http://www.cisco.com/web/learning/1e21/1e34/downloads/689/nobel/2005/docs/Abdulhakim\\_Malik.pdf](http://www.cisco.com/web/learning/1e21/1e34/downloads/689/nobel/2005/docs/Abdulhakim_Malik.pdf)

ables Dubai a Smart Government (e-Government)<sup>2</sup>, Smart Media City (DMC)<sup>3</sup>, Healthcare City (DHC)<sup>4</sup> and Knowledge Village (DKV)<sup>5</sup>. Another model of Smart Cities was proposed by IBM in New York<sup>6</sup>. In this context, IBM provides set of applications, such as: The smarter transportation management network<sup>7</sup>, Smarter Building Management<sup>8</sup>, Smart water resources management<sup>9</sup>, etc. Siemens, offers also a model of a smart city in Germany<sup>10</sup>, as we can mention the model of smart city in Montreal<sup>11</sup>. Therefore, several models of smart cities have been proposed and all these models have the same components of *Smart-Economy*, *Smart-Mobility*, *Smart-Governance*, *Smart-Environment*, *Smart-Living* and *Smart-People* [13]. But, the integration of ICT in the different urban functions can pose certain problems, such as:

- Breach of confidentiality, the sensors monitor all the action of each individual, tracing... [6];
- Problem of restructuring [8];
- The emergence of new exclusion forms related to the inaccessibility of ICT and the reduction of creativity [14];
- The expensive installation of digital infrastructure [15];

We can conclude that the main challenge for smart city manifested essentially in its *information infrastructure* that is characterized by distributed and autonomous information sources generate large amount of imperfect data. This imperfection within smart city data can have an adverse effect over the performance of urban services and decision making. The following section describes the problem of imperfection and presents an actual example of imperfect data.

### 3. Smart Cities and imperfect data

Several objects, peoples, processes and devices communicate through internet-connected infrastructures in Smart Cities and generate a large amount of data, such as: the sensors, databases, media, etc. The emergence of ICT promotes several other information sources, such as: Cloud computing, IOT, Crowdsourcing, etc. Figure 1 summarizes the different information sources in smart cities.

However, the distributed and autonomous information infrastructure that specifies the smart cities poses several challenges related to the quality of data. Real-time data generated within this infrastructure can contain all sorts of imperfections in data (e.g. imprecision, uncertainty, ignorance, ambiguity, and/or incompleteness). For example, in the opinion individual's source like the "Crowdsourcing" that was popularized by Jeff Howe in 2006 [16] to execute the tasks that are hard for computers but easy for humans. The participants can answer by several solutions to a question which gives uncertain and/or imprecise response, they can skip to answer a question which give an incomplete or a missing response and they can answer by "I do not know" to reflect the ignorance [17]. All these types of imperfect information can have an adverse effect over the performance of urban services and decision making. Therefore, it's important to deal with

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<sup>2</sup>[www.dubai.ae](http://www.dubai.ae)

<sup>3</sup>[www.dubaимediacity.com](http://www.dubaимediacity.com)

<sup>4</sup>[www.dhcc.ae](http://www.dhcc.ae)

<sup>5</sup>[www.kv.ae](http://www.kv.ae)

<sup>6</sup>IBM (2009): Smarter Cities in New York 2009

[http://www.ibm.com/smarterplanet/us/en/smarter\\_cities/article/newyork2009.html](http://www.ibm.com/smarterplanet/us/en/smarter_cities/article/newyork2009.html)

<sup>7</sup>"Building a smarter transportation management network"

<sup>8</sup>"Smarter Buildings: Reduce cost and gain control"

<sup>9</sup>"Employing integrated operations for water resources management"

<sup>10</sup>"Pictures of the Future": <http://www.siemens.com/innovation/en/home/pictures-of-the-future.html>

<sup>11</sup><http://www.smartcityexpomtl.com/>

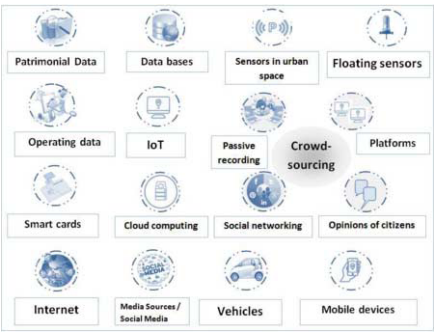


Figure 1. Typology of information sources in Smart Cities

Theories	Application areas	Source
Probability theory	Incompleteness	[26]
Fuzzy set logic	Imprecision and ambiguity	[28]
Possibility theory	Imprecision and uncertainty	[29]
Bipolar fuzzy sets	Non-existence information	[21]
Rough sets theory	Vagueness	[22]
Belief functions theory	Imprecision, uncertainty, incompleteness, ignorance and conflict	[23], [24]

Table 1. The uncertainty theories

all the forms of imperfection in order to improve the efficiency of smart cities. In this context, we focus in this paper on handling imperfect data during the process of information retrieval and data integration. The following section presents our approach to ensure perfect information infrastructure in Smart City.

4. Dealing with imperfect data in Smart Cities

To ensure the sustainability of the different urban functions, it must firstly guarantee an perfect information infrastructure. In the context of smart cities, there are several information coming from different sources, this information can be, for the most part, uncertain, imprecise, incomplete and/or missing. Several theories have been proposed to model data’s imperfections such as: the probability theory [18] for modeling incomplete data, the possibility theory [19] for modeling imprecise data, the fuzzy set logic [20] for modeling ambiguity and imprecise data, we can also mention the bipolar logic [21] and the set approximate (Rough Sets) [22]. But, still the Dempster [23] Shafer [24] theory (DST) the most used theory. Its a mathematical theory represents a powerful tool enables to model all forms of imperfection (imprecision, uncertainty, ignorance, incompleteness and have access to conflict) [25]. Indeed, the Probability theory is the oldest theory for modeling incomplete data, but it cannot distinguish the uncertainty of the imprecision [26,27]. The fuzzy sets theory used only for modeling imprecision and vagueness [28]. Thus, Possibility theory offers a natural setting for representing only imprecise data and poor information [29]. However, the theory of belief function also referred to the evidence theory or DST provides a powerful tool for modeling all the kinds of imperfection. It’s a flexible tool to take into account the imperfection of data in pattern recognition and information fusion. Table 1 summarizes the specificities of each theory to deal with the imperfection.

In this context, we resort to the belief functions theory in order to ensure a smart information infrastructure. According to this theory, we model all the forms of imperfection in smart city data and we create evidential databases containing both certain and/or uncertain data. We

focus on handling the problem of imperfection in real-time data and provide mechanisms for real-time updates in evidential databases. The following sections present the basic concepts of Dempster-Shafer theory (section 4.1) and describe the D-S databases (section 4.2) and internet of everything that it will be our application area (section 4.3).

#### 4.1. Theory of belief functions (TBF)

Decision making is more difficult when handling imperfect information. Several theories have been proposed to model this imperfection. As they uncertainty theories like the theory of probability, the theory of possibility and the theory of fuzzy sets, the theory of belief functions models all the forms of imperfection. It's a mathematical theory represents a powerful tool for representing imperfect information. This theory was introduced firstly by Dempster [23] then formalized by Shafer [24]. The evidence theory gives a complete framework to model the imperfection in smart cities data. In this section, we introduce the fundamental notions of this theory and we present some related functions and some combination of rules that was later using to create the evidential databases (EDB).

##### 4.1.1. Frame of discernment

A discernment frame  $\Omega = \{\omega_1, \omega_2, \omega_3, \dots, \omega_n\}$  is the set of all the exclusive and exhaustive hypotheses, called also the universe of discourse or domain of reference. The power set  $2^\Omega = \{A | A \subseteq \Omega\} = \{\emptyset, \omega_1, \omega_2, \omega_3, \dots, \omega_n, \omega_1 \cup \omega_2, \Omega\}$  represents the set of all the hypothesis of  $\Omega$  and their disjunctions.

##### 4.1.2. Basic belief assignment (BBA)

A basic belief assignment or a mass function represents the degree of belief that supports the event (A). It affects a real value from  $[0 ; 1]$  and defined as follows:

$$m^\Omega : 2^\Omega \rightarrow [0, 1] \quad (1)$$

$$\sum_{A \subseteq \Omega} m^\Omega(A) = 1 \quad (2)$$

We consider any positive elementary mass  $m(A) > 0$  as a focal element such that A belongs to  $2^\Omega$ . If we have  $m(\Omega) = 1$  that represent a total ignorance. If we consider a mass function such as  $m(\{\omega_1, \omega_3\}) = 0.7$  and  $m(\Omega) = 0.3$ , this mass function model both imprecision (on  $\{\omega_1, \omega_3\}$ ) and uncertainty with 0.7.

##### 4.1.3. Particular belief functions

The mass function or the basic belief assignment represents a common representation of evidential knowledge, it has several categories and many particular functions. Such as:

**Definition 1** *Categorical mass functions:* A categorical BBA is a mass function noted by  $m_A^\Omega$  which has a unique focal element  $A \subseteq \Omega : m_A^\Omega(A) = 1$ .

**Definition 2** *Vacuous mass functions:* A vacuous BBA is a particular categorical mass function characterized by only one focal element  $A = \Omega$ , such that  $m^\Omega(A) = 1$ . This type of mass function is defined as follows:

$$m^\Omega(A) = \begin{cases} 1 & \text{if } A = \Omega \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

**Definition 3** *Dogmatic mass functions:* Dogmatic BBA characterized by a focal element different from  $\Omega$  with  $m(\Omega) = 0$ .

**Definition 4** *Simple mass function:* A simple BBA is a mass function which has only two focal elements.

**Definition 5** *Consonant mass functions:* A consonant BBA is a mass function with the focal elements are nested, such as:  $(A \subseteq B \subseteq \dots \subseteq \Omega), \forall A, B \subseteq \Omega$  with  $m(A) \neq 0$  and  $m(B) \neq 0$ .

**Definition 6** *Bayesian mass functions:* A Bayesian BBA is a mass function which all the focal elements are singletons.

#### 4.1.4. The combination rules

There are several combination rules proposed in the context of belief functions. We start by the first combination rule that was proposed by [23]. For two mass functions  $m_1$  and  $m_2$  and  $\forall X \in 2^\Omega$ , the Dempsters combination rule ( $m_{\oplus}$ ) is given by:

$$m_{1 \oplus 2}(X) = \frac{1}{1 - K} \sum_{Y_1 \cap Y_2 = X} m_1(Y_1) m_2(Y_2) \quad (4)$$

Where  $k = m_{\oplus}(\emptyset)$ , and it's called the *global conflict*. In order to solve the problem enlightened by Zadeh's counter example [30] where the Dempster's rule produced unsatisfactory results, several combinations rules have been proposed. Smets improved in the Transferable Belief Model [31] the Dempster's rule by the *conjunctive combination rule*. For two mass functions  $m_1$  and  $m_2$  and  $\forall X \in 2^\Omega$ ,  $m_{1 \odot 2}(A)$  is defined by:

$$m_{1 \odot 2}(A) = (m_1 \odot m_2)(A) = \sum_{B \cap C = A} m_1(B) m_2(C) \quad (5)$$

#### 4.2. Evidential database (EDB)

The databases used to store a large amount of information that can be uncertain or imprecise. To address this problem, the evidential databases have been proposed by Hewawasam *et al.* in [32] and Bach Tobji *et al.* in [33]. An evidential database is a database that contains perfect and imperfect data. Where the imperfection (uncertainty and / or imprecision) is represented by the belief functions theory with an evidential value  $V_{ij}$ . Formally, an evidential database is composed of  $X$  attributes (columns) and  $Y$  records (rows). Each attribute  $j(1 < j < X)$  has a framework that represents all possible values of this attribute: This is the frame of discernment. The evidential value ( $V_{ij}$ ) described by a mass function defined by:

$$m_{ij} : 2^\Omega : 2^{D_j} \rightarrow [0, 1] \quad (6)$$

$$m_{ij}(\emptyset) = 0 \quad \sum_{x \subseteq D_j} m_{ij}(x) = 1 \quad (7)$$

#### 4.3. Internet of everythings (IoE)

In smart cities all the objects, the people, the processes and the databases are connected to an Internet network. Internet of Everything is a networked connection of all of the information sources. This concept is a novel paradigm that is rapidly gaining ground in the scenario of modern wireless cities. Cisco was the founder of the concept of Internet of Everything (IoE) [34], it defined this concept as the brings of "*people, process, data and things to make networked connections more relevant and valuable than ever before turning information into actions that create new capabilities, richer experiences, and unprecedented economic opportunity for businesses, individuals, and countries*"<sup>12</sup>. Several models of Internet of Everything will be proposed in smart cities. Cisco was the leader on integrating Internet of Everything in Smart Cities [35] by a model

<sup>12</sup>"The Internet of Everything": Global Private Sector Economic Analysis

of IoE economics in Dubai (IoE To Drive Dubai's Smart Economy)<sup>13 14 15</sup>. Therefore, ensuring a reliable information infrastructure signified ensuring a reliable infrastructure for IoE in smart cities. In this context, we chose the environment of IoE to prove the importance of our approach in the the context of smart cities data.

## 5. Experimentation

In order to improve the efficiency of smart cities, we address the problem of handling imperfect data during the process of information retrieval and data integration. This imperfection manifested in the information circulated in the smart cities (Real-time data or data warehouse) can have several forms, such as:

- **Uncertain information:** It reflects the lack of knowledge (eg. "I think that the percent of water in the Earth's surface equal to 70%").
- **Imprecision information:** It translates the non-specificity (eg. "I think that the percent of water in the Earth's surface between 70% and 71%").
- **Vague information:** It reflects an ambiguous information (eg. "I think there are large amounts of water in Earth's surface").
- **Missing information:** It reflects the not found or incomplete information.

All these types of imperfect information influence the performance of urban services. Therefore, it's important to deal with the problem of imperfection to ensure a reliable information infrastructure. The following section presents the different steps of handling imperfect data with the evidence theory in smart city.

### 5.1. Experimental Setup

Handling imperfect data with the belief functions theory comprises two main steps: **representing data** and **modeling data**. In order to present the real knowledge and to improve the quality of real-time data, we estimate the reliability of the information sources and we integrate it in an evidential database. In this context, we will develop a platform based on the principles of IoE ensures the interconnection and the integration of the different information sources (objects, people, process and databases) and provides the opportunity to express the certainty level about the information. In this article we limited by modeling data coming from the opinion individual's source like "Crowdsourcing platforms". The following sections present the ways of representing and modeling data.

#### 5.1.1. Presenting data

The main idea through the representation of data consists to deduct the imperfection that it will be modeled after with a mass function (*BBA*) and give the opportunity to present the uncertainty and the imprecision level. Generally, we assume that each data ( $D_i$ ) coming from the source ( $s_j$ ) is defined in the frame of discernment  $\Omega_{s_j}^{D_i}$  and each frame belongs to a specific area (eg. transport, health, education, economy,...). Each information will have a degree of certainty  $D_c$  generated by the source of the information  $s_j$  and modeled after by a mass function  $m_{s_j}^{D_i}$ , which gives a matrix of  $I$  data/lines for  $J$  source/columns given by:

<sup>13</sup>“Dubai Smart City IoE Value at Stake in the Public Sector”

<sup>14</sup>“The Internet of Everything AED 17.9 bn Opportunity for Dubai:2014-2019”

<sup>15</sup><http://www.gulfbusiness.com/articles/insights/internet-of-everything-to-drive-dubais-smart-economy/>

Type of data	Mass function (bba)	Case
1 Perfect data	$\{m^\Omega(\omega_i) = 1\}$	Perfect data
2 Ambiguous data		
2.1 Certain but imprecise data	$\{m^\Omega(\omega_i \cup \omega_j) = 1\}$	Possibilistic data
2.2 Precise but uncertain data	$\{m^\Omega(\omega_i) = 0.7\}, \{m^\Omega(\omega_j) = 0.3\}$	Probabilistic data
3 Missing data	$\{m^\Omega(\Omega) = 1\}$	Total ignorance

Table 2. The cases of imperfection

$$\begin{matrix}
 & \begin{matrix} s_1 & \dots & s_j & \dots & s_J \end{matrix} \\
 \begin{matrix} D_1 \\ \vdots \\ D_i \\ \vdots \\ D_I \end{matrix} & \left[ \begin{array}{cccc|c}
 m_{s_1}^{\Omega_1} & \dots & m_{s_j}^{\Omega_1} & \dots & m_{s_J}^{\Omega_1} & \Omega_{s_j}^{D_1} \\
 \vdots & & \vdots & & \vdots & \vdots \\
 m_{s_1}^{\Omega_i} & \dots & m_{s_j}^{\Omega_i} & \dots & m_{s_J}^{\Omega_i} & \Omega_{s_j}^{D_i} \\
 \vdots & & \vdots & & \vdots & \vdots \\
 m_{s_1}^{\Omega_I} & \dots & m_{s_j}^{\Omega_I} & \dots & m_{s_J}^{\Omega_I} & \Omega_{s_j}^{D_I}
 \end{array} \right]
 \end{matrix} \quad (8)$$

The idea through the representation consists to better express the knowledge level of the source  $s_j$  about data with a certainty degree  $D_c \in [0, \dots, 1]$  will be modeled by a mass function ( $m_{s_j}^{D_i}$ ) in order to present the imperfection level.

### 5.1.2. Modeling data

To model the received information, we assume that each data  $D_i$  proposed by the source  $s_j$  with  $s_j = \{1, \dots, J\}$  belongs to a specific frame of discernment  $\Omega_{s_j}^{D_i}$  with  $\Omega_{s_j}^{D_i} = \{\omega_1, \omega_2, \omega_3, \dots, \omega_n\}$ . Where the power set  $2^\Omega = \{A | A \subseteq \Omega\} = \{\emptyset, \omega_1, \omega_2, \omega_3, \dots, \omega_n, \omega_1 \cup \omega_2, \Omega\}$  represents the set of all the hypothesis on  $\Omega$ . The choice of the frame of discernment is extremely important to avoid the problem of complexity. For these reasons we limited the size of our frame of discernment between 2 and 6 focal elements, in order to guarantee an precise generation of the mass functions. Each focal element should be modeled by a mass function ( $m_{s_j}^{D_i}$ ). The choice of BBA is done according to the categories of the selected focal element ( $\omega_i$ ). If the focal element ( $\omega_i$ ) is a singleton and its  $D_c$  equal to one, the bba will be a *certain bba* with  $m_{s_j}^{D_i}(\omega_i) = 1$ , which models the case of perfect information (precise and certain information), else if its  $D_c \neq 1$  the bba will be a *bayesian bba* with  $m_{s_j}^{D_i}(\omega_i) \in [0, \dots, 0.9]$ . We are in the case of probabilistic information, which models the case of precise but uncertain information. When the focal element is  $\Omega$  which  $m_{s_j}^{D_i}(\Omega) = 1$ , we are in the case of the *total ignorance*. Finally, if the focal elements are nested ( $\omega_1 \subseteq \omega_2 \subseteq \omega_3 \dots$ ), its bba will be a *consonant bba* with  $m_{s_j}^{D_i}(\omega_1 \cup \omega_2 \cup \omega_3) \in [0, \dots, 1]$ . Table 2 summarizes the cases of modeling imperfect data with Dempster-Shafer theory.

### 5.1.3. Particular case: Handling imperfection in "Crowdsourcing platforms"

We present in this section a particular case of modeling imperfect data in "Crowdsourcing platforms" specific on healthcare area. The principle of "Crowdsourcing" consists to enlist a set of humans to solve some problem via the World-Wide Web. Ben Rjab *et al.* are already identified in [17] the reliable sources in crowdsourcing platforms with the evidence theory. In this context, we assume that there are only the experts in this platform. Therefore, the applicants ask the questions and the experts in health care should be respond by one or more answers. If the asked question ( $Q_i$ ) was: "What are the symptoms of Alzheimer's disease?". The frame of discernment of  $Q_i$  with  $\Omega_{Q_i} = \{H_1, H_2, H_3, H_4\}$  will be:

- $H_1$ : **Forgetfulness** with  $D_c \in [0, \dots, 1]$

- $H_2$ : **Depression** with  $D_c \in [0, \dots, 1]$
- $H_3$ : **Anger** with  $D_c \in [0, \dots, 1]$
- $H_4$ : **Non discrimination** with  $D_c \in [0, \dots, 1]$

This algorithm (Algorithm 1) presents the steps to deduce the certainty degree. If an expert

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**Algorithm 1** CERTAINTY DEGREE  $D_c$

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**Input:**

$I$ : Number of questions

$J$ : Number of participants

**Output:**

```

1  $D_c$ : Certainty degree
  # Initialization
   $know \leftarrow False$ 
  for  $i \in [1 : I]$  do
2   for  $j \in [1 : J]$  do
3      $Res[i][j] \leftarrow$  Response to a question
4     if ( $know = True$ ) then
5        $D_c \leftarrow$  An evidential value between  $[0, \dots, 1]$ 
6    $D_c \leftarrow 0$ 
7 return  $D_c$ 

```

---

( $s_1$ ) responds with a singleton focal element eg.  $\{H_1\}$  with a certainty degree ( $D_c$ ) equal to one. We are in the case of perfect response (certain and precise answer), a *certain bba* with  $m_{s_1}^{\Omega_{Q_i}}(H_1) = 1$  will be added to this information. If the focal elements are singletons, but with a  $D_c \neq 1$ . We are in the case of precise but uncertain answer, a *bayesian bba* will be added to this information. If an expert ( $s_2$ ) responds by  $\{H_1 \cup H_2\}$  with a degree of belief ( $D_c$ ) equal to 1. We are in the case of imprecise (on  $\{H_1, H_2\}$ ) but certain answer, a *consonant bba* with  $m_{s_3}^{\Omega_{Q_i}}(H_1 \cup H_2) = 1$  will be added to this information. But, if an expert ( $s_3$ ) responds by  $\{H_1 \cup H_2 \cup H_3\}$  with a  $D_c \neq 1$  eg. 0.7. In this case, we have the uncertainty on the belief degree of 0.7 and the imprecision on  $\{H_1, H_2, H_3\}$ . Finally, if an expert ( $s_4$ ) respond with  $\{H_1, H_2, H_3, H_4\}$ , in this case a *Vacuous bba* will be added to this information with  $m_{s_4}^{\Omega_{Q_i}}(\Omega) = 1$  which reflects the total ignorance. Therefore, we can obtain for each question a matrix as follows:

## 5.2. Experimental Results

The result of our work manifested in an *evidential database (EDB)* also called *D-S database* includes all the perfect and imperfect data coming from the different sources. The imperfection in the evidential databases are expressed with the theory of belief functions presented above. Table 4 present an example of evidential table in evidential database stores perfect and imperfect data coming from the different participants (the experts) in “Crowdsourcing platforms” of health care area, where the imperfection is modeled by an evidential value  $V_{ij}$ .

As we have already explained, if the focal element is a singleton and its mass function equal to one, its bba will be a “*certain bba*”. We are in the case of *perfect information*, else if the focal elements are singletons and its  $D_c \neq 1$ , we are in the case of *probabilistic information*, its bba will be a “*bayesian bba*”. Else if, the focal element is  $\Omega$  where its mass function is equal to one, its bba will be a “*Vacuous bba*” and we are in the case of the “*total ignorance*”. Else, we are the case of *possibilistic information* with *consonant bba*. Therefore, integrating evidential databases in smart cities promotes the sustainability of the different urban functions, improves the decision making and the efficiency of smart cities.



$[[Q_i]]$	$s_1$	$s_j$	$s_J$
$H_1$	$m_{s_1}^{\Omega_{Q_i}}(H_1)$	$m_{s_j}^{\Omega_{Q_i}}(H_1)$	$m_{s_J}^{\Omega_{Q_i}}(H_1)$
$H_2$	$m_{s_1}^{\Omega_{Q_i}}(H_2)$	$m_{s_j}^{\Omega_{Q_i}}(H_2)$	$m_{s_J}^{\Omega_{Q_i}}(H_2)$
$H_1 \cup H_2$	$m_{s_1}^{\Omega_{Q_i}}(H_1 \cup H_2)$	$m_{s_j}^{\Omega_{Q_i}}(H_1 \cup H_2)$	$m_{s_J}^{\Omega_{Q_i}}(H_1 \cup H_2)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$
$H_n$	$m_{s_1}^{\Omega_{Q_i}}(H_n)$	$m_{s_j}^{\Omega_{Q_i}}(H_n)$	$m_{s_J}^{\Omega_{Q_i}}(H_n)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$
$\Omega$	$m_{s_1}^{\Omega_{Q_i}}(\Omega)$	$m_{s_j}^{\Omega_{Q_i}}(\Omega)$	$m_{s_J}^{\Omega_{Q_i}}(\Omega)$

**Table 3.** Mass functions coming from the different sources

To combine the different opinions offered by the different participants in the crowd, there are several combination rules expressed via the evidence theory. In this context, we use the *conjunctive combination rule* that it was proposed by Smets improved in the Transferable Belief Model [31]. We chose this combination rule because the sources in this platform are reliable. The combination of the different mass functions ( $m_{s_j}^{\Omega_{Q_i}}$ ) generated by the sources ( $s_j$ ) is very important to implement the evidential database that will be illustrated in the next section.

ID	Symptoms of Alzheimer disease	Evidential value ( $V_{ij}$ )
1	$\{\text{Forgetfulness}\}$	$m_{s_J}^{\Omega_{Q_i}}(H_1) = 1$
2	$\{\text{Forgetfulness} \cup \text{Depression}\}$	$m_{s_J}^{\Omega_{Q_i}}(H_1 \cup H_2) = 0.7$ $m_{s_J}^{\Omega_{Q_i}}(\Omega) = 0.3$
3	$\{\text{Depression}\}, \{\text{Anger}\}$	$m_{s_J}^{\Omega_{Q_i}}(H_2) = 0.6$ $m_{s_J}^{\Omega_{Q_i}}(H_3) = 0.4$
4	$\{\text{Forgetfulness} \cup \text{Depression} \cup \text{Anger} \cup \text{Non-discrimination}\}$	$m_{s_J}^{\Omega_{Q_i}}(\Omega) = 1$

**Table 4.** Example of evidential table

## 6. Conclusion

With growing popularity of IoT and sensor technologies a large amount of data will be produced by different devices in the context of smart cities. Analyzing real-time data and handling imperfect information represent the main challenges of smart cities. In this context, we focus on dealing with imperfection in smart cities data. We limited in this article by modeling data coming from the individual's source. We offered the opportunity for the individuals to express their certainty level about the added information, we modeled the data with the basic concepts of the belief functions theory and we integrated it in evidential databases by using such combination rule. Modeling imperfect data and integrating it in evidential databases promote the urban development, improve the decision making and increase the efficiency of smart cities. The use of the different concepts modeled in the evidential databases in such semantic models (ontologies) guarantees an evidential data interoperability in smart city. In another paper we will show how modeling imperfect data coming from other information sources (like the objects, processors, databases) and we will present how integrate it in evidential databases in order to ensure a reliable information infrastructure for smart cities.

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# Studying the Effects of Peer-to-Peer Sharing Economy Platforms on Society

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**Abstract.** Peer-to-peer sharing economy platforms potentially have big effects on values in society. Policymakers need to develop governance arrangements to benefit from the positive effects, while simultaneously mitigate the negative effects. This requires having a structured overview of the effects of these platforms on the diversity of values that are involved. Currently no theoretical overview of these effects on values is available. The objective of this article is to structure the research into the effects of sharing economy platforms. We use a theoretical mapping that was developed by using a Grounded Theory approach. By positioning the literature onto the map, we derived an overview of the extent in which each effected value has been studied so far. Based on this mapping, we propose five research themes into specific effects of peer-to-peer sharing economy platforms: social values, consumer and societal risks, working conditions and labor market dynamics, environmental sustainability and innovation.

**Keywords.** Sharing economy, Peer-to-peer platform, P2P, Values, Effects, Grounded Theory, Governance arrangement, Literature Review

## Introduction: The Rise of Sharing Economy Platforms

In the past few years multiple peer-to-peer (P2P) sharing economy platforms, such as Uber and Airbnb, have grown exponentially [1]. Their success is, amongst other factors, based on the ability to greatly reduce transaction costs for users and providers in the market [2] and the positive network externalities of platform use. Besides this, the platforms profit from a legal void and the post-economic crisis conditions [3]. The effects of these platforms on society are considerable. The platforms for example hold the promise of more efficient markets, the empowerment of citizens, economic growth and environmental sustainability [4]. However, they also face multiple challenges and run into opposition from incumbent companies and regulators [1]. Issues that are raised include consumer protection, working conditions and fair competition [5].

Policymakers now face the challenge to find the right governance approach towards these P2P sharing economy platforms. On the one hand the possible positive effects should be stimulated as much as possible, but on the other hand the negative effects should be mitigated. In the words of Kenney and Zysman: “these transfor-

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mations need to be simultaneously nurtured, supported, and protected against” [4, p. 4]. To develop suited governance arrangements, it is important that policymakers have sufficient insights into the effects of P2P platforms on values in society. These insights can also support governments that wish to develop P2P platforms as part of their e-government and e-participation policies, in order to assess the consequences of providing e-services via public platforms on societal values. Currently however no theoretical overview of these effects is present apart from separate studies [4][6, 7].

The objective of this article is to structure the research on the effects of sharing economy platforms. We do so by using a theoretical mapping of the effects of P2P sharing economy platforms. Current literature is linked to the effects that are identified in this map. By doing so blind spots in literature are identified and new studies towards specific effects are proposed.

P2P sharing economy platforms in this article are defined as digital platforms where providers meet with users in order to execute a 1-on-1 transaction with a physical world component, where no transfer of ownership takes place. More specifically, only broker platforms are included, which means that providers own the value added assets and the platform controls the user relationship [8]. Uber and AirBnB are the well-known examples of this type of platforms.

The remainder of the article is structured as follows. The next section gives an overview of the types of studies conducted on the sharing economy and positions this article within this theoretical context. In the third section the mapping of the effects of P2P sharing economy platforms will be presented, combined with an elaboration on the approach used to come to this overview. In section four recent publications on the effects of the platforms are presented and linked to the theoretical model. Section five uses this information to identify blind spots in literature, i.e. effects that have been identified, but have not yet been studied. The article concludes with a discussion of the contributions of this article and recommendations for future research.

## 1. Theoretical Context

Research on the sharing economy has only recently been started, with Botsman and Rogers [9] as one of the first to describe the phenomenon as *collaborative consumption* [10]. In the past few years different studies on platforms in the sharing economy have been published, which can be roughly divided into four distinct trends: 1) studies on the mechanisms behind and success factors of platforms, 2) studies on the motivations for sharing on these platforms, 3) studies on specific effects of sharing economy platforms and 4) studies that try to give a holistic view on the effects of sharing economy platforms. Below examples of each of these trends are given and the positioning of this article is elaborated on.

The first trend in literature focusses on the mechanisms behind and success factors of platforms. Examples of publications in this trend are Hill and Wellman [11], who use a game theory approach to prove that by setting the suiting incentives it is possible to get participants to truthfully report on the quality of their offered products; Andersson, Hjalmarsson and Avital [12], who study a multitude of ride sharing companies to find important distinguishing factors for these companies; Kohda and Masuda [13], who show that platforms that absorb risks for users are more successful; Slee [14], who explores the role of reputation systems in the success of platforms; Chen, Mislove and

Wilson [15], who use data analytics to determine Uber's algorithms; and Henten and Windekille [2] who elaborately study the role of transaction costs in the sharing economy.

The second trend in literature explores the motivation for sharing via platforms and the types of users of these platforms. Examples of publications within this trend are Leonard and Jones [16], who studied the factors that lead to trust in websites and digital platforms; Albinsson and Perera [17], who interviewed users of gift economy platforms to find their motivations for sharing; Zekanović-Korona and Grzunov [18], who used a survey to investigate the demographics and motivations of users of Airbnb; and Hamari, Sjöklint and Ukkonen [19], who used a survey to find the intrinsic motivations for sharing on a P2P platforms.

The third trend in theory is to focus on specific effects of P2P sharing economy platforms or effects of specific sharing economy platforms. The following publications are examples of this trend in literature: Isaac [3, 20], who describes how respectively Uber and Taskrabbit became a success and what effects these platform companies have on their environment; Dillahunt and Malone [21], who study the effects of P2P platforms on income opportunities and reintegration of workers; Zervas, Byers and Proserpio [22], who study the effects of the rise of Airbnb on the incumbent hospitality sector; and Schor, Fitzmaurice, Carfagna & Attwood-Charles [23], who study the effects of sharing economy platforms on inclusion and equality in society.

The final trend in literature aims at a holistic view on the effects of P2P sharing economy platforms on society. Examples of publications in this trend are Cheng [24], who breaks the sharing economy down in different subcomponents and describes a broad range of effects (with a focus on work-related issues); Schor [1], who provides arguments both for and against the sharing economy, with a focus on ecological and social aspects; and Kenney and Zysman [4], who focus on the implications and consequences of digital platforms and attempt to sketch the debate around them.

This article proposes a theoretical mapping of the effects of P2P sharing economy platforms and links publications on the effects of these platforms to this overview. This in order to structure the research on the effects of sharing economy platforms and to identify blind spots in literature. With this objective, our article is positioned in the last trend of research that tries to provide an holistic view on the effects of P2P platforms. This article however also strongly links to the third trend that focusses on specific effects, as we connect the specific studies to a holistic theoretical overview of effects on values in society.

## **2. Mapping the Effects of Sharing Economy Platforms on Society**

In this section we present a theoretical mapping of the effects of P2P sharing economy platforms on society. This theoretical mapping was composed since policymakers have to find the best approach towards the development of peer-to-peer sharing economy platform [4] and currently no theoretical overview of these effects was yet present to support them [4, 6, 7]. The mapping was composed from the perspective of Dutch policymakers, but is based on international literature on peer-to-peer sharing economy platforms.

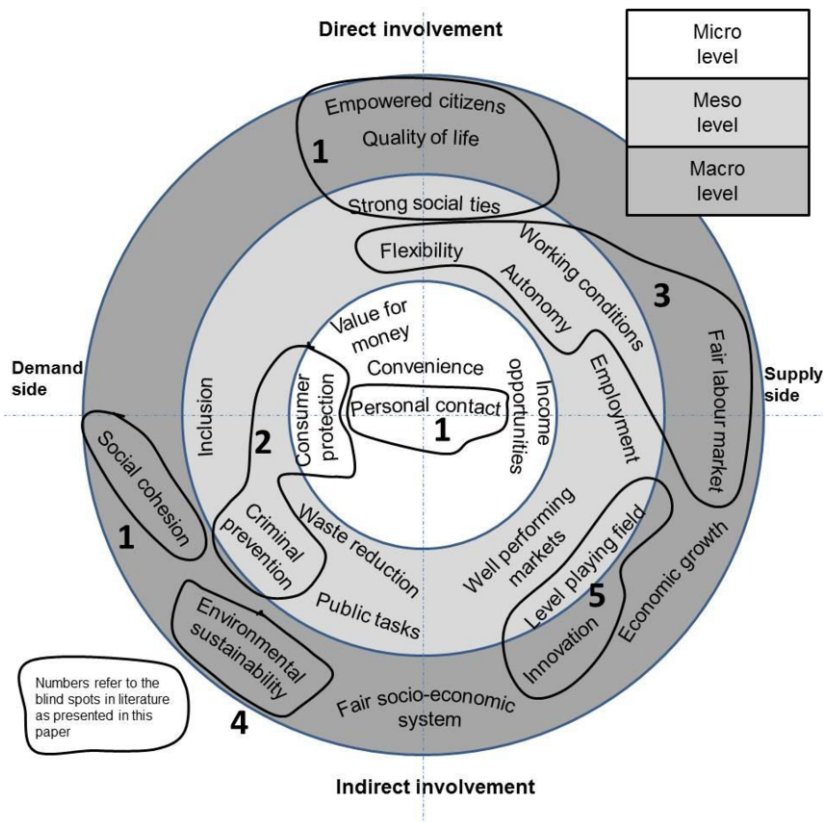
The perspective that was chosen to indicate the effects of the platforms was the perspective of institutional economics. From this perspective it can be argued that poli-

cymakers need to base their decisions on the underlying values that are effectuated, while considering the involved actors and possible institutional arrangements. The effectuated values are thus the main concepts of interest. In this context, we define values as: “Principles or standards of behavior; one’s judgement of what is important in life” [25]. The decision to focus especially on these values is founded on the premise that policymakers should preferably base their decision on the protection of underlying values and not on the existing institutional arrangements (e.g. sector legislation), which are challenged by the P2P platforms [26]. These values are the ultimate objective of policy and instruments such as legislation and other institutions are used to reach this objective. The foundation for developing new governance arrangements to mitigate the negative consequences of P2P platforms should thus ideally be based on guarding the values and not on the continued use of current instruments or institutions.

To come to this theoretical mapping of the effects on these values a Grounded Theory approach was used [27]. This approach is specifically suitable for the exploratory nature of the study and the aim to build a theoretical framework [28]. The approach consists of three steps of coding in which relevant concepts (in this case: values, actors and institutional arrangements) are identified, categorized and related to each other [29]. The theoretical mapping was constructed in the last months of 2015 and was based on the academic and semi-academic sources available at that time. To validate the model, it was validated with independent experts on the digital economy and public policy and with representatives of different involved actors (e.g. a sharing economy company, the municipality of Amsterdam and the Dutch Consumer Association). The derived theoretical map is presented in [Figure 1](#).

The theoretical map discerns three levels of values (visualized by the three rings): values effectuated at a micro, meso and macro level. The differentiating variables for these levels are the scale and the frequency of transactions on peer-to-peer sharing economy platforms. Micro values can already be effectuated when only a small number of transactions takes place on a small scale. Meso values can be effectuated when this scale and frequency rise (i.e. when the platforms grow and start to become successful). Macro values can be effectuated when the scale and frequency of the transactions are at its max and the peer-to-peer sharing economy platforms are an integral part of the economy.

Besides the three levels of values, the model is divided into four quadrants on the basis of two axes. These axes divide the involved actors into four groups. The horizontal axis divides actors into a demand and supply side of the transaction. The vertical axis divides the actors in direct and indirect involved actors. Direct demand side actors are the consumers that use the platform. Direct supply side actors are the providers to the platform. Indirect supply side actors include investors, incumbent competitors and labor associations. Indirect demand side actors include other citizens and consumer associations. Governmental parties are indirectly involved on both the demand and supply side of the transaction.



**Figure 1.** Mapping the Effects of P2P Sharing Economy Platforms on Values in Society

By identifying and structuring the effects of peer-to-peer sharing economy platforms in this theoretical mapping, a holistic overview is created, which can be used by policymakers and other parties that want to increase their insight into the sharing economy. An example of this use would be a large city that wants to assess the effects of the rise of Airbnb within city borders. Besides the practical usability of the model, the theoretical overview of effectuated values is the first academic attempt at analytically mapping the effects of P2P sharing economy platforms. Due to the exploratory nature of the Grounded Theory approach the model contains a broad range of identified effects that transcend specific fields of study and is more complete than similar studies discussing the effects of this type of platforms (e.g. [4] & [24]).

### 3. Structuring the Research

The mapping of the effects of P2P sharing economy platforms can help to create insights into these effects, but also to structure the studies that already have been conducted into these effects. As was discussed in section two of this article, one trend in sharing economy literature focusses on these specific effects. In this section these

**Table 1.** Overview of publications on the effects of peer-to-peer sharing economy platforms

Author & year	Studied effects	Method	Outcome
Benjaafar, Kong, Li & Courcoubetis, 2015 [30]	Waste reduction Value for money Income opportunities	General Equilibrium Model for car sharing	Depending on the price of renting, ownership levels go up or down. Consumer surplus is created in any case. Platform companies make the most profit when rental prices are not too low and not too high
Dillahunt & Malone, 2015 [21]	Income opportunities Employment Convenience	Participatory design approach with 20 unemployed citizens	The sharing economy holds a promise for unemployed persons, however lack of trust in these types of initiatives could be an impediment.
Edelman, Luca & Svirsky, 2016 [31]	Inclusion	Data analysis of Airbnb field experiment	Airbnb users with distinctively African-American names are less likely to be accepted into an accommodation.
Fang, Ye & Law, 2015 [32]	Employment Economic growth	Fixed effects model based on Airbnb data	Airbnb benefits the whole tourism sector and leads to more revenue and jobs. Low-end hospitality jobs will however drop.
Fraiberger & Sundararajan, 2015 [33]	Waste reduction Value for money Income opportunities Inclusion	General Equilibrium Model based on GetAround car-sharing data	Generally car-sharing leads to higher consumer welfare and lower ownership levels. Especially below-median income consumers stand to benefit from car-sharing as they experience higher value for money, new income opportunities and possibilities for inclusion.
Horton & Zeckhauser, 2016 [34]	Waste reduction Value for money	General Equilibrium Model and survey on the attitudes towards use and ownership of different types of goods	Predicted usage of goods is the biggest determinant for ownership. Generally non-owned goods are most likely to be rented, with the exception of cars, which are rented irrespective of the ownership. Diversity of use is likely to increase.
Schor, Fitzmaurice, Carfagna & Attwood-Charles, 2016 [23]	Inclusion Fair socio-economic system	Interviews and participant observation of four sharing economy sites	Equality on sharing economy platforms is hard to establish. It is especially hard to create an equal and robust system. A paradox thus exists between the intentions of the sharing economy and its outcome.
Zervas, Byers & Proserpio, 2015 [22]	Well performing markets Economic growth Value for money	Analysis of Airbnb and hotel data in Texas.	The presence of Airbnb lowers hotel revenue, especially low-end hotels face stronger competition. This increased competition leads to lower prices and increased diversity for consumers. Airbnb does not lead to more economic activity, but changes patterns of consumption.



papers will be linked to the model to show what effects have already been studied and to identify blind spots in current literature. The mapping of the effects of peer-to-peer sharing economy platforms is suited for this exercise since it contains a broad range of effects on different layers and with relevance to different actors involved. The model thus contains anticipated effects from multiple perspectives on peer-to-peer sharing economy platforms and transcends the (possibly) limited views on the effects from specific fields of study (e.g. economists only focusing on economic effects or ecologists only focusing on environmental effects).

The publications discussed in this section were collected using the search engines Google Scholar and Scopus. By searching on the keywords as “sharing economy,” “digital platforms” and “peer-to-peer” in combination with the keyword “effect”, a multitude of publications was found. This set of publications was gathered up to mid-February 2016. Possibly some publications on the effects of these platforms have been missed due to the fact that the keywords of these publications did not match the search criteria. In [Table 1](#) the eight publications that were found and the effects they study are presented in alphabetical order of authors. Besides this the type of study and a short summary of the outcomes are presented.

The overview in the table shows that research has especially been done into the effects of P2P platforms on waste reduction, convenience, fair socio-economic system, employment, income opportunities, inclusion, value for money, economic growth and well performing markets. These values that are covered in the literature are the stand alone values without circles in [Figure 1](#). In the next section we identify the blind spots in the literature and propose research approaches to fill them in.

#### 4. Blind Spots in Literature

Combining the studied effects of [Table 1](#) with the mapping of the effects of P2P sharing economy platforms, results in an overview of effects that have been studied and effects that have not or only partly been studied. These last ones are indicated in [Figure 1](#) by circles, the numbers refer to the blind spots as presented in this section. They are composed of combinations of different effectuated values in the mapping model of the effects. Naturally all identified effectuated values can be studied individually, but since limited research has been conducted so far, we formulated broader blind spots. On the basis of these blind spots we propose several approaches to study values in the domain of P2P platforms.

**Blind spot 1 – Social value** The first blind spot in literature concerns studies into the social value that is created by P2P platforms in the sharing economy. Social value includes concepts such as establishing personal contact, the creation of social ties, strengthening communities and social cohesion. In the discourse around the sharing economy these aspects are frequently mentioned as an argument in favor of the sharing economy development [35], but no academic studies have been identified in this field. An approach to study the social value of P2P sharing economy platforms would be to conduct a survey amongst users to identify the individual effects these platforms have. Respondents could for example be asked whether the use of a P2P economy platform has led to a lasting social tie or to an increased connection with a specific group or community.

**Blind spot 2 – Consumer and societal risks** The second blind spot in literature on P2P sharing economy platforms are the risks for consumers and society. These risks are broadly acknowledged and are input for much governmental concern [4]. Academic studies into these effects have however not been conducted. Studies towards consumer safety, legal liability, prevention of criminal activity and public health could form the basis for the development of governance arrangements to mitigate these risks. A way to study consumer and societal risks is conducting a data analysis of accidents that happened due to the transactions on these platforms. Such a study might however only be possible after most of the damage is done and might not be preferable. Another approach would be to use a risk management approach specifically adjusted to sharing economy practices. Such a study could include a systematic identification of the consumer and societal risk and a theoretical calculation of these risks in terms of frequency and impact.

**Blind spot 3 – Working conditions and labor market dynamics** The effects on employment possibilities due to the rise of P2P platforms have already been studied [21][30][32,33], but the effects on working conditions and macro labor market dynamics have not. Journalists report that the working conditions of, for example, Uber drivers are not sufficient to provide a sustainable living [36], however no systematic calculations on this issue have been conducted. Macro effects of sharing economy platform work have not been studied yet either. The implications of the rise of part-time work through these platforms for the overall labor market could be a cause for policy reform in which flexibility and autonomy in the labour market play a role for both sides of the platforms: the providers as well as the labour force that provide their services through the platform. To study the working conditions of P2P sharing economy platform providers, case studies could be conducted to identify possible problems with working relations. A next step would be to calculate the minimum preconditions for work in the sharing economy and to identify whether these preconditions are met at different platforms. To study the macro effects on the labor market an approach could be used that models the trends and dynamics that are caused by the sharing economy.

**Blind spot 4 – Environmental sustainability** Despite the fact that the concept of the sharing economy is often considered to have a positive effect on the value environmental sustainability[35], we see that this topic is not covered in the literature on the effects of P2P platforms so far. Although some studies have been conducted into effects on ownership levels, the implications of these effects on environmental sustainability are not clear. Besides this, other second order effects (e.g. increased air travel due to Airbnb) might cancel possible positive environmental effects [1]. A way to study the environmental impact of peer-to-peer sharing economy platforms would be to first identify all possible effects on the environment and to create a conceptual causal model of these effects. This model could then be used to create a dynamic mathematical model to calculate the environmental effects under certain assumptions or in certain scenarios.

**Blind spot 5 – Innovation** The last blind spot that we found refers to the value of the innovative character of P2P platforms. How innovative and disruptive are P2P platforms in the domains in which they operate (e.g. the personal transportation sector or the hospitality domain)? This kind of analysis requires economic approaches to reveal the influence of P2P platforms on the business models and the market structure of the domain in which the platform operates.

In summary, studies towards effects in one of these five blind spots have the potential to add value to the academic discourse on the sharing economy and to help policy-makers in determining the best governance approach towards regulation of P2P sharing economy platforms. In addition, these studies will support policy makers in their own decision making process towards developing public P2P platforms for e-services in their operations as a local, regional or national government organization. In the latter case, the influence of P2P platforms on public tasks (currently not covered in this article, but mentioned in the model) also needs to be taken into account.

## 5. Contributions and Future Work

Peer-to-peer sharing economy platforms show an exponential growth over the past few years and are bound to have significant effects on society [1][4, 5]. Policymakers need to come with the right approach to benefit from the positive effects, but to mitigate the negative effects [4]. In order to find this best approach theoretical insights into the specific effects of these platforms are of vital importance [6]. The contribution of this paper is structuring the recent literature on specific effects by linking the individual studies to a theoretical map of the effects of P2P sharing economy platforms. This theoretical overview of the effects is the first academic attempt at analytically mapping the effects of these platforms and as such aimed at going beyond the descriptive accounts as found in the literature. Our theoretical map offers an holistic overview of the effects of these platforms that transcends the limited perspectives from different fields of study on the effects (e.g. economists only focusing on economic effects or ecologists only focusing on environmental effects). Subsequently, we performed a literature review to discover the values that have been studied so far and compared these with the values positioned in our theoretical map.

We identified five blind spots in literature. These blind spots are the effects of P2P sharing economy platforms on *social values*, *consumer and societal risks*, *working conditions and labor market dynamics*, *environmental sustainability* and, finally, *innovation*. Future work can focus on the effects in these blind spots to increase academic understanding of the effects of P2P sharing economy platforms and to support policy-makers with developing suited governance arrangements and developing public P2P platforms for e-governance.

Besides these studies into specific effects, future work can also focus on the improvement of the theoretical mapping of the effects on values, as presented in this article. Links and relations between the identified effects in the model can be added in order to clarify the cohesion of the model. A logical continuation of the Grounded Theory Approach by which the model was developed would be a continued exploration of effects of P2P platforms on societal values. As such, the proposed studies into specific effects can further enrich the model with new insights from the dynamic phenomenon of P2P sharing economy platforms.

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# Can E-Government Give Voice to Citizens? An Empirical Examination of the 'Jaankari' Project

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**Abstract.** This study examines the use of the 'Jaankari' e-government project by marginalized communities. The Jaankari system, implemented in the state of Bihar in India, enables people to call in and make information requests to government departments. Citizens may speak in their own language and from their own location. Results of an analysis of the data of the call records, when regressed against socio-economic parameters, show that people from marginal communities rely on this service. Those from non-dominant castes and women, in particular, use the system in excess of those from more privileged backgrounds. The paper shows implications of these findings for e-governance research and practice.

**Keywords:** E-government, Right to Information, Marginalized population, Transparency, Developing countries.

## Introduction

Information and communication technology (ICT) has the potential of transforming governance [1]. Diffusion of ICT in 1980s caused significant change in governance in public administration, leading to e-government model [2]. E-government is the use of ICT to empower citizens, reduce corruption, and increase transparency and accountability of the government services by disseminating information [2, 3, 4, 5, 6]. Thus, use of ICT is central to e-government. Despite its potential to combat issues of corruption, increase transparency, accountability, bridging digital divide etc., many e-government projects, especially in developing countries like India, have failed [7, 8]. Prior e-government projects in developing countries have relied on text-based provision of services. For example, in India, computer kiosk-based e-government projects were initiated in the early 2000s, where the idea was the citizens could access government services by visiting these kiosks that were located in remote areas, pay a small fee and demand a service. These were entirely text based and needed a certain level of literacy in the dominant language in which the kiosk operated to use them adequately. Most of these projects failed, one reason for which was the inability of many marginal citizens to access the services.

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This failure of e-government leads us to ask, “Can e-government services provide a ‘Voice’ to citizens?” in developing countries. Since the purpose of e-government is not just to transmit information in form of data, but to empower citizens by ensuring transparency and accountability, it is imperative to provide ‘Voice’ to the citizens so that they can, amongst other things, denounce corruption and seek transparency and accountability in government practices by acting on information provided by e-government [9]. However, enabling voice in developing countries like India using e-government would mean to overcome various social barriers including caste [6] which make a certain section of people marginalized and expect them to be silent [9]. Providing voice to these marginalized people would require adoption of ‘localized form of media’ [9]. This study examines this question of voice in e-government in the case of ‘Jaankari’ project which is run under the Right to Information (RTI) Act in the state of Bihar in India. ‘Jaankari’ adopts a localized media ‘voice calls over the phone’ to make RTI reach masses by overcoming the social barriers.

## 1. Theory of Voice

Identification of conditions and means that facilitate voice making is of critical importance to the scholars working on the issues of empowerment [9]. Voice is traditionally understood as the right to speak and ability to create sounds. It is considered as the basis for meaningful social change. Voice has a very local meaning; its true meaning has to be understood in the local context where voice is made. For example, in India social structure gives power to a privileged group of the population, who may stand against marginalized people. Indian social structure expects these marginalized people to remain silent and not let them exercise their voice. This has led to an alternate theorization of voice. An alternate theorization of voice goes beyond the traditional understanding of voice as simply the right to speak and make sound, and defines voice as the ‘right to be understood’ [9]. It stresses the importance of empowering and giving voice to those marginalized people who, because of socio-economic conditions, often remain silent. It asks to alter the social structure and turn the power equation of society in their favour by making them the center of discussion [9]. Voice is both value and process [10]. It means voice should be seen as the act of valuing those frameworks of organizing human life which give importance to the process of giving right to marginalized people to make voice and be understood by the larger community. Voice is also the sound of specific encounters in social life. Specifically, this alternative view defines voice in following way:

*“Voice needs to be seen not simply in terms of human capacity to create sounds but the politics of speaking in contexts in which the right to speak is a privilege associated with the structures of domination undergirded by the caste, class and gender” [9; p.141].*

Media is the principle vehicle for making voice. Scholars with an alternate perspective of voice question the use of traditional media for making voice which might be controlled by government [11] and private firms [12] to support the status-quo [9]. Thus, traditional media are not suitable for changing the status-quo of power structures. Designing of media within the local context might be one solution to ensure inclusiveness [9]. Local media would provide the opportunity to marginalized people to collect information and make it their voice that may be heard by others. There have been several efforts in the past where local media has been designed to raise voice against the status-quo such as ‘Jan Sunwais’ [9] and Gandhian Ahsram in India [13]

and media for freedom struggle in Rhodesia [11].

## 2. E-Government and Voice

E-government focuses on the use of ICT to disseminate information about government service. Use of ICT is critical to e-government. It traditionally uses internet based, portals-based or kiosk-based ICT models to provide such government information. However, these projects often reinforce the existing social and political structures [6], [14], [15], [16] and create a digital divide [17]. Thus, use of such traditional media for empowering citizens (in other words, giving ‘voice’) in e-government raises the question of whether marginalized communities are able to make their voices heard. To provide voice to the marginalized community, e-government needs to adopt a local media by which information could be shared. Prior research in e-government has considered the role of voice in governance [18], where the idea of enabling voice is drawn from Hirschman's theory, which emphasizes the ability of citizens to express their views to the state. Voice is then seen as an enabler for citizens to inform the state of their views, desires and frustrations. The form that this voice assumes is not important – it may be through written messages, through protests, through official complaints; the difference in this research is that voice is being embodied in the ability to speak, in the natural language of the region, and communicate views to the government. Prior research on this particular aspect of voice is absent.

## 3. Methodology

This study has used case study method and collected two types of data: data on ‘Jaankari’ project and data on socio-economic factors which characterizes the marginalized population of Bihar. Data on ‘Jaankari’ has been collected from the coordinating institute and data for socio-economic factors has been collected from the 2011 census data available on the government of India website<sup>2</sup>. Case study method is appropriate for such studies where multiple sources of data are used [19].

## 4. Case Description

### 4.1 Jaankari Project

‘Jaankari’ is an e-government project which runs under the Right to Information Act (RTI), 2005. RTI Act came into force on 12th October, 2005 with an objective to provide ‘right to information’ to citizens for accessing information under the control of public authorities, to promote transparency and accountability in the working of public authority. Information means *“any material in any form including records, documents, memos, e-mail, opinions, advices, press releases, circulars, orders, logbooks, contracts, reports, papers, samples, models, data material held in any electronic form and information relating to any private body which can be accessed by a public*

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<sup>2</sup> <https://data.gov.in/catalog/villagetown-wise-primary-census-abstract-2011-bihar>



authority under any other law for the time being in force”<sup>3</sup>. Right to Information means the right to “(1) Inspect works, documents, records; (2) take notes, extracts or certified copies of documents or records; (3) take certified samples of material; (4) obtain information in form of print outs, diskettes, floppies, tapes, video cassettes or in any other electronic mode or through print outs”<sup>3</sup>. Standard process for filing RTI application is to fill and submit the application form either in English or other official languages of every state in India. The form has to be submitted either by hand or through post to the respective Public Information Officers (PIO) of the department where the information is sought from. All these PIOs offices are usually situated in the respective state capital. While submitting an application, citizens also need to deposit Rs. 10 (approximately 0.15 USD) either in post office or make a demand draft. While implementing ‘Jaankari’, Government of Bihar realized the need of addressing various social and economic issues that might cause its use to be limited to elite class population only. Some of these issues are; caste, class issues, disadvantaged groups and vulnerable groups, particularly the women, the aged and the people who are traditionally isolated from the government programmes. Followings are some of the specific issues which Government of Bihar considered while implementing Jaankari: “(1) Inability of people to fill the form for filing RTI application, (2) Ignorance of the department to approach for the information, (3) Identification of the right PIOs to approach for the information, (4) Plurality of languages such as Maithili, Bhojpuri, Magahi, Angika etc. which makes the filing of application in ‘Hindi’, official language of Bihar difficult, (5) Uncomfortable with meeting government officials face -to-face for seeking information, (6) Sending RTI application by post was not feasible option because citizens won’t be sure whether the application would reach on time, (7) Depositing application fee of Rs.10 was challenging, (8) People need to go either to post office for depositing the money or to banks for making demand draft. This could cost them lots of time, and (9) If one does not get the right information, filling an appeal is even more complicated.”<sup>4</sup>

Keeping these issues in mind, government decided that ICT need to be innovatively employed for expanding the base of the RTI access and hence adopted ‘Call Centre’ (also known as facilitation centre) model. It was decided that voice communication over phone line will be the better solution of above problems for taking RTI to masses. This facilitation centre model ensured that citizens don’t need to do any physical movement and physical transaction for filing an application. Citizens could make phone calls from their home without physical movements. A dedicated number ‘15531’ was allocated to the centre. Government partnered with Bharat Sanchar Nigam Limited (BSNL) to use its premier service plan for charging the RTI application fee from applicant. Whenever a person makes a call to facilitation centre, BSNL automatically deducts Rs. 10 from the phone balance of applicant. Premier Service plan is special service for subscribing premium services like Doctor’s Advice, Fortune Telling, and Exam Results. Service providers (government in the case of ‘Jaankari’) get their share of revenue from BSNL at the end of every month.

#### 4.2 Procedures for filing “Request for Information”:

‘Jaankari’ follows a unique process for filing RTI application. Citizens need to call, tell

<sup>3</sup><http://righttoinformation.gov.in/rti-act.pdf>

<sup>4</sup> <http://cic.gov.in/CIC-Articles/JAANKARI-pdf-26-03-07.pdf>

their name and address, and tell the information and name of department s/he wants information from. This call is recorded and typed on computer by the call centre executives. If in case, citizens don't know the name of department, executives help them in identifying. Staffs are also well trained to handle a situation where citizen only knows the problem but not the exact information s/he needs. Once application has been made over phone, executives will confirm with the caller and make its two copies. First copy is sent to the applicant and second copy is sent to PIO. Each application has a unique reference number. PIO gets 35 days of time (from the date of application) to respond to the applicants directly. Call centre executives remind PIOs on 34 day. Delay in reply without adequate reasons invites penalty. If applicant has either not received or not satisfied with the information, s/he can call up the call centre again and explain dissatisfaction after quoting reference number. This call is also recorded and called as 'first appeal'. It is forwarded to the first appellate authority in the same manner as the RTI application. If the applicant is not satisfied with the first appellate order, s/he can file second appeal. Both first and second appeal will have the requisite charges of Rs. 10/per call. Table 1 gives the comparison of 'Jaankari' with standard RTI model.

**Table 1:** Comparison of 'Jaankari' with standard RTI model

Particulars	Standard RTI model	Jaankari
Medium to file the application	Filling an application form	Making a voice call
Language(s) used to file the application	English or other official language of the state	Citizens can file the application even in local languages such as 'Bhojpuri' and 'Maithili'
Mode of application fee payment	Demand draft or cash deposit	Payment through phone call via BSNL premier service
Pre-requisite to make an appeal	Applicants need to have the clarity on the type of information and name of department where is sought from	Knowledge of the problem is sufficient to file the application. Applicants need not know the department. Call centre executives help in identifying the department

## 5. Data Collection and Analysis

This study has collected data on total number of calls made for first type of enquiry during January 2011- December 2014. Total number of calls consists of (1) number of first time calls made for filing application, (2) number of calls for first appeal, and (3) number of calls second appeal. Total numbers of calls have been divided across various districts of Bihar. There are 38 districts, each with different socio-economic factors. The study has done analysis on aggregated number of calls made during 2011-2014 from each district and following socio-economic factors of respective districts: (1) Number of females, (2) Number of illiterates, (3) Number of illiterate females, (4) Number of Schedule Caste (SC) and Scheduled Tribe (ST) (5) Number of cultivators (6) Number of agriculture workers (7) Number of marginal workers and (8) Number of non-workers. Linear regression was run to examine the influence of each of these 8 variables on total number of calls. Table 2 reports the findings of the analysis.

**Table 2:** Regression output for ‘Total calls’

SN	Variables	Correlation	R-Square	P-Value
1	Illiterate Population	.557	.310	.000***
2	Female Population	.528	.279	.001**
3	Illiterate Female Population	.510	.260	.001**
4	SC+ST Population	.354	.125	.029*
5	Cultivator Population	.484	.234	.002**
6	Agriculture worker Population	.474	.225	.003**
7	Marginal Worker Population	.424	.180	.008**
8	Non-Working Population	.545	.297	.000***

\*\*\*Significantat.001  
\*\*- Significant at .01  
\*-Significant at .05

Table shows that each of these eight variables has significant influence on total number of calls. They independently explain a significant variation in total calls. For ex., Illiteracy, female population and non-working population independently explain approximately 30% variations. Similarly, Marginal workers, cultivators and agriculture worker population independently explain more than 20% variations. Moreover, these variables have significant positive relationship with total number of calls. Illiteracy, female population, non-working population and illiterate population variables have more .50 correlations. It means that a district with more illiterate population has made maximum use of ‘Jaankari’. Similarly a district with more number of female populations, more non-working population etc. has made more number of calls. This shows that use of ‘Jaankari’ is significantly related to population characterized by the socio-economic factors which represent marginalized community.

**6. Discussion**

E-government concerns the dissemination of information to bring transparency, accountability, thereby empowering citizens. However, its purpose is achieved only when it reaches the masses and offers inclusiveness. In other words, it should give voice to the entire population. However, raising voice in a country like India is highly influenced by various social factors such as caste, race, and gender etc. which make a group of people marginalized and expect them to remain silent. A traditional medium of communication always reinforces the status-quo and hence proves to be little help for these marginalized people to make their voice heard. Giving voice to these marginalized people is even more difficult in the context of e-government where the use of ICT is essential. Because of its use of traditional media, use of most of the e-government projects becomes a privilege of elite classes and hence inclusiveness remains a challenge. Voice theory says that adoption of a localized and non-traditional media could be a solution to this issue. Building on the concept of this theory, this study examined the case of Jaankari e-government project which has adopted a localized media ‘voice-based technology’ to demand information. This study has examined whether the adoption of this media has resulted in giving voice to the

marginalized citizens. It has used eight socio-economic indicators of marginalized population and has examined the use of Jaankari by the citizens with these socio-economic characteristics. Findings from this study confirm the argument of voice theory. Jaankari has been able to reach those marginalized people. Its use is highly related with the population of these marginalized people such as females, illiterate, non-working and so on. This paper contributes to e-government literature by showing that enabling marginal citizens to speak directly to the state has a significant impact in enabling them to obtain government services. The results show that those in marginal categories, non-dominant castes and women, are most prone to use these voice-based e-government services as opposed to those who are from dominant communities. This finding has strong implications for design of e-government systems in developing countries, which have hitherto ignored the inclusion of voice-based services in e-government systems. Further, the findings have implications for practice, as government managers can enable greater inclusion and participation by marginal populations by explicitly enabling voice-based services.

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# A Serious Game Prototype to Encourage Citizens to Use e-Government in Libya

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**Abstract.** Citizen engagement was identified as one of the main factors in e-government success, and many projects failed due to a lack of citizen engagement, particularly in developing countries. The benefits of utilizing serious games in education and training and their positive impacts in the field are expected to be the same in an e-government context, hence, it is argued that the use of serious games to expand knowledge, training, build confidence and trust among citizens can improve their use of e-government service.. This research paper discusses a study conducted with the aim of developing a “e-Reservation” service as a serious game that expands knowledge and trains Libyan citizens on how to act when using the actual e-service. The proposed serious game is dedicated to familiarizing players with all rules and system requirements. Results show that the use of serious games has a positive impact on citizens’ motivation to engage with e-government.

**Keywords.** E-government; Participation; E-reservation; Serious games.

## 1. Introduction

Utilizing IT innovations enhances government services delivery to and communication with the public is the main object of e-government [1]. However, some e-government implementation projects have failed to accomplish this objective, especially in developing nations, because of a disconnect between e-government initiatives and citizen use of services. Systems failed to engage citizens due to a lack of knowledge regarding e-government advantages, less confidence to use IT tools, and technology knowledge as a determinant of users’ participation [2, 3]. Privacy and security barriers also lower trust levels related to the adoption of e-services, compounded by an underlying lack of trust in government itself in many contexts [4, 5].

Libya still in the early stage of e-government development [3]. Thus, it is necessary to take into account the cultural influences in order to narrow the gap between the reality and design. This gap is one of the main reasons for the cause of the failure of e-government projects in developing countries [6]. Therefore, Libyan government should incorporate citizen awareness, trust and participation for successful e-government implementation. As general citizens, employees and business sectors currently have limited knowledge of e-government; this has introduced a major challenge for the Libyan government to move forward in successfully building an e-government project [3].

There are numerous approaches to exchange information or thoughts with people, in general, using modern communication methods, one of the most effective of which is serious games, because of their impact and focusing on all age groups of citizens. Recently, the use of serious games in education, training, healthcare, safety, military and commercial has become a point of focus [7, 8]. According to Knight [9], serious gaming can be utilized to deliver significant objects, increase various skills and allow learners to practice scenarios that are impossible or difficult in the real-world due to cost, time and safety etc. [10, 11]. This study applies the benefits of using the serious games as a tool to encourage citizen participation and to raise the level of public trust in e-services. In addition, it determines how best to utilize serious game technology to provide significant improvements that translate into better citizen invitations to use e-government, especially in developing nations. Thus, this task becomes an integral factor in making the knowledge learning as exciting and interactive steps. Therefore, this paper presents a serious game “e-Reservation” system, a game that allows citizens to learn how to perform while using the actual service, expanding their knowledge of all requirements and information needed. Moreover, it explains privacy and security issues as well as the advantages of using e-reservation, such as saving time and costs.

e-Reservation serious game increases citizen engagement in e-government services by explaining the process and values of the existing reservation system, starting by advertising the service and its benefits to citizens through providing full knowledge, followed by learning how to perform with the services then practicing by following the same steps, which is intended to increase confidence and change beliefs and behaviours. Therefore, the level of trust in government and online services is achieved through understanding explained rules of privacy and security. Finally, all of these processes should lead to instilling motivation, increasing public awareness and motivating citizens to take action.

## **2. Literature Review**

E-government implementation is not simply transferring a demonstrably successful system from one context (i.e. country) to another, especially from developed to developing country, as each context of e-government deployment has unique requirements, with particular differences between developed and developing countries [12]. Practices and cultures have been flagged important because of unsuccessful e-government implementations, which have resulted in the identification of many barriers to adoption, including issues of citizen confidence, privacy and security; citizens' appropriate skills; and the acceptance of e-government as an alternative to traditional governmental interfaces (i.e. bureaucratic systems) [13]. In addition, the digital divide issue in society is also a barrier against e-government success in developing nations. As the primary users of e-government services, citizens play a fundamental role in the success of e-government [6, 12]. Therefore, public usage of e-government services is a core factor of success. E-government literature presents many previous studies that focused on the factors influence e-government success that reflect the inherent complexity of e-government, with a noted emphasis on technological aspects. Some studies have examined decision makers' attitudes and political pressures, organisational and management, legal and regulatory, institutional and environmental barriers, but few studies have considered the users' perspective, such as citizens' perceptions of e-government use [14]. Huge gaps in e-government research still need to be filled to cover

citizens' intention to use e-services and to identify ways to build citizens' confidence in both government and technology [15]. In some cases, e-government experience user failure is a reason for citizens rejecting the use of the system, in spite of the systems being well presented in terms of technological aspects and project development [16]. Some techniques such as m-government was introduced to increase the availability of governmental services and raise citizens' engagement [17]. However, more efforts are still required regarding building citizens' confidence and trust of using e-services. On the other hand, many fields of research have benefited from using serious games technology as safe, low costs, easy to distribute and effective tool [18].

According to Djaout et al [19], serious games are computer programs designed for serious purposes such as learning, teaching and communication in an entertaining format. Other scholars defined serious games as video games, virtual environments and simulations that provide opportunities to be employed through responsive scenarios, gameplay or encounters, to inform and influence to promote well-being and experiences to express meaning [9, 20]. The success or quality of serious games is characterized by the degree to which their aims are achieved. Serious games are identified as experiential environments with less or no entertainment characteristics for experience [10]. According to [21], given the diversity of its applications, it appears that the concept of the serious game can apply to a vast field of applications, and it is not limited to training, although it seems particularly beneficial for educational purposes. With particular modifications of the salient characteristic features of serious gaming (i.e. teaching and entertainment objects), the method can be applied in almost any context (e.g. for all learners, from preschool age to adult learning) to improve knowledge and enable the acquisition of skills [22]. In recent years' serious game technology has been used for different purposes such as education, healthcare, training, commercial, well-being, advertisement, cultural heritage, interpersonal communication and military training [20, 23]. Therefore, the functions of serious gaming should be amenable to the improvement of citizen participation and employee training in the e-government concept.

To conclude, with the growing attention and use of the gaming industry for non-entertainment purposes, serious games and game-based learning technologies have brought undeniable benefits to all fields in which they have been deployed. Therefore, it is clearly necessary to understand how the use of serious games affects, benefits and improves the quality of e-services. Ahmed et al [24] proposed a framework that utilized serious games to address four main elements that affect citizens' intention to use e-government: usefulness, (perceived) ease of use, internet trust and government trust.

### **3. Methodology**

This section provides an explanation and justification of the research process design, methodology, and methods of data collection and analysis, taking into account the nature of the research done in the area of IS.

#### *3.1. Research Method*

Libya as a developing country was chosen as a case study for this research were very few or no earlier studies have been conducted. Considering the research objectives, and the e-government service available for citizens to use in Libya. This research is investigating the behaviour of individuals; therefore, it is a very subjective issue. Each



individual has their own experience and perspective. For this reason, a quantitative research methodology was selected for data collection.

A criteria was selected for this systems used in this study, e-reservation services for booking time slot for passport renew/issue systems provided by local governments in Libya. Then a serious game prototype was developed to fulfil all objectives. Then a questionnaire was developed to discover how the participants satisfy after e-Reservation game. Five-point Likert-type scale formats were used to measure the scale items. Result of post-test questionnaire were analysed using SPSS (Statistical Package for the Social Sciences). The samples are the actual e-services user (Libyan citizens) who are intending to either renewing or issuing new passport at Passport and Immigration Departments in Libya. Selection of these participants sample was for several reasons. First, guarantee that all participants will be Libyan citizens who are the targeted customers of the actual e-reservation service. Second, this sample would allow the researcher to gain both pre-test and post-test evaluation. Last, insuring sufficient reliable respondents for the questionnaire.

3.2. *Game design*

E-Reservation serious game was developed based on a framework that applies the benefits of using serious games as a tool to improve citizens’ intention of using e-government [24]. The model shown in figure 1 designed by Lotfiet al [25] allows instructors and trainers to design their own serious games to make the acquisition of knowledge and skills more efficient and entertaining to attract learner engagement.

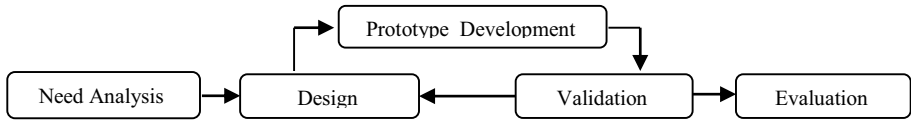


Figure 1: Game Design Model (Lotfi et al, 2014)

3.3. *e-Reservation game implementation*

E-Reservation game is serious game that aims to empower citizen engagement and participation in e-government services. It is dedicated to citizens of different age groups and educational levels. The game provides players with excitement since the game is will be full of learning and acquiring best practices, expanding e-services knowledge. Moreover, players will discover or deploy some basic IT knowledge that can raise the level of trust in e-services. Also, the e-Reservation game explains privacy, security and efficiency in the e-services to promote trust between citizens and government. Game play is based on rules in questions, whereby players will be asked about certain service requirements and information needed. Afterwards the players can fill a short questionnaire that seeks to investigate user satisfaction and change of intention to use an actual e-reservation system provided by the government. The game was evaluated against several points, such as delivering the expected objectives, improving citizens’ participation and engagement in using e-Government and assessing users’ willingness to use more games related to e-services.

### 3.4. *e-Reservation gameplay*

The proposed serious game is based on the actual reservation system that is available for citizens to use in order to book for renewal/issuance of passports in Libya, thus the e-Reservation game follows all of its steps, needs and requirements. Moreover, the game's entertainment starts by the sampling system requirements, such as national ID, computer and internet connection for playing a character to collect in order to be given a key to use the service. Among the outcomes that the proposed game must deliver to learners is a working knowledge of system requirements. Consequently, the filling information level entails the player selecting from one of three options for every section, only one of which is in the correct format.



**Figure 2:** Screenshot of actual reservation system, filling information and IT knowledge levels of e-Reservation serious game

Non-play characters explain all privacy and security protocols used to protect citizen data and information, as shown in figure 2.

### 3.5. Game objectives

The first objective of the e-Reservation game is to familiarize all citizens with the concept that their government is offering them practical services that can save time and costs as well as guarantee some level of transparency. The second objective is to expand public knowledge regarding using available services, through explaining all needs and requirements. Learning how to perform and use actual services is the main underlying objective of the e-Reservation serious game. By following the exact same steps and required information in a simulated (though essentially identical) environment inspires personal confidence to use the actual service. Another objective is to increase the level of trust in technology by explaining the basics of security knowledge to players and the privacy background of the service through informing the user of who can access to their data and for what purposes. Finally, it increases the level of trust in government itself by showing care about serving the public and improving the way they are served in terms of efficiency, transparency, privacy and confidentiality.

## 4. Finding

This section contains the overall data analysis results of the use of the proposed e-Reservation serious game by the sampled Libyan citizens. The game was used by 85

people,91% of whom were males. All respondents were coming to issue/renew their passports in different occasions during the five days of fieldwork. The questionnaire conducted included 19 citizens aged between 15 and 24 years, 29 aged 25 - 44, 21 aged 45 - 64, and 16 over 65 years old. Their occupations were categorised as students (19%), government employees (34%), employees of private businesses (16%), self-employed (8%), unemployed (12%) and retirees (11%). Nearly half of the participants had completed a university degree, 28% had finished secondary education, 14% have reached postgraduate level and the rest had basic education (e.g. high school). The statistics shown in figure 3 indicate that at baseline, 28% did not know what e-reservation services are, 32% knew all the requirements and 71% had not used it themselves before.

In terms of having booked appointments, 57% of participants had been booked for the day they came in. However, 75% of them asked a friend or relative who has good IT knowledge and experience to book their appointment. The five-point Likert-type scale was used to measure the participants’ satisfaction in terms of understanding the nature of the service, the needs and requirements of use, how to use the service and understand privacy and security issues whose results are shown in table 1.

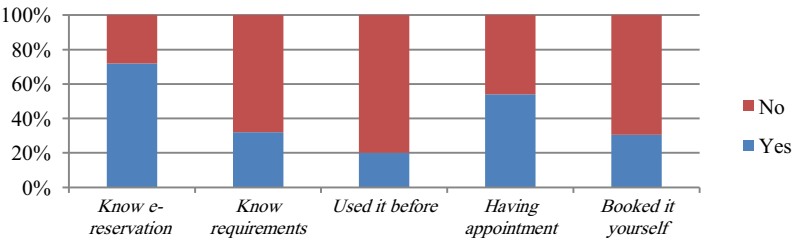


Figure 3: e-reservation service experience

After using the game, 78% of respondents expressed satisfaction and willingness to use the actual e-reservation service provided by government (measured in terms of confidence, ease of use and usefulness) was expressed by 82% of citizens. Finally, the vast majority (88%) said they would recommend the e-Reservation game to others.

Table 1: Game Evaluation Post-test

Theme	Average	Percentages
Satisfaction	3.9	78%
Willing to use actual services	4.12	82%
Recommend the game	4.4	88%

To conclude, comparing pre-test and post-test collected result indicated that e-Reservation game has improved users’ confident and intention to use the actual service. Therefore, the use of serious games has good impact on citizens’ participation in e-government context.

5. Discussion

This paper examined how serious games would provide an opportunity to improve public engagement in e-government to reduce the probability of failure by focusing on e-government clients’ participation and the use of serious games as a tool to increase citizens’ intention to get government information and to conduct governmental online

transactions. The results show that 57% of respondents succeeded in booking an appointment, but only 25% of them did this without assistance. Therefore, 75% of respondents who have booked their appointment did not make it themselves. Thus, there is undeniable problem among citizens' intention and ability to use the governmental e-service provided for the reasons of lack of confidence, IT knowledge, and experience. On the other hand, after testing the given serious game, their level of confidence increased to the extent that 82% of participants were willing to use the real system. This significant change in users' intention was made after learning, practicing and expanding knowledge about e-services. Therefore, serious games could provide a great opportunity to e-government in developing nations if used to empower the public. Nevertheless, some respondents made suggestions to improve the proposed game, such as providing the game for mobile platforms for easier and wider distribution and accessibility. Others argued that entertainment should not be included in learning and practicing the game, reflecting the traditionally austere interactions of citizens and government in legacy systems of governance.

## **6. Conclusion**

A large number of users are latently doubtful and reluctant to adopt e-government in developing countries for many reasons, such as the digital divide, less internet experience and disillusionment with (and lack of trust in) government generally. However, organised tools to build confidence, such as serious games, represent an opportunity to improve e-government adoption. Therefore, governments should make efforts to encourage the public to engage in use of e-services, which leads to e-government success and paves the way for e-commerce. This work has proposed and tested a serious game prototype to motivate users to participate in e-government, administered to Libyan e-government clients. Post-test evaluation data was collected, which indicated that the proposed serious game is dedicated to follow the sequence steps of the actual reservation system with detailed explanation of each stage, to gain familiarity and confidence. Additionally, it informed players of all rules and system requirements. The evaluation indicated that a significant improvement could be delivered to the field of e-government adoption by using serious games as tools to bridge the digital divide and increase public awareness.

For future work, it is believed that the proposed solution of using serious games must be expanded and tested in different developing countries. In addition, further work is needed in the implementation and design of serious games, to identify how it could be generalized and facilitate more citizens' participation and engagement in e-government for instance using mobile phones games.

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# e-Government Implementation and Adoption

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# E-Government Implementation in Developing Countries: Enterprise Content Management in Rwanda

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**Abstract.** E-Government is now on the rise in developing countries. While developing countries can “leapfrog” technology generations, the necessary organizational change is another matter. In industrialized countries technical systems have been developed over long time in parallel with institutional development; developing countries hope to make that journey faster. Most of the e-Government implementation research focuses on developed countries. It is important to explore the relation between the literature and the findings in the context of developing countries as to come up with a gap to reduce. An interview study with 56 people in 10 government organizations involved in implementing a government-wide enterprise content management system was conducted to find out how critical success factors found in literature on implementation of information management systems relate to the situation in the Rwanda public sector to discover the step forward in Rwanda. We find a large gap between expectations and results due to a strong focus on the technical tool and little concerns about issues related to organizational change.

**Keywords:** e-Government, Implementation, ECM, Developing countries, Rwanda

## 1. Introduction

Using IT for managing information in an organization is an issue that has attracted a lot of research over a number of years. Research has concerned technical as well as organizational and user-oriented issues. There are several reviews of the literature in the area. Some recent ones (2012) on Enterprise Content Management (ECM), management of diverse and unstructured information include those by Grahlmann [1] and Alalawan and Weistroffer [2]. Another three reviews of the related concept of Enterprise Resource Planning systems (ERP), from 2013, 2015 and 2016 respectively include those by Shaul and Tauber [3], Norton [4] and Saade and Nijher [5]. These studies provide a number of critical success factors for implementation of information management systems that aim

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at supporting organizations in implementing those systems to manage their information content. Managing information on a large scale is of course a key issue in e-government and systems labelled ECM, ERP and similar IT systems are frequently used in governments across the world. However, implementation of such systems goes with challenges in any type of country [6]. A major challenge involved is that managing information in large and diverse organizations, of which governments are very good examples, involves tying together different information from many sources which may work under different regulations and be differently organized.

In developing countries today we find an increased interest in e-government including implementation of ECM and other organization information management systems. An expectation, or hope, is that e-government will emerge more rapidly in developing countries as the technology is already there. It has been developed over many years in the industrialized world and is today relatively cheap and standardized. By example from the rapid spread of the mobile phones across the developing world, so would e-government.

However, major challenges in ERP or ECM implementation pertain to organizational issues [6]. Effective and efficient use of technology requires effective organization. In the industrialized world government organization has changed considerably over the e-government decades as technology has permeated the organizations. In developing countries much administration is still manual. Now modern technology is being installed, the same technology as in governments in developed countries but in very different organizations. Of course it would be good if the developing countries could leapfrog not just some technology generations but also some implementation mistakes done in other countries. But is that possible?

As there is yet little research on e-government in general from developing countries, particularly concerning organizational issues, this paper reports a case study of e-government in Rwanda. The paper studies the partly completed implementation of one of these systems, an ECM system labelled DTWMS, document tracking and workflow management system. As of today it is implemented in 120 government organizations (project coordinator, 2015, personal communication, August 12) but use of DTWMS varies a lot among those organizations. Many organizations do not use it at all. This study aims to find success factors in implementation of the DTWMS and to relate them with those found in literature on implementation of information management systems in order to formulate the step forward for Rwanda case.

## **2. Related work and the case of Rwanda**

Klein and Sorra [7] find two key determinants of innovation implementation effectiveness: (1) implementation climate, defined as “targeted employees’ shared summary perceptions of the extent to which their use of a specific innovation is rewarded, supported, and expected within an organization” [7, p. 1060]; and (2) innovation-values fit, defined as “the extent to which targeted users perceive that use of the innovation will foster (or, conversely, inhibit) the fulfilment of their values” [7, p.1063]. Implementation climate affects implementation effectiveness through skills, incentives, and absence of obstacles, while innovation-values fit impacts implementation effectiveness through user commitment [7, 8]. Steenkamp [9] found that the key reasons indicated for not adopting eXtensible Business Reporting Language (XBRL), a language for electronic

communication of business and financial data, are that it is not yet an obligation in South Africa to adopt it and according to respondents they do not see any benefit in adopting XBRL [9].

The above three research works tackle, in general, on issues of innovation, technology in relation to implementation climate in this case meaning ‘organizations’ or ‘governments’ and users.

Looking at specific technologies for information management, Enterprise Content Management (ECM) and Enterprise Resource Planning (ERP) are the two main technologies to manage mainly unstructured and structured information respectively in an organization setting [10]. Implementation critical success factors of ERP systems cited include organization fit, skills, management structure and strategy, software systems design, user involvement and training, technology planning, and project management, user friendliness, alignment with user needs, change management [11, 12]. Literature works such as Norton [4] identified 27 critical ERP implementation factors among which balanced team, business process re-engineering, change management, clear vision and communication plan are the top five. Likewise, Horne and Hawamdeh suggest five categories of factors that impact ECM implementation: managerial factors, user factors, task-related factors, technological factors and content factors [13].

As concerns developing countries, Nkohkwo and Islam [14] as well as Weerakkody *et al.* [15] suggest that the most salient challenges include ICT infrastructure, human resources, legal framework, Internet access, the digital divide, and inability to access e-government services using local languages. While such studies consistently mention major general challenges in e-government implementation, there is yet little knowledge on issues in information systems implementation, especially ECM implementation issues in public sector organizations in developing countries. A study by Katuu [16] on a developing country on ECM implementation highlights the penetration of ECM among organisations and their vendors but it does not tackle any issues on its implementation in the public sector.

In order to find critical success factors in implementation of ECM in a developing country and to relate them to literature, this study considers a case in the Rwanda public sector where an ECM labelled ‘DTWMS’ (Document tracking and workflow management system) was implemented. As described in a Country Report [17], e-government in Rwanda is part of an ambitious modernization plan where IT plays a major role. It includes a long-term – 20 years – economic development plan (“Vision 2020”) as well as medium-term strategy (“Economic Development Poverty Reduction Strategy”) and the National Information Communication Infrastructure (NICI) plan. Together these plans aim to transform the country from an agrarian economy to an information-rich and knowledge-based middle-income country by 2020 [17]. As indicated in [18], key actors in the NICI plan are the Ministry of Youth and ICT at e-government policy and strategy level, Rwanda Development Board/IT (RDB/IT) department at the level of project co-ordination and implementation, and Rwanda Utilities Regulatory Agency (RURA) as the national ICT Regulating Agency [18].

The project of implementing the DTWMS started in 2010 and was expected to be completed by 2015 [17]. An ECM system was procured by RDB which also customized it and trained staff [19, 20]. The goal was to improve information sharing and management and to improve how administrative processes are carried out in public sector. Main outcomes are cited as reduction of petty corruption, increased accountability

and transparency, increased efficiency, and increased productivity of employees [17]. The project was funded by World Bank [21] and out of the total funding of 10 million USD, 1.7 million was allocated to the DTWMS project (project coordinator, 2015, personal communication, August 12, 2015). The DTWMS was built to help public organizations to manage and exchange documents, emails and other unstructured information electronically, not only internally but also across the entire public sector as necessary to improve administrative processes. It was originally intended to be used by the Office of the President, all ministries and organizations under those ministries. Later all province headquarters and local government were included. The system was first introduced by end of 2012 in ministries and by beginning of 2013 in local government organizations.

### **3. Method**

The study is based on semi-structured interviews with 56 people – managers, users, and IT staff – in ten public organizations in Rwanda, eight in local government and two in central government. Ten organizations were selected based on system usage data, which is regularly retrieved by the RDB/IT department. We inspected usage data from 50 organizations (30 districts, 15 ministries and 5 provinces) from February to May 2014. We selected the three ones (one ministry and two districts) who had the highest use (700-1000 document transactions per month), and seven (one ministry and six districts) with low use (0-40 transactions per month). In fact, out of the 30 districts in Rwanda the two “high use” ones we selected were the only with anything resembling regular use; all the others had only a few transactions per month. The districts are all (except one which is 10 % larger) of similar size with population ranging from about 320 000 to 360 000 and a staff of 87 (93 for the larger one). All provide similar services to citizens, other government units, firms, and non-governmental organizations.

The interview questionnaire (available upon request) was designed based on ECM and document management literature [2], [22]. The interviews were conducted in Kinyarwanda language from July to December 2015. Fifty-six of them were retained after discarding nine with insufficient information. Interviewees were selected in three categories, unit managers (n=26), system users (n=17) and IT professionals (n=13). The selection of individuals was based on their involvement in the DTWMS project in their respective organizations and their availability to participate in interviews. In nine of the organizations 4-8 people were interviewed, in one it was only one person.

#### *3.1 Research Design and Data Analysis frameworks*

As the purpose of this article is find issues related to implementation of the DTWMS in developing country and to relate the corresponding critical success factors with those in literature on the implementation of information management systems, we analysed the interviews in view of just that literature. The framework by Horne and Hawamdeh [13] suggests various types of factors that have been found to influence ECM implementation. Norton [4] provides another type of framework ranking the relative importance of known success factors and shows that this has changed over the years. The frameworks hence take two different perspectives on organization development with use of organizational

information management systems. A comprehensive map is useful to understand what factors should be considered. A relative importance framework suggests that different factors are more or less important at different stages of development. Together they provide reasonable tools to understand the current situation in Rwanda; to what extent does it resemble the state of the art as provided by the literature at different points in time along the development process?

The Horne and Hawamdeh framework [13] draws on an earlier IS success model by Roger [23], the IS implementation model of Kwon and Zmud [24] and ECM factors by Tyrvaenen *et al.* [25]. The Horne and Hawamdeh framework includes five sets of success factors: managerial, user, task-related, content and technological [13, p.4].

#### 4. Results

Out of the 40 success factors in the Horne and Hawamdeh [13] framework our respondents mentioned 14. Table 1 shows that user factors followed by task related factors were most mentioned by the respondents. It also shows that in general all three respondent categories were in agreement on factors such as user involvement in IT system improvement, change management and technical infrastructure. Some factors, like project management plan, was mainly mentioned by those directly involved with the project, i.e. managers and IT professionals. Each and every category of success factors found in the case of Rwanda is discussed in the following paragraphs.

**Table 1.** Factors by respondent categories

	Managers (n=26)	Users (n=17)	IT professionals (n=13)	All respondents (n=56)
<b>User factors</b>				
User Involvement in IT system improvement	23 (88%)	14 (82%)	5 (39%)	42 (75%)
User Perception of System advantage	6 (23%)	14 (82%)	4 (31%)	24 (43%)
Training	4 (15%)	6 (35%)	3 (23%)	13 (23%)
User Perception of System complexity	0 (0%)	1 (6%)	0 (0%)	1 (2%)
<b>Task related Factors</b>				
Project Management Plan	17 (65%)	3 (18%)	8 (62%)	28 (50%)
Change Management Plan	9 (35%)	7 (42%)	7 (54%)	23 (41%)
Project Cost Planning	2 (8%)	4 (24%)	0 (0%)	6 (11%)
Post- implementation evaluation Plan	4 (15%)	0 (0%)	1 (8%)	5 (9%)
Building a Business Case	2 (8%)	0 (0%)	0 (0%)	2 (4%)

	Managers (n=26)	Users (n=17)	IT professionals (n=13)	All respondents (n=56)
<b>Technological Factors</b>				
Technical infrastructure	6 (23%)	5 (29%)	1 (8%)	12 (21%)
Business Process Re-engineering	1 (4%)	4 (24%)	0 (0%)	5 (9%)
System Quality	1 (4%)	1 (6%)	0 (0%)	2 (4%)
<b>Content Factors</b>				
Digital Signature	7 (27%)	5 (29%)	1 (8%)	13 (23%)
<b>Managerial Factors</b>				
Top management support	5 (19%)	2 (12%)	3 (23%)	10 (18%)

**User factors.** The respondents strongly point out a lack of user involvement in the IT system improvement. A second major factor was the perceived lack of advantages for the users, even though managers were considerably more positive on this point than the actual users themselves. Although far less important, users and IT professionals also much more than managers pointed to a need for more training. The numbers suggest that the training need was more related to aligning technology with work processes and achieving benefits than system complexity. Users mentioned issues like incomplete system requiring much double work, such as first scanning documents to process them and then printing them for signing.

**Task-related factors.** There seemed to be a lack of strategy regarding how to make efficient and effective use of the system. Respondents mentioned users being resistant to use, lack of buy-in among managers, and, limited ‘follow up’ about use of the system. Others mentioned lack of plans for change; the system is not ‘mandatory’, there is no policy about the system of document tracking in their organizations, neither internal in the organizations or as part of the performance contracts. Says one manager: “Up to now there is no strategy in place but as we do a district management meeting every year we may take resolutions...”

**Technological factors.** Technical infrastructure is the most mentioned factor, exemplified by internet disconnection, power cuts or other technical issues of the system and network. In particular system users called for analysis and redesign of processes and workflow so as to improve efficiency of work processes and to retain staff; some respondents mentioned issues related to a lot of work, imbalance in work distribution, staff leaving their duties when requested to go help their colleagues with too much work, Data Security and Confidentiality was an issue which was raised by staff in finance as a reason not to adopt DTWMS.

**Managerial factors.** While not the highest ranked factor, a lack of top management commitment and support was identified among all respondent groups. Organizations managers and unit managers in those organizations were criticized for not ‘encouraging’ or ‘stimulating’ or ‘supporting’ use of the system. Some system user: voices: “there are leaders who don’t like to use a computer machine...”  
“the management in general does not give attention to the system...”  
Some managers also admitted to have no policy regarding system implementation.

**Content factors.** The lack of an electronic signature system was mentioned as managers and users alike found this to be the main reason behind the double work caused by the failure to reduce printing. As concerns differences between the different kinds of organizations (high-low use), unsurprisingly, the “low” users were much more concerned in general about the project. There were not major differences in terms of what was mentioned. The same four factors were mentioned most frequently. However, the low users mentioned User involvement in IT system improvement as number the number one factor while this came as number four by the high users. Conversely the high users had Change management most frequently and this appeared as the fourth most frequent factor by the low users.

Table 2 ranks success factors in order of importance and compares the top four factors of Norton’s 2007 ranking of factors [4] with our findings. It is interesting to see that the rankings give very different pictures of the situation. Norton provides rankings from 2001 and 2007. Top management support is the number one factor both 2001 and 2007, but it does not appear until on place 8 in our study. Change management is high ranked in 2007 and in our study but not in 2001. Change management is an issue that has received increasing attention over a number of years, but in 2001 it was still behind other important issues, predominantly those to do with project management and technology. User involvement appears on top of the list as defined by our respondents followed by Project management, User perception of system advantage and Change management.

**Table 2.** Factor ranking from Norton [4] on ERP literature 2007 compared to the ranking in our study

Ranking	Factors by Norton	Ranking in Rwanda
1	Top management commitment and support	8
2	Change management	4
3	Business Process and Re-engineering and Software Configuration	12
4	Training and job redesign	5

## 5. Discussion and Conclusion

Comparing the responses from this study with success factors of previous research we find that the picture changes over time. While generally the same factors appear in our ranking as in Norton’s rankings from 2001 and 2007, the order differs considerably among the three. Clearly – as Norton [4] also concludes – the order of success factors change considerably depending on changes in the context, including increased technical sophistication and maturity as well as increased managerial awareness of the opportunities for redesign of operations and willingness to redesign. One lesson from this comparison is that it is important to understand both where you want to go and the

nature of your current situation in order to understand the gaps you need to overcome. It does not seem a great idea to just take a list of success factors as the blueprint for success.

So what about the Rwanda situation? User issues appear on top of the list as defined by our respondents. Only two districts out of the total 30 exhibit anything like regular use of the system (700-1000 transactions per month), all the others show no or sporadic transactions. It appears users do not see advantages of the system and the project management plan is at least unclear. This does not seem strange given a start situation where most operations are still manual. The move from papers to digitalization and at the same time from organizational isolation to inter-organizational electronic cooperation is indeed a big one. It is implemented top-down: the technical system, the DTWMS is procured and implemented by a central government IT organization on central government order. Hence there is little management commitment and support in the government organizations where the system is to be used. Neither is there any known (to users and management alike) plan for reorganization as the project is so far only about implementing a technical system. There is no project on the user organizations' side concerning organizational change, improved performance, or the like.

All in all, our ranking paints a picture of organizations at a very early stage of e-government development. In this situation the choice has been to first implement the technical system and then assume people will use it. In retrospect – from the viewpoint of countries where e-government is much more implemented – this seems to be a situation where organizational change issues should be brought in. The change plan should be defined: What are staff and citizens supposed to do and achieve by using the new system? In terms of Norton's two rankings, our findings match better with the one from 2001 than the later one. Issues of clear goals, project management, project champions, management of expectations, and top management support seem to be most urgently lacking in general at user organizations. More generally expressed, while both Norton's [4] rankings picture implementation of organization information management system as a project of change, the picture of the Rwanda project is rather one of implementing a technical system.

We set out to investigate how critical success factors found in literature on implementation of information management systems relate to findings in the Rwanda public sector. The findings indicate that they do but it is not enough to take the latest findings as the blueprint for success. It would not be fair to say that the early strong focus on technology was wrong. It may have been a necessary first step to take to make the ball roll. At this point, however, it is clearly due time for concerns about users, processes, and incentives for government organizations to change.

One limitation of this study is the relatively small number of respondents. To some extent this is compensated for by the agreement across categories of respondents and organizations.

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## E-ARK: Harmonising Pan-European Archival Processes to Ensure Continuous Access to e-Government Records and Information

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**Abstract.** There has been a widespread shift to electronic ways of conducting business that has transformed existing relationships between governments, governments and citizens, and governments and business. This move to electronic interactions is supported by new business systems that streamline and automate transactions, enable integration of information and service delivery and enhance collaboration between participants. Such changes in the way government business is carried out have significant implications for how public administrations document their activities and make that information available to both government and citizens to aid future decision making and accountability. Because digital records are particularly vulnerable to technological obsolescence and media decay, ensuring future access to the information created by government is a challenging issue for all jurisdictions. This paper focus on the E-ARK project, a European endeavour to standardise and create tools for consistently transferring digital records between business systems and digital archives. The E-ARK approach has the potential to simplify and make consistent diverse approaches to solving the issue of how to transfer information between the ICT systems in use in government, and the archives charged with the responsibility for ongoing and management of the information considered to be of long-term significance.

**General e-Government track (Ongoing research)**

### **Keywords**

Digital archiving, access, digital preservation, information management.

## 1. Introduction

The adoption by governments of increasingly sophisticated ICT has led to the widespread introduction of electronic business systems. A consequence of this shift to electronic ways of conducting government processes is the need to ensure that information managed in these systems is available and accessible for as long as necessary, often across multiple generations of technology. In many cases such information is of long-term value and is transferred to dedicated digital archives which continue offering relevant access services to citizens and government branches.

However, there is no single, widely understood and accepted approach on how valuable digital information should be transferred to digital archives, preserved and accessed for the long-term [1]. In practice, existing approaches to digital archiving mimic the traditional archiving processes designed for paper-based materials, which do not take advantage of the our current ability to mass process large volumes of digital records.

The European Commission has acknowledged the need for more standardized solutions in the area of long-term preservation and access, and has funded the E-ARK project [2] to address the problem. In co-operation with academia, national archival services and commercial systems providers, E-ARK is creating and piloting a pan-European methodology for electronic document archiving, synthesising existing national and international best practices, that will keep digital information authentic and usable over time. The methodology is being implemented in open pilots in various national contexts, using existing, near-to-market tools and services developed by project partners. This approach allows memory institutions and their clients (public- and private-sector) to assess, in an operational context, the suitability of those state-of-the-art technologies.

The objective is to provide a single approach capable of meeting the needs of diverse organisations, public and private, large and small, and able to support various forms of complex data types. E-ARK aims to demonstrate the potential benefits for public administrations, public agencies, public services, citizens and business by providing simple, efficient access to workflows for the main activities of an archive, including export from source business systems, transfer of records to the archives, preservation and enabling access and re-use. The workflows and services being developed by E-ARK will be robust and scalable.

The range of work being undertaken by E-ARK to achieve this objective is wide-ranging and ambitious, and more extensive than can be adequately described here. Accordingly, this paper focusses only on the project's approach to achieving interoperability between source systems and digital archives, specifically, to allow the extraction of information from government agency business systems and its formatting as an information package (IP) for transfer to a digital archive.

## 2. Background

An early phase of E-ARK involved a study of the current state of digital archiving procedures around the world with an emphasis on activities in Europe, in order to es-

establish implementation gaps, as well needs for new tools and services. Initial desk research identified a number of reports that clarified and compared how record keeping institutions have approached the issues of digital archiving and digital preservation. The most recent and relevant studies (as at 2014 when the project started) are summarised here:

1. *Digital Preservation Services: State of the Art Analysis* [3] (2012).

This overview of the state of the art in service provision for digital preservation and curation was carried out as part of the DC-NET project. [4] Its focus is on the areas where bridging the gap between e-Infrastructures and efficient and forward-looking digital preservation services is needed. Based on a desktop study and analysis of some 190 currently available tools and services for digital preservation, the study shows that the majority of tools are small individual tools adapted for local needs. Furthermore, the study finds that there is a lack of services which orchestrate tools and services into holistic preservation solutions. The study is a central contribution to understanding the differences in digital preservation solutions and illustrates the lack of collaboration among different tools available for solving the same tasks.

2. *Common challenges, different strategies* [5] (2012).

This high level study was presented as a keynote speech at the 2012 DLM Forum general meeting in Copenhagen. The paper compares strategies and approaches to digital archiving at national archives in Europe. It shows that there are significant differences in the regulatory mandate of national archives as well as vast differences in how much experience national archives have in relation to handling and preserving born-digital material. It also shows that the quantity, types, complexities and the age of digital material vary greatly between national archives. The study has played an important role in raising awareness about the differences in strategies and approaches to digital archiving in Europe.

3. *Database Archiving* [6] (2012).

This study by the Danish National Archives, investigated and compared approaches to database archiving in Europe. The study outlines the common challenges and problem areas related to database archiving and highlights the fact that even though the majority of archives expect to preserve databases in the future, the current experience is limited.

4. *Analysis of Current Digital Preservation Policies: Archives, Libraries and Museums* [7] (2013).

This study was undertaken by Library of Congress Junior Fellow Madeline Sheldon and examined cultural heritage institutions in both Europe and the US. The study searched for digital preservation policies, strategies or plans published on the Internet by cultural heritage institutions. The analysis identified a list of policies and bulk of the analysis focused on developing and applying a taxonomy to describe the topics covered by the documents. The identified policies were grouped into a number of categories indicating the institutional source: archives, libraries, and museums. The study does little more than identify the policies and does not go actually analyse the content of the policies.

5. *Standards and Interoperability Best Practices Report* [8] (2013)

The survey was undertaken for the Digital Cultural Heritage Roadmap for Preservation project (DHC-RP) and investigates standards, best practices, and identifiers that are in use by the Digital Cultural Heritage (DCH) sector. The report provides short descriptions and links to various types of important standards and discusses issues and challenges regarding use of these standards. The report suggests that practical tests made within the DCH-RP project have shown that previously developed e-infrastructures must be modified and/or improved in order to provide a “pan-European” solution for the DCH community.

6. *Survey on Digital Preservation* (2013) [9]

This study investigated digital preservation practices and how they are implemented at libraries and archives. The main focus was on North America, but the study included survey respondents from all over the world. The study found, amongst other things, that most organisations do digital preservation locally, but that some participate in collaborative efforts, especially related to digital repositories. The study confirms what has been concluded in other studies, i.e. that the approaches taken to digital archiving differ greatly around the world, even though the challenges are the same.

7. *SCAPE survey on preservation monitoring* [10] (2014).

In 2014 the Scalable Preservation Environments (SCAPE) Project carried out a web-based survey seeking respondents’ help on understanding digital preservation incidents, threats and opportunities which are relevant to organisations, and the ways they would like to detect these threats, opportunities and incidents. The survey focus is on monitoring systems for early detection of incidents and threats and is not a general survey about digital archiving practice.

The general conclusion the project drew from these reports and surveys is that harmonising currently fragmented archival approaches across Europe is required to provide the economies of scale necessary for general adoption of end-to-end digital archiving solutions. There is a critical need for an overarching methodology addressing business and operational issues, and technical solutions for ingest, preservation and re-use.

### 3. Information Interoperability

Achieving interoperability between source and archival systems requires that:

- Data and metadata are in standardised formats so their subsequent use is not inhibited by system differences;
- The data and metadata, and any other information required to use the data, are combined in a single conceptual package;
- The package contains enough information to allow validation both before and after transfer to a digital archive;
- The package is constructed in such a way that its information content can be understood in the long term without reference to external systems or standards.

Ensuring that information can be easily and consistently transferred between systems with all characteristics and components intact requires a coordinated approach and agreement on standardised methods for packaging and sending information. E-ARK has approached this issue by developing a generalised E-ARK Common Specification (see 3.1 below) for how information being transferred and managed over time should be packaged to support interoperability and long-term access.

The E-ARK approach to digital archiving is based on the widely recognised OAIS Reference Model [11]. Consequently, the project follows the definitions of the main archival processes and associated conceptual information package definitions articulated in OAIS:

- Ingest - the Submission Information Package (SIP);
- Archiving - the Archival Information Package (AIP);
- Dissemination - the Dissemination Information Package (DIP).

All of these conceptual *Information Package* types have been tackled in the project and detailed technical specifications have been created for each. All of the specifications are based on the E-ARK Common Specification but extend it with specifics of the relevant processes. In this paper (see 3.2 below) we concentrate on the SIP format, which sets out the requirements for packaging information for transfer between producer systems and the archives. The interoperability encouraged by the specification also allows archives to replace repository systems as needed while remaining compatible with established ingest workflows. Secondly, vendors will be able to adapt their electronic records management systems to be compatible with the specification, allowing the creation of integrated workflows between producers and archives.

Finally, to guarantee that the integrity and authenticity of transferred information is not compromised, we need to go beyond the actual data and also consider system-specific aspects. For example, a typical real world records management system contains records arranged into aggregations, metadata relating to records and their relationships to other entities, a business classification scheme, a set of retention and disposal schedules, user access controls and definitions, information to support the retrieval of a record by a search engine and so on. All these components, which make up a specific and complete information package, must be transferred together with the data in a way that ensures the integrity, authenticity and understandability of the whole package are maintained. This need has been addressed in E-ARK by the concept of Content Types (see 3.3 below), which allow for the definition of relevant system-specific elements which need to be archived along with the data, and which ultimately are used to extend the scope of the common specification itself.

## 4. E-ARK Specifications

In this section we explain some of the details of the E-ARK Information Package specifications which are mentioned above, specifically the Common Specification, the Submission Information Package specification, and Content Type profiles.

### 4.1. The Common Specification for IPs

The backbone of archival interoperability in E-ARK is provided by the so-called Common Specification for Information Packages [12]. The OAIS compliant specifica-

tion is built on the requirements presented above and provides a unified set of rules for packaging any data and metadata into a single conceptual package which can be seamlessly transferred between systems, preserved and reused in long term. The core of the common specification is a definition of an Information Package structure (Figure 1).

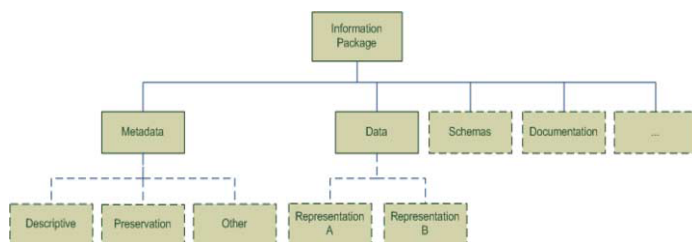


Figure 1: E-ARK Information Package structure

The structure allows for the separated inclusion of any metadata, data, relevant schemas and documentation. Further the metadata in the package can be divided into descriptive (metadata needed to find and understand the data), preservation (metadata needed to ensure the integrity and authenticity of data, metadata and the whole package) and other (any other metadata which is deemed relevant by the source system or the archives).

A specific feature of the data component is that it can be further divided into multiple representations. We cannot expect the file formats and data structures which have been originally used to last for the long term and we have to foresee the need for (potentially multiple) data migration cycles during the preservation of the information.

Lastly, to ensure that the whole package can be understood and reused in the long term users have the possibility of making the package self-sustainable by including any relevant schemas and documentation which might not be available externally in the future. Documentation may take many forms and constitutes what the OAIS calls *Representation Information*, i.e. information which cannot easily be classified as semantic or structural, e.g. software, algorithms, encryption, written instructions and many other things may be needed to understand the data.

In addition to the structure, the Common Specification details the use of core structural and packaging metadata. Essentially each package includes a core XML metadata file which follows the widely recognized METS standard [13]. The core METS metadata serves the main purpose of:

- Identifying the package and its components in a persistent and unique way;
- Providing a standardized overview of all components of the package;
- Connecting relevant pieces of data, metadata and other components to each other.

Ultimately, the METS metadata ensures that everything inside the information package can be validated according to commonly accepted rules.

#### 4.2. Submission Information Packages (SIPs)

The first stage in the digital archiving workflow is extracting information from the producer's business system and packaging it for transfer to the archive's system. The OAIS Reference Model [11] conceptualises information submitted to an Archive as

one or more discrete transmissions of Submission Information Packages (SIPs). The E-ARK SIP specification provides a detailed description of the structure and main metadata elements that should be part of an E-ARK SIP and also functions as initial input for the technical implementations of pre-ingest and ingest tools that automate the creation and transformation of SIPs.

In its simplest form, an E-ARK SIP is a packaged set of files and folders inside a ZIP or TAR container (Figure 2). A SIP can contain one or more representations of a single intellectual entity (e.g. Rep-001 and Rep-002 under the “representations” folder in the diagram). The SIP can hold metadata that is related to the intellectual entity as a whole; at the same time each representation may also contain its own specific metadata, although separation of metadata in this way is purely optional.

In addition, as provided for in the E-ARK Common Specification, the information package folder must include a mandatory core metadata file named “METS.xml”, which includes the information needed to identify and describe the structure of the package itself and the rest of its constituent components. One vital requirement for the E-ARK SIP specification is that it is able to be extended to support any content type a digital repository needs to ingest. Accordingly, the specification allows for the development of additional separate content type descriptions for different types of information being submitted to the archives.

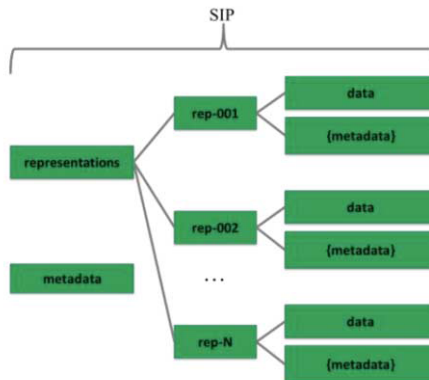


Figure 2 - E-ARK SIP structure.

#### 4.3. Content Type-Specific SIP Profiles

As discussed above, a SIP can contain content type specific data and metadata. Types of data files and their structural relationships, and metadata elements vary for different content types. Metadata is submitted to an archive so that it can support functions in the archive. Metadata produced by a content type specific business system will variously be intended to support descriptive, structural, administrative, technical, preservation, provenance (relating to authenticity) and rights (relating to IP, retention and access) functions.

The METS standard used in the E-ARK SIP specification does not offer one single structure in which content type specific metadata could be stored as a whole. In order to efficiently use metadata to support archival functions, the SIP defines separate METS sections as containers for the various metadata functions, such as the METS header for package management, the <dmdSec> for Encoded Archival Descriptions

(EAD) [14] and other descriptive metadata standards, and the <amdSec> for preservation (PREMIS) [15], technical and other functions. In order to use the submitted metadata, it has to be extracted into the standards used in the SIP METS sections. To do this the content type specific metadata elements need to be mapped to those METS sections and implemented using the agreed standards. Therefore, complementary SIP metadata profiles are needed for the key E-ARK content types to define how the submitted content-specific metadata should be mapped to the E-ARK SIP structure. E-ARK has developed two specific content type SIP profiles:

- *SMURF Profile* [16] (Semantically Marked-Up Record Format), which contains mappings for both electronic records management systems (based on MoReq2010 [17]) and for simple file-system based records. The SMURF profile specifies further how to archive the necessary elements of an ERMS system, including the classification scheme, aggregations and classes, disposal schedules, and user access controls.
- *Relational Database Profile* which is based on the SIARD format [18]. SIARD is an open format developed by the Swiss Federal Archives. The format is designed for archiving relational databases in a vendor-neutral form. The format proposes a common standard for describing core elements of the live DBMS: data; structure; stored procedures; triggers; views; and queries. A new version of SIARD (i.e. SIARD 2.0) has been developed by E-ARK in straight collaboration with the Swiss Federal Archives.

## 5. Content Type-Specific Tools

Constructing SIPs to conform to the content type specific profiles manually is time consuming and onerous, as well as potentially causing inefficiencies and errors in package construction. To overcome such limitations to interoperability, E-ARK is partnering with a number of developers of archival software (ES Solutions, KEEP SOLUTIONS and Magenta) to enhance the functionality of those relevant tools currently in use in E-ARK partner institutions. In particular, the project is developing open source tools that automate the construction of submission packages (SIPs) as described below.

### 5.1. SMURF Profile

RODA-in [19] is a specially designed tool to support the creation of E-ARK compatible SIPs ready to be submitted to an OAIS-based archival system. The tool is intended to be used by producers and archivists to create SIPs from files and folders available on the producers' local file systems.

In its newest release (version 2) the tool aims to satisfy the need for mass processing of data and quickly create thousands of SIPs with little human intervention. The tool includes features such as:

- Create, load and edit classification schemes (managed by the OAIS repository)
- automatic aggregation of files/folders into intellectual entities based on aggregation rules;
- Automatic association of metadata to SIPs;
- Drag'n'drop support for quick creation of SIPs from folders



- Support for various descriptive metadata formats (Encoded Archival Description, Dublin Core, as well as custom-tailed metadata schemas);
- Definition of metadata templates to meet the metadata profiles of each producer/Archive
- Creation of SIPs of unlimited size;
- Compatibility with BagIt [20] and E-ARK SIP formats

Furthermore, the tool is multiplatform and open-source and has been tested to work on Windows, Mac OS X and Linux.

### 5.2. Relational Databases Profile

SIARD, as mentioned above, is an open format for archiving relational databases. A SIARD archive is a ZIP-based package containing mostly files based on XML, SQL:1999 and Unicode. SIARD DK on the other hand is variation of the original SIARD format that has been created by the Danish National Archives to fit their specific requirements. Differences from the original SIARD format include a different hierarchy of folders and file placement specification within the package, normalisation formats, and creation of the SIARD archive as a folder instead of a ZIP file to allow distribution of large databases across multiple storage devices.

E-ARK has collaborated with the Swiss Federal Archives, the Danish National Archives and also with vendors of digital preservation services to create a new version of SIARD that should meet the requirements of all of these stakeholders. SIARD 2 is the most recent update to the SIARD format and is backward-compatible with SIARD 1 [18].

The Database Preservation Toolkit [21] is an open-source tool that allows the extraction of data from various Database Management Systems (DBMS) and the creation of a corresponding SIARD 2 preservation format. The tool also enables the transference of data from the preservation format into an active DBMS (potentially distinct from the one that was originally used to hold the data). The current version of the tool supports conversions from and to Microsoft SQL Server, MySQL, Oracle, PostgreSQL, SIARD 1, SIARD 2 and other JDBC supported systems. It also supports Microsoft Access as an input format and SIARD DK as an output format [22].

## 6. Conclusion and ongoing work

Ongoing access by citizens to information created by governments is a *sine qua non* of the modern world. But access and re-use of government information of long-term value depends, crucially, on ensuring the reliable and error free movement of records between government business systems and the archives charged with the responsibility of providing ongoing access to those records. Additionally, the movement of records between systems may occur many times during their lifespan and requires robust interoperability between those systems.

This paper has described the E-ARK approach on standardising and creation of freely available tools for consistently transferring digital records between business systems and digital archives. The E-ARK approach described in this paper has the potential to simplify and make consistent currently diverse approaches to solving the issue of how to transfer information between the ICT systems in use in government,

and the archives charged with the responsibility for ongoing and management of the information considered to be of long-term significance. End-users will benefit enormously from the adoption of standardised approaches to information exchange across European record keeping institutions.

The E-ARK is currently being validated by means of 7 full scale pilots that will run for a period of 9 months [23]. These pilots aim to demonstrate the suitability of the E-ARK proposed standards and tools to support current electronic archival needs covering all relevant activities from ingest to data reuse while simultaneously addressing the needs of the stakeholders involved, e.g. data producers, data subjects, data owners, data holders and data users. Pilots will integrate E-ARK tools together with systems in use in partner organisations, and provide a framework to ensure compatibility, interoperability and enhancement of current standards.

Pilots are being conducted in 6 different European organisations and focus distinct aspects of the OAIS life-cycle:

- *Pilot 1*, lead by the Danish National Archives, aims to assess E-ARK SIP creation tools and the Database Preservation Toolkit with not less than 4 databases of different sizes and complexities containing several million records;
- *Pilot 2*, lead by the National Archives of Norway (NAN), aims to demonstrate the ability to export electronic records and their metadata from Electronic document and records management systems (EDRMS) and databases of Norwegian public sector institutions, transfer and ingest them in the NAN digital repository. ESSArch Tools will be used to create E-ARK SIPs, and ESSArch Preservation Platform will be used to create and manage the E-ARK AIPs;
- *Pilot 3*, lead by the National Archives of Estonia (NAE), aims to export public records from an EDRMS of a governmental agency to the National Archives of Estonia and make these available through our own catalogue (i.e. Archival Information System, AIS) as well as provide an API for accessing the records from other systems (e.g. the original EDRMS at the agency); The whole set will include about 5000 records;
- *Pilot 4*, also lead by the National Archives of Estonia (NAE), will focus on the migration and ingest of more than 200.000 business records from bespoke business system from private companies to the digital archive of the Estonian Business Archives and their subsequent description required for archiving and preservation;
- *Pilot 5*, lead by the National Archives of Slovenia, aims to prove that the SIP and DIP implementations fulfill specific requirements of records containing geo-referenced data comprising all phases of ingest. Success criteria include the creation, verification, ingest and access to more than 1000 records with geodata layer;
- *Pilot 6*, lead by KEEP SOLUTIONS, aims to demonstrate that the E-ARK SIP is adequate to support the media types found in today's EDRMS and, that the most adequate and scalable form of transference of data between producers and archives is to automate the SIP creation and delivery process by means of specially developed interoperability components. Success criteria include the ingest of no less that 900 historical records

automatically packaged via a custom developed integration component adding up to 1.2 TB of data.

- *Pilot 7*, lead by the National Archives of Hungary, aims to extract structured content from an Oracle database and examine the applicability of data-warehouse concepts in an archival environment in order to maintain both the original structure and intellectual interpretability of ingested data and to enhance reuse by providing advanced analytics on original data. The resulting prototype will be a user-friendly web-based application.

Finally, pilot organisations will be assessed according to a capability model called Information Governance Maturity Model. The model ensures that the assessment focuses on capabilities that the pilots want to achieve, and allows researchers to compare their status at the beginning and at the end of the project.

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# Environmental Information and Policy Cycle: Developing the Complex Relationship

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**Abstract.** The research investigates the link between environmental information and environmental policies, pointing out how, even now, complexity in creation, capture and analysis of first ones makes difficult building knowledge basis for decisions, in spite of variety of available tools with several analytical capabilities. Particularly, research introduces an analysis of criticisms related to environmental information, among which its fragmentary nature, high variety of sources, incompleteness, difficult accessibility, validation lack, multiple formats etc., and, considering policy cycle, it proposes some paths to strengthen the link between environmental information and policies. These paths have been defined in a context characterized by an increasing spread of information and communication technologies; these, moreover, now open also to new scenarios, where citizen science and volunteer geographic information become new and additional sources of information, even if not official, for environmental and not only environmental data, useful to fill potential incompleteness.

**Keywords.** Environmental information, environmental policies, policy cycle, information systems

## 1. Introduction

This research has been conceived in order to improve activities related to environmental information in the context of a public organization supporting a regional governing institution through research activity related to policies development and implementation. In this framework, the positioning has been defined starting from a law article [1] that, implementing European Directive 2003/4 concerning freedom of access to information [2], supplies a definition for environmental information and highlights how difficult is to precisely define the reference context.

In order to accomplish the organization mission, in environmental context, defining environmental policies, reaching objectives concerning safeguard and protection, promoting sustainable development, etc., knowledge is a *must*. Nevertheless, this kind of knowledge, based on environmental information, has a strong complexity, coming from environment system complexity; environment can be defined as a system of systems, and, even if it can be de-composed into sub-systems and subsets, with natural and human components and with continuous interactions between all them [3], a multidisciplinary and comprehensive vision is needed in order to build knowledge. So, environmental information treatment means considering complexity with multidisciplinary approach: this is a complex task, more complex when data must be

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elaborated, in order to advance along the information pyramid up to produce wisdom [4]. Organization models of environmental indexes, such as Determinant-Pressure-State-Impact-Response (DPSIR) model [5], are born in order to tackle this complexity, identifying causes and effects relations between measured and measurable environmental characteristics, in the awareness that natural components status depends on interaction with human components.

Moreover, multidisciplinary vision is not always reached, indeed it often happens that, defining an environmental policy, such as on waste or water, the connection with other sector policies, both of environmental or other sectors, is forgotten, and the transverse character, typical in a sustainable approach, is lost.

The presented research has its basis in this framework. It has been developed in the context of a public organization supporting a regional governing institution, through research activity related to policies development and implementation. In the daily practice, difficulties related to environmental information have been frequently recognized: around them, a reasoning started in order to analyze the observed criticisms and to suggest elements for overpassing. The final goal is the development of a systematic process of observation of environmental phenomena to support policy cycle. First steps, here presented, have been focused on the conception of a model able to describe environmental information process and on sharing it in the organization context; even if this can appear trivial, it has been considered important in order to improve consciousness in the organization itself; it is as a basis on which the "observatory" activity in the organization context can be developed; a test has been started on a specific topic, the urban waste, in order to verify which benefits it brings to the relationship between environmental information and policies. This topic has been chosen among others also because large amount of good data, easily acquirable.

In the next paragraph the developed model is deepened described. Through an analysis of single process steps (creation, capture, processing, management, use and diffusion of environmental information), critical aspects analysis is carried out.

Then, the nowadays context, in which the observatory process is included, is presented, considering the ICT development and some related perspectives.

Therefore, the main aspects of started test on urban waste topic are presented, with some results and the future developments.

## **2. Environmental information: critical aspects**

In order to systematically identify which critical aspects characterize environmental information in the organization context, a logic model has been designed; it highlights consecutive steps through which, starting from raw data creation, diffusion and use into policy implementation is possible. The process has cyclic nature and requires continuous care, reviews and updates; this is fundamental for efficacy of connected activities: often, establishment of informative systems is characterized by a strong initial resources employment, but it is lacking of a continuity perspective; in order to amortize efforts and maintain an updated and always useful system, maintenance is strategic; for this reason, a long term design is important, considering both hardware components and soft ones; these are strategic during system life and they are related to dynamism of environmental information.

Figure 1 shows developed model in four main steps; table 1 presents an overview on their main characteristics and criticisms.

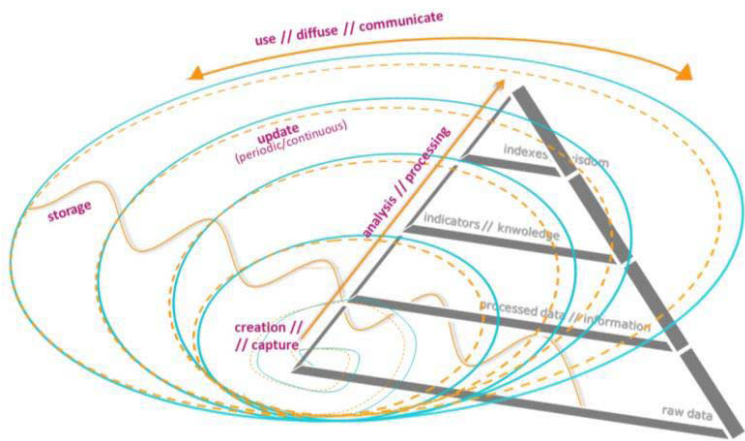


Figure 1. Designed model of environmental information process

Table 1. Main steps of model

Steps	Main characteristics	Main criticisms (in organization context)
Creation and capture	<p>Creation - Many Public Administrations are data creators and often their activity is focused exactly on this activity; in Italy, for instance, the Italian National Institute of Statistics, ISTAT, and the Institute for Environmental Protection and Research, ISPRA, are the first two references to take into account.</p> <p>At regional level, furthermore, it is interesting the mission of Regional Agencies for the Protection of the Environment (ARPA): their activity is inspired by the approach that the more recent national and European legislations propose, of collecting and analyzing environmental data coming from valid and reliable sources [6]. Therefore, the regional agencies produce raw data, for instance implementing a monitoring network for air quality, recorded data can later be elaborated into indicators and indexes.</p> <p>Acquisition - Data can be obtained from producing sources, with specific conditions: often data are sold, and their price is related to production cost; moreover, the request can follow some specific rules and some release interval can exist; data can be used under conditions defined by their license.</p>	<p>The organization, in particular for environmental data, generally obtains data from other institutions and organizations; often these acquired databases have administrative origins, so that, next to limits depending on data nature, fragmentary nature and incompleteness problems appear.</p> <p>This kind of problems depends mainly on reference scale: data are used for regional level analysis, but they generally come from a municipal level; in the aggregation process not homogeneity and incompleteness problems can become evident.</p>
Update	<p>Prevision of obsolescence must be considered before starting a production/capture process, in order to plan update activities, and in dependence of specific phenomenon, that can change rapidly or not.</p>	<p>In the organization context has been observed that, concerning environmental information that is collected from external sources, there is not yet a systematic planning for update activities.</p>
Analysis and processing	<p>In order to support policy cycle, environmental data generally require raw data elaboration to calculate indicators and indexes. Considering indexes building, therefore, elements to take into account depend on the specific theme. In a more general way [7], [8], indicators and</p>	<p>In a general perspective, problems in analysis and processing can be attributed to data quality and completeness: data must exist for each reference unit in space and time.</p> <p>In the organizational context, often external</p>

	indexes must be measurable, comparable, representative of analyzed phenomenon, simple and scientifically founded.	expertise are recruited in order to analyze specific data on a thematic issue, with an out-sourced approach, avoiding an internal capitalization.
<i>Use, diffusion and communication</i>	When data have been processed and indicators and indexes have been developed, finally relationship between environmental information and policy cycle can be shaped; in the proposed model, use and diffusion of information have been introduced together, in reason of the strong connection between them: environmental information use in the context of policy cycle admit at the same time diffusion among decision makers and diffusion to citizens; Aarhus Convention [9] delimitates issues on this topic.	Criticisms are on two main levels: communication channels and interaction within social media on one hand, consciousness and awareness of citizens on the other one. In the organization context, generally the process ends with a formal document for policy makers. It describes analysis and discusses results, often it is publicly presented, but generally it is not structured with communication criteria.

Literature concerning use, diffusion and communication of environmental information shows that, even if in the last year consciousness is increasing, in Italy citizens seem yet not much interested and sensitive to environmental matters, nor they take benefits from new media availability as in-depth analysis tools. In spite of a growing awareness of environmental problems, it seems difficult to find communication channels offering quality information, with care of sources reliability and effective reference to important issues [10], [11], [12] and [13].

This topic must be framed in the transformed context in which we move, that is described in the following section.

3. A transformed context: ICT, social media and VGI

Communication networks availability introduces new tools helping in reduction of data production costs, in particular concerning geographic ones. In USA the National Spatial Data Infrastructure [14] and in Europe the Infrastructure for Spatial InfoRmation in Europe (INSPIRE) [15] established that data must be produced once and appropriately updated; they oblige to verify, before producing, geospatial data existence, through geoportals (websites where search and acquisition of data and map services are carried out) and data catalogues. In Italy, the Spatial Data National Repository - Repertorio Nazionale dei Dati Territoriali (RNDT), and the National Geoportal [16], are the reference tools; almost all Italian regions are present in the RNDT and there is continuous activity; Lombardy Region, in particular, is strongly working on.

This scenario, moreover, must be integrated with two other phenomena: first one is the scenario determined by public administration data openness, with reference to Italian law 221/2012 [17] and second one concerns integration between official sources, social media sources or other not official sources [18] of data; this possibility is developing in the last years in the context of computational social science, considering the ability to collect and analyze data with size, scale and deep never seen before [19]. Integration of data from social media data and other not official sources regards all the emerging issue of Crowdsourced information [21], Volunteer Geographic Information [20], and Ambient Geographic Information [22]. This new large amount of information, often geo-referenced, represents a big opportunity to improve knowledge for decision processes [23] and, in a more general way, for phenomena description, often solving problems of completeness. Experimentations in this field are becoming numerous and

they are carried out also by several public administrations, as European Environment Agency [24].

All these aspects are taken into account in the context organization, as later described.

#### 4. Possible paths

Following process development and in light of some remarks concerning the ICT context, a test has been started and it is currently underway in order to better define some possible paths to improve relationship between environmental information and policies.

The considered public organization intends itself as *“a new organized and strategic system able to produce and diffuse knowledge, supporting regional policies and their implementation on territory, and for innovation in Public Administration and society”*; it places knowledge at the service of policy cycle; use and diffusion of (acquired and produced) information are the hearth of its activities and the ideas here presented have been developed during the daily exploitation of its activities. After a theoretic modeling phase, a test has been started on a specific topic, the urban waste, in order to stress the model, strengthen the process phases in order to bring some benefits to the relationship between environmental information and policies and improve organization results.

In a more concrete perspective, the model represents the functioning mechanism of an *“observatory”* with focus on environmental issues; in order to test, needed activities are listed in the following table. During the test, they have been exploited, sometimes with a flou approach, depending on the test context itself. More detailed description is presented later on.

**Table 2.** Activities for building an “observatory”

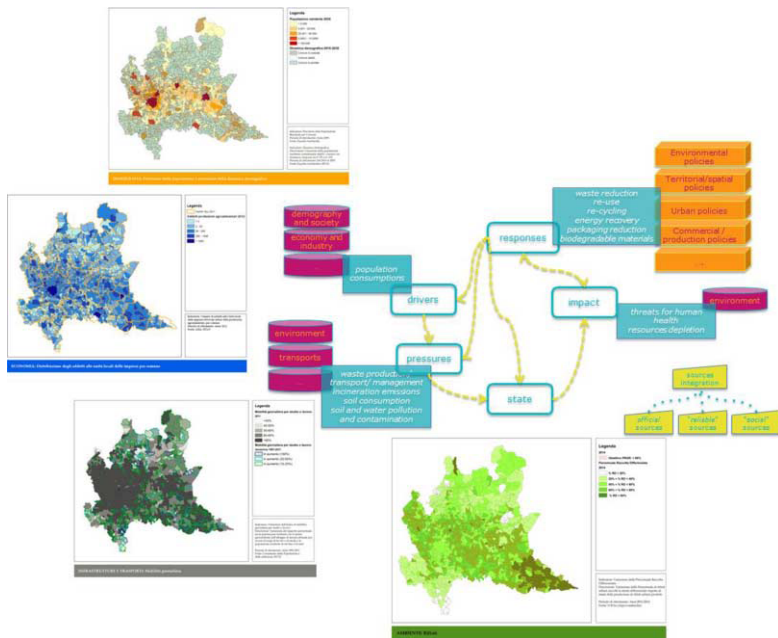
Activity	Description
<i>Observation field</i>	Definition of an area of interest, identifying a specific thematic issue on which acquire/produce raw data to elaborate following the information pyramid.
<i>Planning and resources</i>	In order to structure an “observatory”, identification of a long temporal horizon to guarantee a continuous development, and definition of final and intermediate objectives, are needed.
<i>Responsibilities</i>	Responsibilities must be identified and related to plan. They are needed also to develop integration with other activities in the organization.
<i>Releases, updates and related procedures</i>	Releases must be planned and framed in a structured agenda, with dependence on frequency in updating, need of intersection/integration with policy cycle phases, maturity level of analysis and choices about communication and diffusion activities,
<i>Observing process and tools</i>	They depend on the specific observed theme.
<i>Integration development</i>	In order to build an “observatory” with a comprehensive vision, able to define a framework useful in policy cycle, integration means interdisciplinary reading of phenomenon. It can be structured after thematic index framework building.

For the test in the organization context, the chosen observation field is urban solid waste; it has been chosen considering, among other reasons, also the data availability, in order to allow an easy start; the regional observatory of waste has been considered: each year it acquires data from municipalities, it elaborates, normalizes and then diffuses them in a well-structured and efficient process; starting from its products, the test has been set. Simple and robust indicators have been built and then represented on thematic maps. The geographic dimension allows to study relationship between



phenomenon and space, and it opens to the possibility of developing spatial analysis, aimed at investigate correlation between spatial component and the other variables, but not yet deepen in this direction.

Integration with other current activities in the organization can be developed, with reference to policy cycle and in order to build a thematic integration useful to enlarge the reference framework. A DPSIR model helped in an easy way in characterization of some relationship between urban waste and other themes, not only strictly environmental ones: it allows identification of some other interesting domains, as demographic and social aspects, economic issues (for instance in the impact of products packaging), organization issues (related to waste management process) etc. Figure 2 shows the developed DPSIR model and some starting attempts of integration between thematic indexes, spatially calculated.



**Figure 2.** DPSIR model for the urban waste theme

Integration development, therefore, comes after thematic index framework building, with some care to the minimum observation unit (municipal level in the experimentation) and to the time series (2001-2014 the considered period), ex ante, in order to guarantee homogeneity in data.

Next to a vertical approach on waste theme, parallel transversal activities can be lead in order to integrate with other activities and to build a knowledge framework useful in the policy cycle context. Integration phase between indicators of different thematic areas has not yet started, neither synthetic indexes have been built to make easier phenomena reading also for a not-expert public. Obtained results of this first phase have been used to contribute to a thematic atlas, with some format rules, to diffuse in the regional context and to make available for local public administrations.

During the test, in addition to official sources, some remarks concerning alternatives sources have been exploited: unofficial and alternative sources have been

researched, through an analysis on the main stakeholders on the field; the annual report that an environment Italian association publishes has been analyzed and its results have been internalized. Other not official sources, such as VGI or crowdsourced information, are not yet been integrated.

In order to better use ICT and taking into account normative recommendations, supplied by Italian Digital Agency and in order to fulfill objectives of Digital Italian Agenda [25], organization data catalogue has been implemented, at now limited for internal use.

## 5. Conclusion and future development

Obtained results are at the embryo stage, as the test on urban waste needs deepen integration with other disciplinary domains and not official data sources. Even if several critical points have been clarified, in order to guarantee that work can improve phenomena knowledge and, consequently, development, implementation, monitoring and assessment of environmental policies, so much it needs to be done.

Continuity, independence, resources availability and integration with daily activities are the *conditio sine qua non*. All of them depend strictly on organization choices: if organization would guarantee these conditions, then “observatory” can still live and make real the process described in section 2. So, finally, it seems that organizational and relational aspects, such as planning capacity and resources identification, are more relevant than operational ones, such as updating frequency or data acquisition/production costs, and can contribute in overpassing structural problems in data.

Concerning the transformed context, as described in section 3, there is a wide field of activities concerning use of technologies and tools to support the process; a stronger integration in an ICT context can produce advantage in acquiring and exchanging data and supplying services [26], with positive impact on modalities in which these activities are carried out, and it can contribute to re-engineer them [27], eventually also in a tacit way. At now, a data catalogue has been implemented following technical specification of [25], but some work is needed in order to make organization’s employees able to use, update and feed it.

Concerning ICT use, moreover, some changes are needed in the organization approach, to strengthen presence on the web and interaction with web-users. This can lead also to structure integration of consolidated official sources with not official sources, such as those related to social media, overpassing incompleteness problems and contributing to make organization closer to several actors.

These are the main steps for the next future; a new and comprehensive approach has been defined, linking environmental information process to policy cycle; with no revolutionary discovery, we trust the hypothesis that a comprehensive approach, with care in resources planning and a long-term vision, can strongly improve relation between environmental information and policy cycle, with positive effects on organization goals.

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# A Tool to Generate Public Policies

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**Abstract.** This article shows the results obtained in the application of a model to assess the digital maturity of a government at a country level. The model, based on maturity model concepts, identifies the relevant variables that need to be improved in the implementation of the digital strategy. This tool shows the weaknesses of the digital strategy guiding the generation of public policies.

**Keywords.** maturity model, digital strategy, e-gov

## Introduction

Since 2007, a maturity model is being implemented and adjusted in Chile to diagnose the implementation of e-government [1, 2, 3, 4, 5]. The maturity model has evolved from 5 maturity levels to 4, and has included automation in the generation of a roadmap, and it's being adjusted to the 2020 digital government strategy [6, 7]. With this experience, in 2015 the Digital Government Maturity Model (DGMM) was redefined, and massively applied to 121 Public Agencies (PAs) of the central government; hence, the information was collected through a web tool developed for these purposes.

Based on Campbell [8], "An informed assessment of why issues are not advancing will reveal a great deal about the strategies needed to move forward", in this work the results are analyzed in the self-diagnosis of these 121 government agencies, which are the basis to elaborate recommendations when generating public policies.

The areas considered in the DGMM are summarized in section 1, and are aligned with the action lines of the Digital Government. Section 2 provides the results of the assessment process, and the analysis of the average maturity of the 121 PAs involved in this self-assessment. This resulted in an average maturity level of 2.3, which corresponds to level 2 of organizational maturity (early stage development) of a maximum of 4. The description of the results is conducted following the model logic, from the results obtained by domain, then by its sub-domains, and ultimately the results obtained by the relevant variables that constitute the sub-domain. The variables relevant for the model were defined according to an expert criterion. Finally, section 3 delivers the conclusions and general recommendations of the variables that might add value.

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## 1. Digital Government Maturity Model (DGMM)

In total, 4 domains and 12 sub-domains (SDs) have been defined (3 for each domain), essentially based in the digital government (DG) development strategy of the Modernization Unit and DG (MU&DG) from the Government of Chile. The 41 variables distributed in the 12 SDs are connected with the goals and objectives of the DG strategy of the MU&DG, such as inter-operability, unique password, electronic signature, and open data policy, among others. The model domains are hereunder described.

**1. General Abilities:** This domain measures the ability of a PA to provide the factors to develop the DG. It includes strategic activities to manage business-aligned IT resources, project management, and human capital management to make progresses in the achievements of the DG strategy. It includes 3 SDs: 1.1 Strategic Alignment; 1.2 ICT Project Management; and 1.3 Human Capital and Change Management.

**2. Citizen-oriented Services:** This domain measures the supply capacity in on-line multi-channels services, effectively used by satisfied customers. This domain is the main priority of the DG strategy in Chile. Its 3 SDs are: 2.1 Multi-channel Service/Close Government; 2.2. User' Experience and satisfaction; and 2.3 Process Management.

**3. DG Enablers:** This domain measures the training in using protocols and mechanisms enablers of the current DG development, of the privacy, and security that make possible an inter-operability with data protection, as well as having a protected unique identity. It promotes the informed technological neutrality, and includes the following 3 SDs: 3.1 Public software and *cloud computing*; 3.2 Security, Protection, electronic identity and signature; and 3.3 State inter-operability.

**4. Open Government:** This domain measures the status of the data publication by the entity, and its implication in encouraging and assisting the labor of re-user's agencies. Also, it considers the development in on-line citizen's participation and co-design. Its SDs are: 4.1 Open data; 4.2 Citizen's participation online; and 4.3 Co-design.

Each SD is linked to a  $p_i$  weight within its respective domain (percentage in the third column in Table 1), in the same way that each variable is linked to a  $w_i$  weighting within its SD (percentage in fourth column in Table 1). Both,  $p_i$  and  $w_i$  were defined with an expert criterion according to a methodology in use and improved since 2008. The code in 1<sup>st</sup> column, in Table 1, the 1<sup>st</sup> number corresponds to the domain, the 2<sup>nd</sup> is the number of the SD within the domain, and the 3<sup>rd</sup> is the number of the variable within the SD. The column  $p_i * w_i$  corresponds to the relative relevance of the variables within the full model, considering that the domains have equal weight (25% each one). If this result is higher or equal than 10% it is considered a relevant variable within the model; otherwise, it is labeled as a lower weighting variable.

## 2. Data Results and Analysis

The aim of this study is to have a tool to measure the abilities of PAs to implement the digital development strategy. In this self-assessment participated 121 PAs, and the diagnosis returned an average maturity level of 2.3, which corresponds to a level 2 (of 4) of organizational maturity (early stage development). Regarding the domains, Citizen-oriented Services is the most developed of the State, with an average maturity of 2.5. The domain DG Enablers has an average maturity of 2.3, and Open Government has an average of 2.2. Finally, the domain General Abilities has the lowest level of development of all the domains, with an average maturity of 2.1.

**Table 1.** High and lower weighting variables

Code	Variable	$p_i$	$w_i$	$p_i * w_i$	Weighting
1.3.2	Change management	45%	40%	18%	High
4.2.1	Access to relevant information	35%	50%	17,5%	High
4.2.2	Access to public enquiries	35%	50%	17,5%	High
3.3.1	Integration of information to conduct procedures	45%	35%	15,8%	High
3.3.2	Inter-operative normative framework	45%	35%	15,8%	High
4.3.1	Citizen's participation in the design of public policies	25%	60%	15%	High
4.1.1	Publication of data in open format	40%	35%	14%	High
4.1.2	Open data normative	40%	35%	14%	High
1.3.1	Professional skills IT staff	45%	30%	13,5%	High
1.3.3	IT development abilities	45%	30%	13,5%	High
3.3.3	Make web/information services available to inter-operate	45%	30%	13,5%	High
2.1.1	Diversity of access channels	35%	35%	12,3%	High
2.1.3	Users / requests - transactions	35%	35%	12,3%	High
4.1.3	Publication format and license, and data use	40%	30%	12%	High
2.2.5	Customer's satisfaction	45%	25%	11,3%	High
1.2.1	Project management	35%	30%	10,5%	High
1.2.3	Purchasing and suppliers' management	35%	30%	10,5%	High
2.1.2	Integration of channels in the services delivery	35%	30%	10,5%	High
3.1.1	Government in the Cloud	25%	40%	10%	High
3.1.2	Informed technological neutrality	25%	40%	10%	High
4.3.2	E – Requests	25%	40%	10%	High
3.2.2	Use of electronic unique identity system	30%	30%	9%	Low
2.2.1	Implementation on-line procedures	45%	20%	9%	Low
2.2.6	Diffusion on-line procedures	45%	20%	9%	Low
2.3.2	Re-design and digitization of business processes	20%	40%	8%	Low
3.2.1	Use of electronic signature	30%	25%	7,5%	Low
3.2.4	Personal Data Protection	30%	25%	7,5%	Low
1.2.2	Alignment and IT project management	35%	20%	7%	Low
1.2.4	Management and follow-up budgetary implementation	35%	20%	7%	Low
2.2.2	User's experience	45%	15%	6,8%	Low
2.3.1	Use of On-Line Guide to Procedures of the State	20%	30%	6%	Low
2.3.3	Indicators of digitalized processes effectiveness	20%	30%	6%	Low
3.2.3	Security of Information	30%	20%	6%	Low
1.1.4	Role and CIO dependence	20%	25%	5%	Low
1.1.5	Leadership	20%	25%	5%	Low
3.1.3	Public Software	25%	20%	5%	Low
2.2.3	Institutional Innovation	45%	10%	4,5%	Low
2.2.4	Benefits estimation	45%	10%	4,5%	Low
1.1.1	Alignment IT Plan with Institutional Strategy	20%	20%	4%	Low
1.1.2	Allocation of Resources to Technological Projects	20%	20%	4%	Low
1.1.3	Planning and assessment of IT Infrastructure purchases	20%	10%	2%	Low

First are here presented the relevant variables for the model of each of the SDs and domains that comprise it, to conduct an analysis of the results. The SDs and variables have different weightings, so their contribution to the results makes consider the various degrees of influence; the higher the weighting, the greater the influence in the respective SD or domain. The variables relevant to the model are a consequence of the weighting of the SDs and variables. The variables relevant to the model turn out to be the 21 high-weighting ones displayed of Table 1, displayed in Table 2 with the average maturity result obtained in the self-assessment of the 121 PAs.

As part of the analysis hereunder presented, following is a review of the results of these 21 relevant variables, as well as a more detailed analysis of those that have an early stage of development, with a maturity model lower or equal to the general average, which is 2.3 (shaded in Table 2) that can give rise to a recommendation to improve in their future development.

Table 2. Variables relevant to the model and their average maturity

Domain	Sub-domain	Variables relevant to the model	Maturity
General Abilities	ICT Project Management	1. Project Management	2,2
		2. Purchasing and suppliers' management	2,1
	Human Capital and Change Management	3. Professional skills IT staff	1,8
		4. Change management	1,9
		5. IT development Abilities	1,9
Citizen-oriented Services	Multi-channel Service/Close Government	6. Diversity of Access Channels	3,0
		7. Integration of channels in the services delivery	3,1
		8. Users/requests-transactions	2,4
Digital Government Enablers	Users' Experience and Satisfaction	9. Customer's satisfaction	2,1
	Public Software and Cloud Computing	10. Government in the Cloud	2,6
		11. Informed Technological Neutrality	2,5
	State Inter-operability	12. Integration of information to conduct procedures	2,4
		13. Inter-operative normative framework	2,3
Open Government	Open Data	14. Make web/information services available to inter-operate	1,9
		15. Publication of data in open formats	2,2
		16. Open data normative	2,0
	Citizen's participation On-line	17. Publication format and license and data use	1,9
		18. Access to relevant information	3,0
	Co-design	19. Access to public enquiries	2,6
		20. Citizen's participation in the design of public policies	2,1
		21. E-Requests	1,5

2.1. Domain General Abilities

This is the least developed domain from the four, with an average maturity of 2.1 for the 121 PAs assessed. From the 3 SDs, the most developed is the *Strategic Alignment*, with an average result of 2.5, being a low weighting SD. Then is the *ICT Project Management*, with an average of 2.3; and the least developed with an average of 1.8 is the *Human Capital and Change Management*, both SDs with a high weighting.

Regarding the **Human Capital and Change Management**, its average level of development raises an alarm, because it reflects that no development exists, or it is at its very early stage on the human capital management and abilities management linked to IT development, both in its incorporation, and development. This SD obtained the lowest average in its level of development, only 1.8, being one of the lowest results observed among all the SDs of the model. The result is explained by the incipient level of development of all its variables, with a high weighting, being all of them relevant (Table 1): *Professional skills IT staff*, *Change Management*, and *IT Development Abilities*.

The **ICT Project Management** SD measures the level of development of the ICT project management, as a relevant aspect that affects in the level of alignment, as well as the management and follow-up of the budgetary implementation, including the purchasing and suppliers' management. The 2.3 average result of this SD, is mainly explained by the incipient level of development of the *Project Management* and *Purchasing and Suppliers' Management*.

According to Table 2, in this domain only 2 SDs have relevant variables: *ICT Project Management*, and *Human Capital and Change Management*. It is important to highlight that the 5 relevant variables of the model in this domain were assessed with a very incipient level of development; these are hereunder displayed:

**Project Management:** This variable measures the management level of IT projects, particularly those of the DG, from the strategic perspective, and its effects in both the users and the efficiency of the organization. 66% of the PAs are in a level 1 and 2. The project management concerns "correctly" implemented projects; that is, they should meet their scope within the time and budget defined. If it is in an incipient level means that

agencies know the importance, but they do not have a technological project management system, in accordance with the institutional strategy. This result allows to recommend training in technological project management for the directorates of ICT projects.

**Purchasing and Suppliers' Management:** This variable is to evaluate how the agency manages its purchases and coordination with suppliers, for a good project implementation. The result of this study reflects that an 81% of PAs, at the most, manage their purchases and coordinate with suppliers as established by ChileCompra; this, with the purpose of monitoring the deliveries set within the time limits of the budgetary implementation, but they do not include a coordination of the work with suppliers. The recommendation for PAs is to have project management methods or processes; thus, would improve the level not only in this variable, but also in the *Project Management* variable.

**Professional Skills IT Staff:** This variable measures the level of development of the institution abilities to incorporate additional staff that will be required to design, implement, and operate the new technologies and processes of the DG. In this variable, the least developed of the domain, an 81% of the PAs are between level 1 and 2; that is, "the institutions do not have recruitment and training processes for people by competencies to develop technological projects, or these were applied only in some projects." The abilities of the human resources of the area of IT must be encouraged, since they are essential to improve the result of PAs.

**Change Management:** This variable confirms that a formal plan of training/diffusion/communication exists to manage the changes required to support the business processes. An 87% of the PAs have occasionally started training/diffusion/communication processes in their technological projects; however, they still do not have systematic programs to implement them. PAs should invest in the training of human resources with programs to develop abilities and critical behaviors, to sustain the change management processes.

**Abilities for IT Development:** This variable confirms the incorporation of the knowledge and abilities required by people to develop the DG. In this variable we find that 88% of the PAs are in level 1 and 2; that is, "The plans and programs to provide education and training to the staff are occasionally implemented". The PA needs to systematically build IT abilities of project management, suggesting training programs of people, and working teams. The PAs should provide formal training through internal study programs or external certifications.

## 2.2. Domain Citizen-oriented Services

This is the most developed domain from the 121 PAs assessed. The 3 SDs are in a development level higher than 2.3. The most developed one is the *Multichannel Service/Close Government*, with a 2.8 average, which compared with the SD of the full model, is the highest stage of development; this, in terms of organizational maturity corresponds to level 3. The following most developed SD is the *Process Management*, with an average of 2.4; finally, the least developed is *Users' Experience and Satisfaction*, with an average of 2.3. It can be concluded that the domain itself is equal-level developed in all its SDs. The four relevant variables in this domain are in two SDs, *Multichannel/Close Government*, and *Users' Experience and Satisfaction*.

**Users/Requests-Transactions:** This is the variable where a 59% of PAs have a 1 and 2 development level, which means an early stage of development. In this level the PA conducts a measuring of the amount of *Users/Requests-Transaction* through



technological means, but only in specific cases. Indicators need to be defined to enhance the level of development of this variable, as well as measuring the effect of the various channels through statistics of use and analysis, and be adapted to the needs of the emerging citizens and technological progress. For a more efficient and effective delivery of public services, it is important to understand the needs of target-citizens, and provide services that will undertake the specific needs of citizens through a multi-channel approach.

**Diversity of access channels:** This is a variable with a good level of development, since 69% of the PAs are in level 3 and 4; this is an intermediate level (3), and (4) advanced.

**Integration of channels in the delivery of Services:** This is the most developed variable, averaging 3.1, being also the most developed in the model. This level of development indicates that the institution has a web site that includes collaborative tools, social networks and access from mobiles for on-line information delivery; this is consistent with its personalized service strategy, but it does not have a content manager and/or digital communities.

**Customer satisfaction:** This variable is an instrument to assess how the institution measures the level of satisfaction of its customer's needs. A 71% of the PAs are in level 1 and 2 of development. This indicates that the PA has identified the need of having a satisfaction measuring methodology of its customers, reporting thus, effectiveness data in its management. Citizens and companies' opinion are consulted, but only occasionally.

### 2.3. Domain DG Enablers

All its SDs have a development level higher than 2.2, being the most developed the *Public Software and Cloud Computing*, with 2.4. The next most developed SD is *Security, Protection, Identity, and Electronic Signature*, with an average of 2.3; and the least developed is the SD *State Inter-operability*, with an average of 2.2, showing a very low dispersion. From the 5 relevant variables in this domain, those that are, at the most, in an incipient stage of development are presented here under.

**Inter-operative Normative Framework:** This variable is to define the degree of compliance of the current normative framework to the exchange of information with other PA. 70% of the PAs are in level 1 and 2; this indicates that the PA knows the current normative framework on the interchange of information and inter-operation with other PAs, but has not yet adopted it. The diffusion of this normative should be particularly extended to the entire IT community.

**Make web/information services available to inter-operate:** This variable is to measure the WS or information that the PA has made available to inter-operate. 77% of the PAs are in level 1 or 2, this is, the PA has made available at least one WS or information to inter-operate with other PA, but it has not yet formally adopted it.

### 2.4. Domain Open Government

There is an important dispersion among the SDs that comprise this domain, since we have a well-developed SD (2.8) and a very low one in its average (1.8). The most developed is *Citizen's Participation On-line*, with an average of 2.8 which in practice is level 3 of maturity; the least developed is *Co-Design* with an average of 1.8. *Open Data* SD presents an average 2 of development. This domain has 7 relevant variables, it is necessary to focus on those who have, at the most, an early development stage, being these:

**Open Data Normative:** This variable allows to define whether the PA knows and implements some open data normative in its datasets. 81% of the self-assessed PAs recognize that they are in level 1 or 2. This implies that the institution knows the existence of national regulations for the publication and reuse of open data, but its implementation is not a priority.

**Publication Format and License, and Data use:** This variable measures whether the PA makes datasets available, which are processed with open licenses. 88% of PAs are in level 1 or 2, which means that PAs have published processed data with open licenses in structured reusable formats at least once. The recommendation to improve the development level of this variable is to publish a technical manual of open data formats and licenses publication, through increased use at international level.

**Publication of data in open formats:** This variable measures whether the PA has and publishes data in open format, publicly. 66% of the PAs are in level 1 and 2, but it means that the PA has made, at least once, an open format data publication; this does not imply a commitment with the permanent publication of open data.

**Citizen's Participation in the Design of Public Policies:** This variable measures whether the PA publishes in its portal citizen-oriented programs and projects, with the option for citizens to give their opinion, propose, vote, or other mechanism that the PA considers in the design of these programs. 68% of the self-assessed PAs recognize they are in level 1 or 2; hence, they know the normative on citizen participation, and are working in the publication of their programs and projects in a web portal.

**E-Requests:** This variable measures whether the PA portal has the possibility to enter collective requests to incorporate new institutional projects. This is the least developed variable of this domain, 86% of the PAs are in level 1 or 2. Here, the institution is considering the possibility of receiving in a web portal citizen's collective requests, to incorporate them in their programs and projects.

### 2.5. Overall Analysis of Model Variables

The development of the model relevant variables (21 of 41) is displayed in Figure 1, arranged from left to right, according to its overall average in all PAs. The most developed is on the left, and the least developed is on the right. In each variable can be seen (at the bottom of the graph, in blue), the number of PAs in level 1 (in red); the number of PAs in level 2 (in green); the number of PAs in level 2, and the number of PAs in level 4 (upper part of the graph, in violet). In this Figure 1, it can be seen that variables in level 1, in many PAs represent *Professional Skills IT Staff*, in level 1, 54 of the 121 PAs (45%); and finally *E-Requests*, which in 65% (79 of 121) of PAs were classified in level 1, this latter also with the least maturity average (1.5). The variable *E-Requests* not only corresponds to the higher percentage of PAs in level 1, but in this variable there is no other institution in level 4.

### 3. Conclusions and Future Works

This paper provides insights of the results obtained when implementing a DGMM to diagnose the level of development of the PAs. In all, 121 PAs of the central government responded to the call; this allows to attain results to identify the weaknesses of the DG strategy implementation. Detecting these weaknesses is the basis to formulate recommendations when creating public policies at government levels.

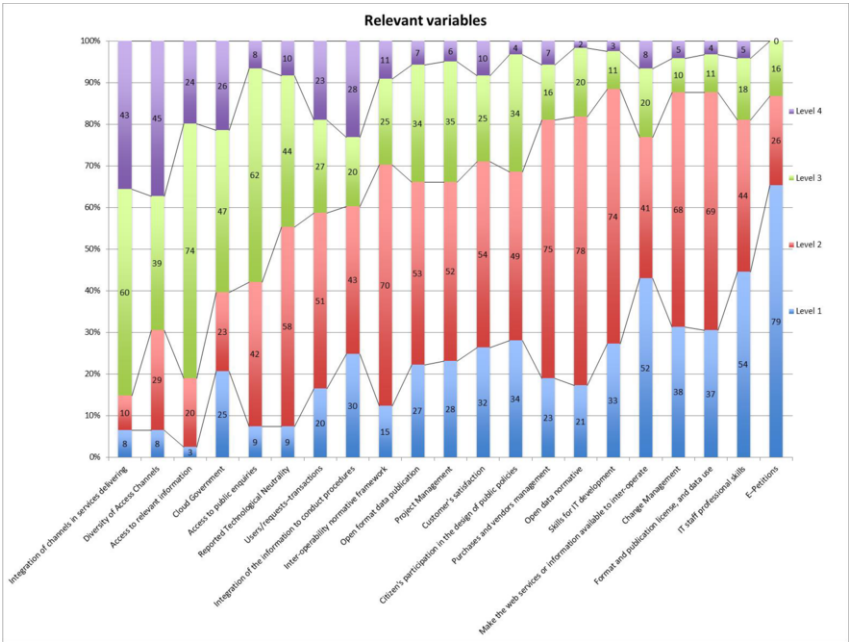


Figure 1. Percentage of institutions by relevant variable in level of development 1, 2, 3 or 4.

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# Improving Citizen Participation Through Improved Information Access in e-Government: Technology, Organisation and Environment Factors for South Africa

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**Abstract.** Many governments around the world, including South Africa, are spending millions on improving their e-Government services to allow citizens to interact with government more freely than before. Although the evolution of e-Government started during the early 1990s, it has not achieved the same success in terms of citizen participation as e-commerce. According to the e-Government Readiness Index, South Africa is considered ready for e-Government. However, actual citizen participation in e-Government remains low. Thus, this paper sets out to investigate the technology, organisation and environment factors which impact on information access and citizen participation in e-Government. A model for improving access to information for citizens through e-government is proposed. The elements of this model are derived from an extensive literature review of studies in similar developing economies, while citizen-related factors are confirmed through questionnaire findings. This model can be used to identify areas that need to be addressed in order to ensure that information access and citizen participation in e-Government is enhanced.

**Keywords:** Citizen Participation; E-Government; Information Access

## 1 Introduction

Electronic government (e-government) arose in the late 1990s as a way through which the public and government are able to partake in the new knowledge landscape for better service delivery [1] [2]. For developing nations in Africa, e-government is viewed as a hypothetical solution to curb poverty associated problems [1] [3]. Over the years, developed and developing countries have been making significant efforts towards e-government development and implementation [4] [5]. However, a far more positive trend for e-government adoption has been seen in developed countries as opposed to developing countries [4] [5] [6] [7]. Evidence reveals that developed countries are moving ahead more rapidly than developing countries.

Many governments all over the world have put more emphasis on e-government implementation for many reasons. The reason that South Africa is pursuing e-government development and implementation is because of the legislative mandate as well as benefits envisioned [8]. The legislative environment in South Africa places a mandate on government to deliver extensive access to government information. The South African government has made relentless efforts to provide access to government through e-government. The government has established bodies such as the State

Information Technology Agency (SITA) and Government Information Technology Officers Council (GITO Council) [1]. Moreover, the National Planning Commission (NPC) appointed in May 2010 by President Jacob Zuma developed the National Development Plan (NDP) in which the South African government committed itself to create an enabling environment that will provide its citizens with more government services electronically by 2030 [9]. Collectively, these show that the South African government has been devising ways to enhance citizens' access to government institutions and services. The South African government recognises that e-government is at the heart of the drive to modernise government and it can attain this by: making services more available, valuable, responsive, and economical; making government heads and members more transparent and responsible so that they are capable of guiding their societies; and encouraging local economic vitality [10].

Thus, public participation for information access is the main concern in this study. Public participation can be defined as a voluntary process through which citizens can interchange information and opinions on local, state and national issues to influence governmental decision-making. There are four levels of citizen participation, namely: posting information, communicating, transacting and governance i.e. citizens transition from a passive phase to become active participants [12]. This study has focused on the informational and communication stages of participation. Against this background, this study seeks to propose a model for improving access to information and thereby enhancing citizen participation in e-government.

## **2. The Research Problem**

The South African government recognises that e-government permits the public to communicate with government and contributes to policy and decision-making [13]. Nonetheless, it has been revealed that e-government implementation has remained lower than anticipated and highly challenging in developing countries as compared to developed countries [14] [15]. South Africa is not an exception as the public is not fully utilizing the available technology to ensure maximum participation in government activities. This is evident from the 2014 UN e-government survey which ranks South Africa 93 out of 193 UN member states [11]. The decline from 45th position in 2003 ever since its inception suggests serious challenges with e-government development in South Africa.

A lack of public participation means that the public misses out on information and services that are available online which results in more inequality [16]. This has a devastating impact on service delivery because participatory democracy would be non-existent. Thus the problem under investigation is concerned with the low levels of citizen participation impacting on the perceived success of e-government initiatives. Thus, this research study therefore seeks to answer the research question: How can the South African government improve citizen participation in e-government for information access? As a result, there is a need to produce a framework to ensure that the public participate in e-government. This framework will provide guidance to the Eastern Cape Provincial management and policy makers to take appropriate decisions to improve citizen participation and ensure that factors that hinder citizen participation are addressed. The model proposed in this paper is a first step toward the development of such a framework.

### 3. The Method

This study reviewed the recent and available literature, and academic and professional perspectives from various media on citizen participation in e-Government. The media reviewed included printed media (such as books and journals) and online media in the form of electronic journals and industry white papers. This literature search followed the guidelines for a systematic search, in that it was focused on obtaining relevant findings for the objectives of the study [28]. Specifically, the literature search focused on sub research questions answering the main question provided in section 2 above, namely: What technological requirements should be taken into account to ensure effective accessibility of government information by citizens? How do organisational factors influence or impact citizens' willingness to participate in an e-government initiative? How can environmental barriers be overcome to ensure better citizen participation in e-government? Through this review, a proposed model was developed. This model identifies factors from both a citizen and government view point.

As a first step in refining the model, the citizen factors were confirmed through the findings of a web-based questionnaire. The research instrument was a formal, web based survey investigating citizen's perceptions of the barriers to participation e-government services. Of the 181 registered participants of a local government pilot initiative for public safety, 52 completed the survey. The quantitative data from the web-based survey was analysed and the responses summarised to be meaningful and to identify trends through the use of charts and graphs. These findings provide the basis for the recommendation of the citizen factors in the proposed model.

### 4. Theoretical Background: Technology, Organisation and Environment

This research study refers to the Technology-Organization-Environment (TOE) [17] theoretical framework as the basis for studying the aforementioned research problem. According to TOE, adopting, implementing and using a technological innovation such as e-government is dependent on three inter-related constructs: (1) the technology being diffused; (2) the organisation that is diffusing such technology, and (3) the environment in which the technology is being diffused [17]. The TOE framework has been widely used in studying e-government and other technologies, including: factors affecting e-government assimilation in developing countries [18]; the determinants affecting e-government adoption in Sudan [19]; and the factors affecting e-government integration in Indonesia [20]. The TOE framework is therefore considered to be suitable for this study as it offers a comparatively comprehensive view to study the technological, organisational and environmental issues related to encouraging citizens to participate in an e-government initiative.

1. *Technology Factors*: In order for e-government to be a success, the required technological infrastructure should be made available [21]. In a study done in Quebec, despite the fact that services are offered online, a lack of technological resources, lack of high speed Internet access, lack of technological infrastructure, as well as expensive Internet access was identified as barriers [22]. Therefore, if these barriers are not addressed, then citizens' use of online services will not be realised. Although there are many benefits associated with successful e-government implementation, there are also numerous disadvantages [3] [16].

Amongst such is the exclusion of citizens without access to technology as a result of digital divide or lack of citizen involvement in e-government platforms caused by anticipated lower trust levels. For e-government to realise its perceived benefits, citizens need to have confidence in both the government and the enabling technologies [23]. E-government is likely to improve government operations, but there should not be uncertainties of data misuse or fears that privacy will be compromised when personal information is shared over the Internet [23]. This undoubtedly means that attention must be paid to technology as well as ensuring that technology is recognised as a trustworthy source for public service delivery.

2. *Organisation Factors*: Organisation factors include, amongst other things, human resources, citizens' awareness of e-government, and resistance to e-government. The main obstacle in Greece is that employees lack the required IT skills to support the adoption and application of effective e-government [24]. Computer literacy among citizens has been seen to be a contributing factor to citizen participation in e-government [25]. Educated people are more prone to use the Internet and visit government websites than uneducated people who might not interact with e-government services as they are computer based [26]. Therefore this suggests that citizens need to be empowered with technology education in order to close this gap. In terms of citizens' awareness, one of the barriers toward e-government success is due to lack of awareness programmes that promotes e-government advantages and benefits [27]. In a study done in Jordan, it was found that despite having home Internet access and a desire to use mobile devices for those without home Internet, only 21% of inhabitants were aware of e-government applications [27]. In a similar vein, a study on Citizens' Readiness for e-Government Services in Tanzania found that most respondents lacked awareness of e-government services offered by public entities [27]. Thus, if information access by means of e-government is to be realised, people need to be made aware of e-government initiatives and be convinced to make use of this service.
3. *Environment Factors*: E-government application helps to improve the performance of government agencies, thus ensuring that public services are delivered effectively to all citizens [2]. Nonetheless, there are environmental barriers that seem to impact citizens' willingness to participate in an e-government initiative. These include regulatory, legal and political issues [25]. E-government applications call for a new set of rules, laws and policies to address electronic activities such as data protection, transmission of information and privacy, as regulations and laws developed before this technology might not address it [27]. Involvement of government's top authorities will ensure that government officials implement e-government initiatives with high confidence, thus resulting in higher success levels and non-resistance.

## 5. A Model for Improving Information Access for Citizens through E-Government

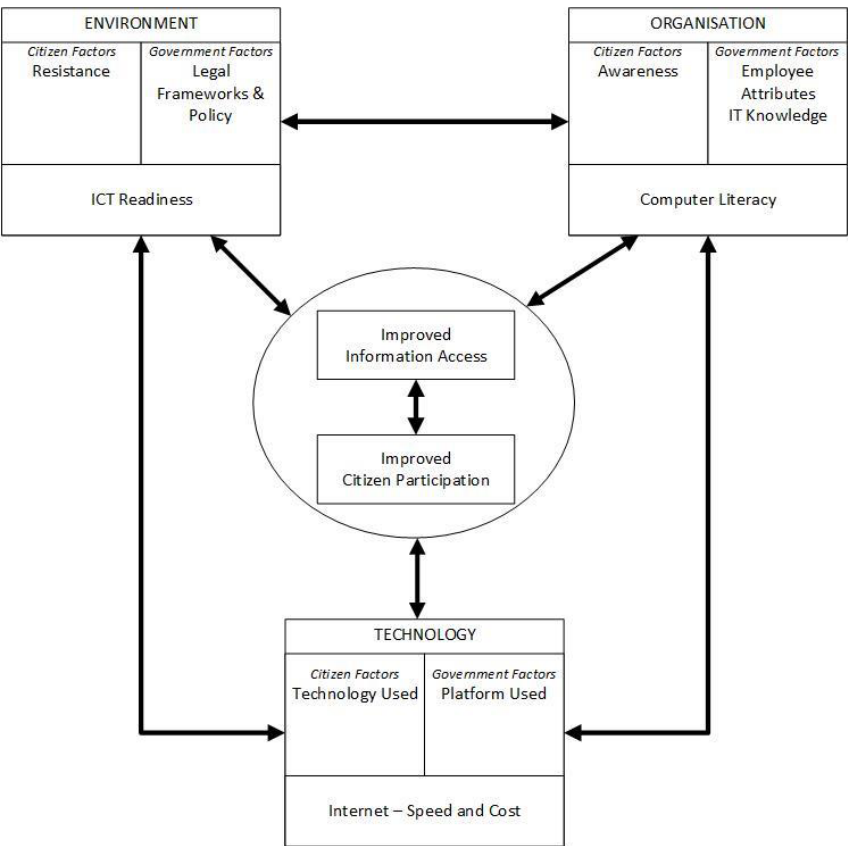
The model presented in this section (Fig 1) is based on the assumption that improved information access and improved citizen participation are similarly affected by technology, organisation and environment factors. Thus, these are depicted centrally in the model and are determined by the factors bordering them. The factors impacting on information access and citizen participation are derived from the theoretical

background described in Section 4. These have been classified according to their relevance for the citizens, government or where they have an impact on both. These factors are as follows:

- *Technology Factors*: For the citizen, the technology they have available and are able to use determines their use of e-government platforms, while government need to consider which technology platforms to use for e-government provision. The core factor for both government and citizens is the availability, speed and cost of Internet connectivity which underpins e-government initiatives.
- *Organisation Factors*: Citizen awareness of e-government services is a relevant concern, while employee attributes (including efficiency and motivation) and IT knowledge affect the government side. For both citizens and government, ensuring computer literacy skills are attained is essential.
- *Environmental Factors*: For the citizen, resistance to use of e-government platforms is a significant factor, while legal frameworks and policy affect the government environment. The status of ICT readiness impacts on both government and citizens.

Careful consideration of each of the factors mentioned above is necessary in order to meet the needs of both citizens and government and establish a more effective means of accessing government information and thereby enhancing citizen participation. As an initial test of the relevance of the factors described in literature, a survey was administered to citizens who participated in a pilot project on public safety initiated by a local government agency. The questions focused on the identified technology (Technology Used: Did you have the necessary resources (e.g. phone, airtime) to report public safety issues?), Organization (Awareness: The extent to which they found it useful to report public safety matters) and Environment (Resistance: The extent to which they feel it shows empathy to people at risk to report public safety matters) factors as identified from literature. The results of these questions are reported in Table 1 below. Only those responses which agreed or disagreed were reported, thus the “missing” responses were where the neutral option was selected by the respondents.





**Fig. 1.** Improving Information Access for Citizens Through e-Government

**Table 1.** Survey Results.

Construct	Median	Mean	Agree	Disagree
Technology Used	2 (Agree)	2.36 (Agree)	61.00%	28.14%
Awareness	1 (Strongly Agree)	1.61 (Agree)	80.49%	4.88%
Resistance	1 (Strongly Agree)	1.80 (Agree)	80.49%	9.76%

The results indicate that the participants found resistance and awareness to be significantly more important factors for ensuring improved citizen participation in e-government services. In terms of the technology factors, 61.00% of the respondents indicated that they do have the necessary resources in order to participate in the project. Thus, the choice of platform is deemed appropriate for this e-government initiative. For organisation factors, 80.49% of the respondents agreed that it is useful to report public safety matters in this way. Awareness of the opportunities available via e-government is therefore important. The environmental factors were agreed to by 80.49% of the respondents, thus reporting public safety matters allows citizens to contribute to the society they live in.

## 6. Conclusions and Recommendations

This paper investigated factors which affect information access and participation in e-government services. A literature survey was conducted which provided the foundation for the proposed Model. This Model proposes various technology, organisation and environment factors impacting on information access and citizen participation. The citizen-related factors were empirically tested through a questionnaire to confirm their applicability.

Further research conducted into enhancing citizen participation in e-government will empirically test and refine this model to ensure its applicability within the South African e-government context. The model suggested in this paper can also be expanded into a framework to assist government in improving its e-government offerings.

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# The Elderly and the Electronic Government in Brazil

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**Abstract.** The use of information technology can increase the quality of life of senior citizens. The elderly tend to be more cautious and seek greater certitude before they act when compared to younger individuals. In Brazil, the elderly are already 13% of the population. The objective of this research was to study what factors influence the elderly in the use of e-government in Brazil. The focus of this study was to investigate an initiative of the Brazilian government to computerize fiscal control mechanisms. We interviewed 137 elderly individuals who have used the program. We used a quantitative methodology for the development of this research, through the multivariate analysis technique of structural equation modeling. The study presented a robust model with a high explanatory power, in which the influencing factors are: Performance Expectancy, Facilitating Conditions and Habit. The research assists in the participation and involvement of the elderly in the current e-government development phase in Brazil, exposing their perceptions.

**Keywords:** elderly, electronic government, Brazil

## 1. Introduction

Information and communication technology (ICT) permeates human actions, and the effects arising from this can be observed in various social segments. This intensive use of IT in all sectors has also been spread to the Public Administration, becoming indispensable in this area. The use of IT combined with the Internet as a public management tool is called electronic government and aims to better qualify the provision of services and maximize the Public Administration efficiency [5].

Theories on e-gov are in a process of definition, as it is a recent area of study, still in development [42]. The movement originated because the growing development and popularization of technologies has highlighted the need for understanding the adoption of both products and services that they provide [40]. This understanding would allow governments to benefit society through public policies of inclusion and services for the quality of life of their citizens, including the elderly. At the same time, individuals would accept and use such technologies [2], [18], [42].

In the e-government concept, IT is a tool by which, through e-Services, the interaction between citizen and government occurs. We can infer that the implementation of e-gov is linked to the desire of citizens [14], [42], with its accession

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depending on the acceptance, dissemination and success of propositions and policies inherent to e-gov.

There are several studies in different countries studying the adoption of e-gov, as in Canada [42], the United States [4], Netherlands [25], Romania [9], Turkey [36] and Brazil [33], among others. Those studies have shown different results; however, all the suggested models are based or adapted from current theories of technology acceptance, such as the Technology Acceptance Model (TAM) and the UTAUT. These differences in the models indicate a difficulty in the generalization of one context to another, because of cultural differences and different stages of the development of e-gov in these countries. Thus, it is becoming more relevant to study specific contexts of adoption of e-government.

In the last years, the interest in the elderly (defined as adults aged 65 and older) has burgeoned because this demographic segment has expanded in size and spending power.

In Brazil, the population is estimated at 201.5 million individuals, and the tendency is the reduction in the number of children and the increase in the number of elderly individuals. The elderly are already 13% of population. The elderly tend to be more cautious and seek greater certitude before they act when compared to younger individuals [3], [50]. As consumers, older adults have been shown to be among the last to adopt an innovative product, service or idea [39]. Kerschner and Chelsvig found that age is related to attitudes toward and the adoption of technology: the older the consumer, the more negative the view towards technology and the lower the use of various technologies [28].

Therefore, the studying and researching of the resistance and adhesion of the elderly to e-government technologies in Brazil is an opportunity to collaborate on a model development for the reality of the country, and the identification of its factors can enable its more effective administration, thus increasing opportunities for positive results.

Thus, the objective of this work is to study what factors influence the elderly in the use of e-government in Brazil. The focus of the study is to investigate an initiative of the Brazilian government to computerize fiscal control mechanisms.

## **2. Literature Review**

### *2.1 Models of technological adoption*

Contemporary theorists have examined the study of the acceptance and adoption of technology by individuals, proposing theoretical models based on social psychology; the diversity of such models lies on determinants for such adoption. In order to explain and increase the acceptance of individuals with regard to the technologies, it is necessary to understand the reasons that lead them to adopt or reject information technology [12].

Models intending to predict the acceptance and use of technology have emerged with the Technology Acceptance Model (TAM) [11]. Several other researchers have conducted studies, using TAM as a main reference, deepening the knowledge on acceptance and technological adoption in some areas of knowledge related to information technology.

In 2003, some authors proposed a theory named Unified Theory of Acceptance and Use of Technology (UTAUT). It is the most highlighted article of technological adoption, which features one of the most widespread models in the literature on IT.

The model is based in eight prominent models in the area, and it empirically compares their dimensions, seeking convergence to its integrated model. Venkatesh's model was presented as a way for administrators to assess the probability of success in the introduction of new technologies, assisting in understanding the initiative.

The UTAUT has led to significant progress in understanding the adoption and use of technology, although its focus has been primarily on individual processes at a psychological level and contingencies that arise as related technology perceptions and situational factors, respectively. Some years later, other researchers developed the UTAUT2, extending the acceptance model and use of technology to the consumer context.

## *2.2 E-government in Brazil*

The use of information by the Brazilian government started before the 1950s, but the use of the term e-government is from 1996, with e-services provided by the Brazilian federal government [17]. Services such as the delivery of income tax declaration, information on social security and government procurement are available on the Internet since 1998, and in 2000 the Electronic Government Policy was defined and established and the Information Society Program was launched, consolidating and spreading e-government and the social importance of digital inclusion strategies, as well as actions related to information technology in the country, implementing the e-government in the country through structures and legal guidelines [41].

The authors of e-gov in Brazil could prove the success of the e-government program until 2003, when there was the transition of the federal government and the program was no longer a priority, because of four factors: change in political leadership; absence of inter-bureaucratic coordination, with no individuals responsible for the program in several Ministries; problems in connecting with society, thus causing discontinuation of partnerships and withdrawal of companies that provided technological services; and, lack of resources for the e-gov program, with subsisting projects of specific sectors, yet isolated from an aligned policy development [37].

Brazil stands out in specific initiatives such as the Open Government and Open Data, mentioned in the UN report as an example of good practices for having a single goal of access to public data. Currently, the Brazilian government offers to its citizens several e-gov systems. Among the most important, we can highlight: a) IRS – income tax collection services; fiscal status of taxpayers; social security and national register of legal entities; statements; among others; b) Poupa Tempo (a state of São Paulo program) – access to public service information, such as documents request, and opening and closing of businesses; c) Federal Police – services such as passport application, statements of criminal records, support for international adoptions, among others; d) Public Digital Bookkeeping System (SPED, in Portuguese) – tax information, rationalization and standardization of ancillary obligations of taxpayers; e) Integrated System of Financial Administration of the Federal Government (SIAFI, in Portuguese) – interests linked to the national treasury, as availability of public spending; f) OntoJuris Project – provision of legislation information on intellectual property, consumer rights and electronic rights; g) Compras Net – shopping website of the federal government.

### *2.3 Technology acceptance by the elderly*

Many researchers argue that elderly individuals are often more reluctant to accept technology [34], [50]. The use of IT can increase the quality of life of senior citizens [10], [32]. The elderly can reduce social isolation using IT, communicating with friends and family and having an active participation in an increasingly computerized healthcare system [10]. Elderly individuals are less likely to adopt the Internet [24], [30].

This age-related digital divide prevents many elderly individuals from using IT to enhance their quality of life through tools, such as egov and Internet-based service delivery.

In the case of the e-government program chosen for this study, the population can voluntarily use it. Thus, this study intends to increase the understanding about the perception of the elderly in this e-government initiative.

### **3. Proposed Model**

The models present many generalization difficulties, because of cultural differences, phases of e-government implementation and the economic development of countries. Thus, we have decided to develop a model according to the Brazilian context.

The proposed model was based on the theories of IT adoption and e-gov.

The hypotheses of this study, with their theoretical bases: H1: Performance Expectancy positively influences the Intention to Use e-government by the elderly; H2: Effort Expectancy positively influences the Intention to Use e-government by the elderly; H3: Social Influence positively influences the Intention to Use e-government by the elderly; H4: Facilitating Conditions positively influence the Intention to Use e-government by the elderly; H5: Habit positively influences the Intention to Use e-government by the elderly; H6: Habit positively influences the Use of e-government by the elderly; H7: Intention to Use influences the Use of e-government by the elderly.

### **4. Methodological Aspects**

For the development of this research, we used the quantitative methodology, through multivariate data analysis. Given the characteristics of this research, we chose to use the Partial Least Squares Path Modeling (PLS-SEM) [21]. We conducted interviews with elderly individuals to obtain data to use the PLS-SEM, using a survey for data collection according to the suggestions of authors [22]. We interviewed 137 elderly individuals who have used the program. The interviews were conducted in the city São Paulo, in public places. All questions were measured using a Likert scale of seven points, which is similar to studies that used similar models for IT adoption. For calculation and validation of statistical tests, we used the SmartPLS [38].

### **5. Descriptions and Analysis of Results**

According to Hair et al. (2013), the evaluation criteria of reflective measurement models are: internal consistency (composite reliability), reliability of the indicator, convergent validity (average variance extracted) and discriminant validity [20].

To examine the convergent and discriminant validity of the constructs used in the structural model, we performed the Confirmatory Factor Analysis [19]. All constructs showed indicators with high loads in their latent variables, above 0.70, and low loads in the other latent variables, indicating reasonable discriminant and convergent validity [6].

A key measure used to assess the measurement model, in addition to the tests for each indicator, is the composite reliability of each construct [19,20]. The composite reliability describes the degree to which the indicators represent the latent construct in common. A standard commonly used for acceptable trust is 0.70. For the convergent validity of the model, another indicator used is the average variance extracted (AVE), value that, as a criterion for validation, should have a value greater than 0.5 [21]. The verification of the internal consistency was another indicator used to analyze the convergent validity. A high internal consistency value in the construct indicates that all variables represent the same latent construct. The internal consistency is evaluated by means of Cronbach's alpha, ranging from 0 to 1, with higher values indicating a high consistency level. For exploratory studies, values between 0.60 and 0.70 are considered acceptable [20], [35].

To verify the discriminant validity between constructs, we used: the estimated correlation matrix and the square root of the average variance extracted (AVE) of the constructs. The square root of the AVE of the constructs should be greater than the correlation between the latent variables; this is displayed prominently on the diagonal [20].

The values of all indicators are within those established by the authors.

The analysis of the indicators of significance was carried out with the values calculated by the bootstrapping technique [13]. The use of the bootstrapping technique to analyze the load significance obtained for the observable variables is not based only on one model estimation; nevertheless, it calculates parameter estimates and their confidence intervals based on multiple estimates [19,20].

In this research, there was a resampling of 5,000 samples, with replacement of 137 cases, according to recommendations [20].

Student's t-test analyzes the hypothesis that the correlation coefficients are equal to zero. If the results of this test show values higher than 1.96, the hypothesis is rejected and the correlation is significant [13,20].

The values were estimated by the bootstrapping technique. All relation values, except for Effort Expectancy and Social Influence regarding Intention to Use, presented Student's t-test higher than 1.96 (significance level = 5%). The t-test value for Effort Expectancy with Intention to Use was 0.677, with a p-value of 0.498, and the t-test value for Social Influence with Intention to Use was 0.854, with p-value of 0.393. These values mean that the constructs of Effort Expectancy and Social Influence do not influence the Intent for Adoption of the program by the elderly, thus not confirming Hypothesis 2 and 3.

Analyzing the coefficient of determination ( $r^2$ ), according to Cohen's scale, the model has high value for both Intention to Use and Effective Use of the Nota Fiscal Paulista, and the amounts are 0.599 and 0.639, respectively [7]. However, according to the scale of others authors, the values are considered moderate, though adequate [21], [23], [20].

All hypotheses were confirmed, except the cases 2 and 3.



## 6. Conclusions

This study presented a robust model with a high explanatory power ( $r^2 = 63.9\%$ ) in which the influencing factors are: Performance Expectancy; Effort Expectancy; Social Influence; Facilitating Conditions and Habit.

The model has unique characteristics because it was developed in an unexplored area with the elderly. However, the results are at the convergence of several other models developed by IT researchers related to the individual use.

The results contribute to IT research studies, with a model that reinforces and extends previous studies on technological adoption and e-government, adding a model in a new context yet to be explored.

There are no studies on the adoption of e-government in Brazil for the elderly and the existing models in the literature cannot represent all the dimensions addressed in the model presented in this study.

According to this research, the main factors for Intention to Use are Habit and Performance Expectancy, positively influencing the Intention to Use.

In relation to the effective Use, the selected and tested factors were: Intention to Use and Habit. In this case, both constructs showed positive results and positively influence the Use of the program. According to the model, Effort Expectancy and Social Influence have no influence on Intention to Use. Effort Expectancy is related to the ability to use technology to access the necessary information available. As respondents were elderly individuals who have used the program before, they were probably elderly individuals that had no difficulty in using technology. Regarding Social Influence, we have observed that individuals who are important in the social circle of the elderly person do not exert influence on the use of the e-gov program.

In practical terms, the research assists in the participation and involvement of elderly individuals in the current e-government development phase in Brazil, exposing their perceptions. Such participation is important in order to maximize the potential benefits for the government and for the elderly population that is growing in Brazil.

By understanding the factors that positively influence the adoption of this e-government program and clarifying the influence of this technology in the personal and professional lives of elderly individuals it is possible to improve the quality of service to meet the demands of the society. Thus, they can also allow an increase in the adoption of Brazilian e-government initiatives. The findings also support the faster implementation of the program in other administrative contexts for e-government, generating useful information for the main points to be considered in order to increase the use by the elderly and the chances of successful implementation.

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# PhD Colloquium Papers

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# Towards Organizational Transformation in Developing Countries: Enterprise Content Management in Rwanda

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**Abstract.** E-government development is more advanced in developed countries compared to developing countries. Organizational transformation by e-government in developing countries is still at infancy stage. Incremental or radical changes seem to be a subsequent stage in settings where technological implementations are still fresh like in developing countries. In a journey towards organizational transformation, this research work, using design science research, aims 1) to find critical factors influencing implementation of enterprise content management (ECM) in Rwanda as one of the developing countries, 2) to carry out an investigation on how these factors are related to literature in order to detect e-government development stage and 3) to eventually propose a next step towards organizational transformation. Preliminary results show that implementation of ECM in Rwanda has been focusing on deploying a technical tool in government organizations and this implies that work processes re-design and change management are imperative. The overall contribution of this entire study in progress is two-fold: 1) to suggest a practical way in solving some issues related to efficiency in administrative activities for practitioners towards organizational transformation in a developing country and 2) to create new knowledge for e-government researchers on organization matters especially in developing countries.

**Keywords.** E-government, implementation, organizational transformation, business process re-engineering, Rwanda

## 1. Introduction

Drawing from a UN survey [1] and looking at e-government development stage studies, i.e. Layne and Lee[2], e-government development in developing countries [3] is behind that of developed nations. As defined by Layne and Lee's model[2], the second stage which is transactional is not yet fully reached by the majority of developing countries.

Two studies, one in Sub-Saharan Africa and another in an Asian country – the continents where majority of the developing countries are located – Nkohlkwo and Islam [4] claim that the most e-government related challenges in Sub-Saharan Africa include ICT infrastructure, human resources, legal framework, internet access, the digital divide,

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and connectivity. The study in Asia [5] points out the issues of ICT infrastructure, the lack of ICT literacy and inability to access e-government services using local languages as problems in some Asian developing countries [5]. Furthermore in the Caribbean, for instance in Jamaica, ICT infrastructure, privacy and security, culture and the digital divide and financial issues are the factors undermining e-government implementation [6]. From these three studies above, the factors affecting e-government are general ones at national or regional level. In addition to that, other studies on developing countries focus on e-government adoption [7-11] mainly from citizen perspective, and e-services [12-16] and studies on organizational issues are limited in number even though these appear to be the ones mostly and directly affecting e-government implementation [17-19].

Therefore, my study started out to find factors influencing the implementation of an enterprise content management (ECM) system labelled “Document Tracking and Workflow Management System” (DTWMS) in Rwanda as a developing country I am very familiar with. As described in [20], Rwanda, being a unitary state with a central government initiating IT projects, has an ambitious modernization plan where IT has to play a major role. This includes a long-term 20-year economic development plan (“Vision 2020”) as well as medium-term strategy (“Economic Development Poverty Reduction Strategy”) and the National Information Communication Infrastructure (NICI) Plan. Together these plans aim to transform the country from an agrarian economy to an information-rich and knowledge-based middle-income country by 2020 [20]. Key actors in the NICI Plan are the Ministry of Youth and ICT at e-government policy and strategy level, Rwanda Development Board/IT (RDB/IT) department at the level of project co-ordination and implementation, and Rwanda Utilities Regulatory Agency (RURA) as the national ICT Regulating Agency[21]. Rwanda ranks 125 out of 193 UN member states but ranks top among least developed countries [1] as far as e-government development is concerned.

Being motivated by the scarcity of research on e-government, particularly on organization in developing countries, the main research question of my work is: What are current e-government organizational issues and how can improvements be made towards organizational transformation using ICT in a developing country? This is broken down into six sub-questions:

- 1) What are the critical factors in implementing Enterprise Content Management Systems in Rwanda?
- 2) How are the critical factors found related to success factors in literature?
- 3) What are issues related to ICT -enabled organizational change in developing countries?
- 4) What is the current state of ICT enabled Organizational change in Public Sector in Rwanda?
- 5) What improvements could be developed via business process re-engineering (BPR)?
- 6) How can these BPR-based improvements be implemented in Rwanda?

## **2. Related work**

ICT has a potentiality to transform an organizations [22], however e-government implementation is directly affected by organizational issues as it was pointed out by different researchers due misalignment between technology and organization processes,

adaptability or other issues related to user organization itself. For instance, among many studies conducted on developed countries, for instance, vom Brocke, Simons, and Cleven claimed that key challenges of enterprise content management systems adaptation processes are rather organizational than technological[23]. Alignment between organizational businesses and technology is one issue, and organizational change and change management is another.

But what are IT systems or ICTs mostly used in organizations? Enterprise Content Management (ECM) Systems, Enterprise resources planning systems (ERP), finance management systems other similar information systems[26], Payroll systems are those frequently used in organization. When it comes to ECM, it may include all or some components from documents imaging (DI), documents management (DM), records management (RM), workflow/ and business process management (W/BPM), web content management (WCM), knowledge management (KM), digital rights management and digital assets management [27].

As for ERP, it is a category of business-management software—typically a suite of integrated applications—that an organization can use to collect, store, manage and interpret data from many business activities, including: product planning, purchase, manufacturing or service delivery, marketing and sales, inventory management, shipping and payment[28].

When it comes to organization transformation, the concept of business process re-engineering also called business process re-design is important. Since 1990's there has been a growing research interest on business process re-engineering also 're-design used' (BPR)- "a strategy-driven organizational initiative to redesign business process to improve and achieve competitive advantage in performance" [29,p.129]. BPR application started in the private sector and was embraced later in the public sector from the last decade, where from 'Sweden to Spain and from Portugal to Greece', the reform of policies was done as to adjust to 'new managerial practices', with ICT use in this case, efficiently and respond to the needs of citizens effectively [29].

Looking at ICT-enabled organization change but now in developing countries, ICT adaptability and organization transformation is still a challenge in developing countries. For instance, Nurdin, Stockdale, and Scheepers [30] in their study on India and Indonesia, claimed that for a sustained IT implementation, business processes are to be adjusted to 'new technology requirements' which reduces physical contacts, this implying aligning back and front office[30].

But, what are current e-government organizational issues and how can improvements be made towards organizational transformation using ICT in a developing country? In the next section, follow a methodological approach to operationalize the research question.

### **3. Methods**

#### *3.1 Case Study Description*

Empirical research is being carried out in the context of a developing country, Rwanda, from central and local government agencies where the central government mandates implementation of a number of IT projects through the ministry of Youth and ICT at policy and strategy level, and Rwanda Utilities Regulatory Agency (RURA) as the national ICT Regulating Agency, and Rwanda Development Board (RDB) IT



department at project co-ordination and implementation level. These IT projects are rolled out from central government to local government agencies. Apart from project co-ordination, RDB IT deals with IT vendors for procurement, develops and customizes software programs, and conducts trainings for central and local government staff on the use of developed or procured software systems. As RDB implements these projects, they focus on implementing IT systems hoping that the public sector agencies will adopt and use them. Experiences so far show that use of the systems is very limited.

### *3.2 Methodological approach and constituent studies*

This research work use design science research (DSR) as a methodological approach, following the five steps: 1) awareness of problem, 2) suggestion, 3) development, 4) evaluation and 5) conclusion where the knowledge of a part of the study informs the subsequent part [31]. However, this research work will consists of the four DSR steps but step 4 “Evaluation” covered partly. This project consists of four studies:

1. E-Government Implementation in Developing Countries: Enterprise Content Management in Rwanda( which is a completed study)
2. Investigating issues related to ICT-enabled organizational change in developing countries
3. Beyond deployment of ICT systems: Situation of Organizational Change and Business Re-design in Rwanda
4. Organizational Business Re-organization Proposal and implementation of improvements in Rwanda

Study 1: I used interviews with respondents being employees working in two ministries and eight districts in Rwanda and document analysis to answer to the first and second research question. These were analysed mainly qualitatively but also a quantitative analysis was performed to compare with findings in the literature for second research question. The study, addressing the first two research questions, was based on semi-structured interviews with 56 people – 26 managers, 17 users, and 13 IT staff – in ten public organizations in Rwanda, eight in local government and two in central government. Ten organizations were selected based on system usage data, which is regularly retrieved by the RDB IT department. Data from February to May 2014 from 50 organizations was available. We selected the three ones (one ministry and two districts) who had the highest use (700-1000 document transactions per month), and seven (one ministry and six districts) with low use (0-40 transactions per month). There is insignificant difference between the eight districts in terms of population size and the number of staff per each district. The selection of individuals was based on their involvement in the DTWMS project in their respective organizations and their availability to participate in interviews. In nine of the organizations 4-8 people were interviewed, in one it was only one person. The published models in literature for success factors in ECM and ERP implementation i.e. the Horne and Hawamdeh theoretical framework [32] and the work of Norton[33] were used for to answer the first and second research questions, respectively. Those models were chosen because they are recent and comprehensive. This study one is at DSR problem awareness stage in order to have insights into e-Government system implementation problem in public sector in Rwanda in general.

Study 2 will address the third research question on literature review- study whose research question is “What are issues related to ICT -enabled organizational change in

developing countries?” This study serves to gather theoretical aspects on ICT-enabled organization change in developing countries.

Study 3 will address the fourth research question, “What is the current state of ICT enabled Organizational change in Public Sector in Rwanda?” the question is to be addressed by using interviews and analysing documents. The framework by Ward and Elvin [24] and socio-technical theory [25] will be followed in the study. This study three is also at DSR problem awareness stage in order to have insights in the problem of ICT-enabled organizational change in Rwanda.

Study 4, to answer question five and six. Question five will addressed in a three-stage process:

- a) Working with focus groups in a few selected government agencies, we will review and document the present processes (including a partial use of ICT)
- b) Continuing with the focus groups we will design a set of amended or new business processes for efficiency documented in UML for 1) small, 2) medium, and 3) radical change, using also new ICT functionality (to be procured or developed)

The proposed solutions will also be documented using storyboards and presented to groups of staff (potential users and managers in a few government agencies) inviting them to comment and give evaluations using questionnaires.

For question six, it will be a feasibility study on the possible implementation of the scenarios developed in responding to question five. In this work I will investigate the possibilities of using the technologies available by the organization, to be procured or developed. It will also address the steps of reorganization needed for implementation. I will here interact with the IT professionals, users and managers of the user organizations and at Rwanda Development Board. Study 4 fit with DSR stage number two, three: “Suggestion, Development” and part of step four i.e “Evaluation”.

In the four studies three information system artefacts [34] namely Technology artefacts (such as hardware and software), Information artifacts (such as information exchanged) and Social artifacts (people attitude and interaction in the workflow settings) are to be investigated to some extent.

#### **4. Preliminary results**

The results presented in this section relate to “problem awareness” step in the design science approach. The findings in study one prepares for subsequent DSR stages to be tackled in other remaining studies.

Out of the 40 factor elements in the literature in Horne and Hawamdeh [31] (also used as a framework to categorize the critical factors in the case study), respondents grouped into three categories (managers, users, and IT professionals) mentioned 14 factors grouped into five categories which are 1) User factors ( User Involvement in IT system improvement, User Perception of System Advantage, Training , User Perception of System complexity), 2) Task related Factors (Project Management Plan, Change Management Plan, Project Cost Planning, Post- implementation Evaluation Plan, Building a Business Case), 3) Technological Factors (Technical infrastructure, Business Process Re-engineering, , System Quality) 4) Content factor (Digital Signature) 5) Managerial factor (Top management Support). In each factor category, factor elements

in parenthesis are ordered according to frequency of all respondents (from high to low frequency).

User factors followed by task related factors were mentioned most frequently by the respondents. Regarding the most occurring factor elements such as “User Involvement in IT system improvement”, “change management” and “technical infrastructure”, response percentage show that in general all three respondent categories were in agreement on those factors which pertained directly to all of them. Some factors, like project management plan, were mainly mentioned by those directly involved with the project, i.e. managers and IT professionals.

**User factors.** The respondents strongly point out a lack of user involvement in the IT system improvement. A second major factor was the perceived lack of advantages for the users, even though managers were considerably more positive on this point than the actual users themselves. The numbers suggest that the training need was more related to aligning technology with work processes and achieving benefits than system complexity. Users mentioned issues like incomplete system requiring much double work, such as first scanning documents to process them and then printing them for signing.

**Task-related factors.** There seemed to be a lack of strategy regarding how to make efficient and effective use of the system. Respondents mentioned users being resistant to use, lack of buy-in among managers, and, limited ‘follow up’ about use of the system. Others mentioned lack of plans for change; the system is not ‘mandatory’, there is no policy about the system of document tracking in their organizations, neither internal in the organizations or as part of the performance contracts.

**Technological factors.** Technical infrastructure is the most mentioned factor; exemplified by Internet disconnection, power cuts or other technical issues of the system and network. In particular system users called for analysis and redesign of processes and workflow so as to improve efficiency of work processes and to retain staff; some respondents mentioned issues related to a lot of work, imbalance in work distribution among other issues.

**Managerial factors.** While not the highest ranked factor, a lack of top management commitment and support was identified among all respondent groups. Organizations managers and unit managers in those organizations were criticized for not ‘encouraging’ or ‘stimulating’ or ‘supporting’ use of the system. Some managers also admitted to have no policy regarding system implementation.

**Content factors.** The lack of an electronic signature system was mentioned as managers and users alike found this to be the main reason behind the double work caused by the failure to reduce printing. Low users mentioned User involvement in IT system improvement as the number one factor while this came as number four by the high users. Conversely the high users had Change management most frequently and this appeared as the fourth most frequent factor by the low users.

## **5. Discussion and Conclusion**

User issues appear on top of the list as defined by the respondents and use of the system of DTWMS varies a lot and is limited. It appears users do not see advantages of the system and the project management plan is unclear. The DTWMS is procured and implemented by a central government IT organization on central government order and this may explain partly the observed little management commitment and support in the government organizations where the system is to be used. Furthermore there is no known

plan for work process re-design, improved performance as the project is so far only about implementing a technical system. The pig picture from the ranking of factors shows a situation of organizations at infancy stage of e-government development.

Looking at the situation this appears to be the right moment when organizational change ingredient should be brought in. The change plan should be clearly defined for next step towards the efficiency and effectiveness in administrative activities for the benefit of citizens.

The study set out to investigate how critical success factors found in literature on IS implementation of information management systems relate to findings in the Rwanda public sector. The findings indicate that they do however it is not enough to take the latest findings in literature as the blueprint for success. Yes, it has been a necessary step to take first to make the ball roll in focusing on technology in early stage. However at this point, work processes re-design, and change management are imperative for government organizations in Rwanda in a journey towards organizational transformation.

The findings in the first study and those to be found in the second study serve for problem awareness and inform the next studies i.e. study three and study four on the suggestion and design for a solution proposal towards organizational transformation in a developing country like Rwanda. The overall contribution of this entire study in progress is 1) to exemplify and suggest a practical way in solving some issues related to efficiency in administrative activities for practitioners towards organizational transformation in a developing country and 2) to create new knowledge for e-government researchers on organization matters especially in developing countries.

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# E-Services as an Electronic Government Strategy: Proposal of an Info-Communication Model for the Environment Department of the City of Manaus

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**Abstract.** The e-government as an option of administrative is a one-way street. The citizens that use its benefits are the ones that demand transparency and efficiency from the public administration. In Brazil, the e-services offered by the government aren't widely used, except when they are mandatory and directly linked to the finances. This document presents an ongoing study in the scope of the Doctoral Program in Information and Communication in Digital Platforms of Aveiro University and Porto University (Portugal), and has the objective to construct an info-communicational model that defines a platform to support the environmental complaint service of the Environment Department of Manaus (SEMMAS), in Brazil.

**Keywords.** E-government, e-participation, e-services, digital platforms, environmental complaints.

## 1. Introduction

Manaus is the capital city of the State of Amazonas, located in the northern region of Brazil and has, according to the last census, 1.8 million inhabitants. It's considered an economically important city, because it's among the six Brazilian capitals with the biggest Gross Domestic Product (GDP) [1]. It has in its territory an Industrial Center, created 49 years ago, that attracts multinational industries to these days. They settled in the region because of the exemption of import taxes on fabrication input, in exchange for job offers and local reinvestments.

Through an existent service on the institutional website and call center, the Supervision Service of the Manaus city Environmental Department (DEFIS/SEMMAS) offers to citizens the possibility to register complaints of environmental crimes, namely about: air pollution, soil pollution, water pollution, sound pollution, invasion of protected areas and unauthorized cutting or pruning. According to the servers, the complaints are also presented via the social network Facebook, in the SEMMAS fanpage, however, it doesn't have any forms or specific application for that. The total of complaints that the DEFIS/SEMMAS registers surpasses two thousand per month and it is in this aspect that the problems appear.

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It is DEFIS/SEMMAS's responsibility to apply fines and tax assessments against those who commit environmental crimes. Today, the lack of public servers to supervise the city culminates in the exclusive consideration of occurrences considered severe. Typically a complaint has an estimated time of answer around three months and in some cases the environmental crimes aggravate and the responsible for them aren't punished. This study was proposed with the objective of developing an info-communicational model capable of organizing the information and the flow of the existent communication in the service provided by the DEFIS/SEMMAS. The objective is to provide a better management of the performed activities by the public servers and bigger clarification of the governmental activity to the population. Currently, it is in development in the scope of the Doctoral Program in Information and Communication in Digital Platforms of the University of Aveiro and the University of Porto, being oriented by Professor Maria João Antunes.

## 2. Theoretical background

Hereafter, we present the theoretical concepts about e-government, e-democracy and e-services that guide this study.

### 2.1. E-government

According to Castells, the network society is characterized by the social relationships promoted by their members and entities, already has a dynamic based in communication even before the appearance of the internet [2]. This technological evolution brought the expansion of the relationships between users and organizations, that kept a mechanism of information and one-sided communication, before the revolution caused by the *web 2.0*. One of the consequences of this change was the increment of Information and Communication Technologies (ICT), that promote the interaction in network.

To the governments, this speed in the social relations also altered the forms of registry, treatment, uses and communication the information generated in the managed environment. In the democratic systems, the needs find the preferences, since now the common citizen, in theory, can experiment participation in the definition of public policies and in the decision making process.

In literature, the term electronic government, or e-government (e-gov) means the use of digital technologies to the development of public management activities, promoting efficiency and services [3]. The understanding of this new perspective goes beyond the technological appliances and this new posture represents innovation in the processes and methods, strongly supported in a new vision of the uses of technologies to provide public services and in the interaction with citizens and companies [4].

The initiatives of e-government suffer severe criticisms, because not always they are seen as a management advance for the sake of society. The nomenclature "Electronic Administration" is suggested by Fugini [5], because the increment of digital technologies allows, according to the author, only the operationalization in computers of what was done manually, like the digitalization of forms, for example. The author defends that the use of technologies in the government still aren't fully used by the citizens, he sees companies as the biggest winner. Despite being critical, Fugini

[5] admits that the increase of monitoring mechanisms allows a better control of the public administration activities.

According to Flak *et al.* [6] two main entities concentrate *stakeholders* in the e-government: Government and Citizen. The frame developed by the researchers is used as a starting point of this research. In it, the participants in initiatives of e-government are subdivided as presented in Table 1.

**Table 1. Entities of e-government based on the study of Flak *et al.* [6]**

Entities	Subcategories	Description
Government	Politician	Publicly elected decision and policy maker (e.g. mayor, councillor, parliament member)
	Administrator	Middle and higher level salaried career employees executing politicians' policies (city manager, health department head)
	Service Provider	Lower level salaried career employees carrying out day to day government jobs directly or indirectly interacting with citizens (e.g., case officers in school department, advisors and information providers in taxation office)
Citizen	Consumer	Uses services offered by the government
	Activist	Citizens involved in efforts to effect specific government policies and decisions through civil action often individually or in groups (e.g., Amnesty International)
	Direct decision makers	Citizens are directly responsible for the makers decisions being made in a direct democracy system.

## 2.2. E-democracy

In democracy, at first, all eligible citizens are able to participate in the process of choosing their governors, in the scope of the social group they are part of. Understanding the reasons for which not all the citizens are being democratically involved is a complex matter that exceeds the objective of this study. However, the increment of alternatives of democratic participation, starting with the adoption of information and communication technologies, surround the initiatives of e-government and, for that, deserve attention.

Päivärinta and Sæbø [7] highlighted the comprehension of many contexts of use of the technologies in democracy, one of the first initiatives of the use of computers for making democratic decisions occurs in the beginning of the 70's (20th century). The



term e-democracy became popular in the scope of a *web* platform for voting in the State of Minnesota in 1994 [8]. However, an inevitable association with the use of technology made the term lose strength in the broadest meaning. Understanding the dynamics of the democratic process was no longer important, when only the internet was the main focus [7].

Van Dijk [9] called the process as virtual democracy, defining it as an “effort” of practice of democracy with the help of the ICT and the communication vehicles. However, the author highlights that the traditional politics still uses ways that depend on physical conditions of an specific time and space to happen. He highlights that the virtual democracy didn’t have its importance proved and that its studies need to be deepened. Accepting the virtual democracy, to the author, is believing that people are able to participate in the political deliberation through ICT’s, reading, clicking and interacting with the information that will result in making decisions. It’s a change of social *mind set* [9]. In this study, we take as a basis the concept defined by Van Dijk [10] that the digital democracy is the search and the practice of democracy in any aspect using the digital media online or offline. The author considers it as offline, since not every device is connected to the internet and can also be used as a support to democracy.

The possibilities of interaction between politicians, citizens, activists and public administrators are infinite, one of the biggest challenges is to align the speech of those that want to participate in the process of decision-making with those that already have the power to influence in the directioning of public policies. Even bigger is the challenge of supplying the lack of resources of those that don’t have conditions (social, economic, cultural, geographic) of participating in the process. In the Amazon region, this context is more evident given the geographic conditions and the social and political history in which the society was built on.

To some authors the focus of online government consists on the use of polls and voting and that’s why the e-government is confused with e-democracy. Allowing the participation through some mechanisms of interaction isn’t being politically democratic. To them, no democracy exists if the citizens aren’t totally informed about rights, duties, laws and opportunities that beneficiate them [11], [12].

Without considering the contrary speeches, it’s possible to believe that e-democracy can be strengthened in virtue of the increase of digital literacy by part of the authors that participate in it. According to Kolsaker and Lee Kelley [13], two key elements must be considered for collaborative decisions between citizens and politicians: The citizens need to be prepared to understand the several matters to participate in the decision-making process and the government needs to allow time and many channels of communication to increment the engagement in the debate.

### 2.3. E-service

The offer of e-services in the scope of public administration goes beyond the dimensions and the uses of technology by the government [4]. E-government projects sustain their guidelines and foundations on the duality of benefits to the citizens and the increase of efficiency of the administrative infrastructure, these being the biggest justifications to the appliance of financial resources year after year [14].

According to Lindgren and Jansson [15] the e-services are targeted by researchers, because in the scope of researches about e-government face the barrier that they’re still

not considered a segment of solid study. To the authors, when approaching the public e-services in initiatives of electronic government, it's necessary to consider present elements in most of the services, such as characteristics of intangibility, inseparability, heterogeneity and perishability. In other words, the services as a whole can't be measured or counted as an object, they are an unique process and happen in an moment of interaction between offerer and benefited, having a specific demand [15].

With great importance, the value found by the citizen in a public e-service is the key element of incentive to the participation in initiatives of electronic government. As an offerer, the government is capable of interfering in the creation of value, creating mechanisms to facilitation of usage by the citizens [14], [15], [16].

### 3. Methodology

This section presents the research question, the objectives and the data collect process defined to the ongoing study.

#### 3.1. Research question and objectives

To conduct this study, we considered the follow research question: what info-communicational model must give support to the activities of a department of public administration, in the scope of public policies of the environment? In this research, we will use the DEFIS/SEMMAS as the object of study.

The general research objectives are: 1. To build a info-communicational model capable of supporting the services of DEFIS/SEMMAS; 2. To understand how could a technologic support increment the information and communication processes in a public organism. To reach such objectives, we have as steps: 1. To identify the needs of the *stakeholders*; 2. To prototype and to validate a platform capable of attending the public servers, in the scope of the DEFIS/SEMMAS' activities; 3. To attend the citizens' demands as well as the public servers', in the interests related to the online services provided by DEFIS/SEMMAS.

#### 3.2. Data collect

To Axelsson and Melin [14], it's recurrent to adopt a participation of the users only in the phase before the development of e-services. The authors defend the formation of a focus group to increment the requirements collect that a service must have, a method used by other knowledge areas, where a small group of people (around 6 or 8) are gathered to contribute in the discussion of a theme previously presented by the moderator [14].

The data collect will be performed with each of the stakeholders identified in the study presented by Flak et al. [6]: politicians, administrators, public servers, consumers, activists and the direct decision makers. Each of the segments will have a focus group as a representation to deliberate about the functionalities. On the first group meeting, the result will be a list of functional requirements for the platform, later, a team formed by designers and developers will define which technical requirements attend each of the functionalities indicated by the stakeholders for the construction of a functional prototype.

#### 4. Prospective results

As a main future result we have the proposition of an info-communicational model that is necessary for the comprehension of the existent technological mediation environment. More than that, we will be observed the relations between government and the citizen in the same digital environment. Passarelli *et al.* [17] highlights that it is in a dirty environment and immersed in technology which uses and stores information, and at the same time, the exchange of messages occurs, making this an ideal location..

The Public Sector, in a network society, is a promoter and responsible for the technological advances. Therefore, it is possible to see the public administration strategically oriented to services directed to the society.

In order to validate our created model, it's necessary that we perform the application in a digital environment capable of providing the dialogue between citizens and governments. The digital platform of public e-services appears here to fill this space and can be understood as an entry and transmission of the human information in which converge several technologies and services with the objective to turning it into an instrument of info-communicational mediation.

As a tool of support to decision-making, it can be used as a benefit to the city management as one of its e-government policies. And even if it doesn't happen, for administrative matters or policies that are far beyond the limits of this project, the study will work to demonstrate an application of the techniques and the validation of scientific studies performed in initiatives of e-government in other countries.

The e-service as a strategy is an option for the public management of quality and with relevant content for its users. More than the charge of taxes, fines or tributes, the info-communicational model will help us to understand what are the needs included in the dynamics inside an environmental department in a city located in the heart of Amazon.

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# Digital Business Innovation of Public Services

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**Abstract.** The public sector needs to transform itself in order to reap full benefits of new digital technologies. In this regard, a paradigm shift is proposed from New Public Management (NPM) to Digital-Era Governance (DEG). Moving from NPM to DEG entails a full socio-technical change, and it is necessary to investigate what new business models will be needed, and what the impact will be on management, strategy, and governance. This research investigates the implications of moving from NPM to DEG. First, by applying Action Design Research (ADR) in the context of a government lab to examine the implications on strategy in a DEG context. Second, this thesis investigates how the literature is paving the way towards DEG by performing a literature review on open data case studies. In this specific aspect of DEG transformation, focused on ecosystem platforms, it explores how knowledge-based interactions are fostered by open data platforms. Together with the understanding of how to design a DEG strategy, this contributes to a holistic view on how to move towards DEG.

**Keywords.** Digital Era Governance, Digital Transformation, Simple Rules Strategy, Open Government Data, Ecosystem Platforms

## 1. Introduction

As in the private sector, public sector actors are raising questions related to digital transformation: What does digital government look like? How fundamentally different is this digital government organization? Strategy, management and governance-related questions are at play for different levels of government.

New technologies have created the demand for a shift from old ways of working to new ways enabled by digital. Dunleavy et al. [7] propose a shift toward the new management paradigm Digital-Era Governance (DEG). DEG rests on three pillars: reintegration of siloed government agencies, reorganization based on the needs of the citizen, and digitization of the way government and society interact. It differs radically from the way in which government used to organize itself in the past, by applying a management paradigm known as New Public Management (NPM). According to NPM, which never really delivered its promises [2], the public sector should borrow private sector concepts such as competition, performance measures, and a focus on efficiency [20]. Moving from NPM to DEG constitutes a digital transformation, and thus not only implies an IT-intensive change, but also requires new business models that can cope with DEG's three pillars.

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The aim of this PhD research is therefore to investigate what new business models are necessary to move from NPM to DEG and shape the discussion of what will be necessary to organize for DEG. This holistic research will look at DEG from a strategy, management and governance perspective, and includes case examples to 'feel' how fundamentally different DEG is, but also formative research to help define, understand, and further develop the understanding of DEG. This research is realized by means of a partnership and collaboration between a public-sector agency (VDAB) and KU Leuven. VDAB, the public employment service for the Flemish region in Belgium, funds a research chair at KU Leuven. For this research, two research questions have been selected up to now:

- RQ1: How do we formulate a good strategy of simple rules in the DEG context?
- RQ2: How are knowledge-based interactions fostered by open data platforms?

In the spirit of the adopted pragmatic research philosophy, this selection was driven both by a sense of urgency and importance in the context of VDAB, and with the aim to provide important contributions to the more general problem of moving towards DEG.

## 2. Related work

A global McKinsey survey [15] covering all types of industries identified a significant gap between the recognition of the importance of the new digital technologies currently at our disposal and our understanding of the true value digital can create. Therefore, one of the key recommendations of the authors is to understand what creating digital value means. The ExConomy framework was developed in this respect to give digital more precise focus [28]. It explains that the digital economy is ruled by four realities, which are summarized as the ExConomy: customer Experience is value, Experimentation is necessary, Collaboration reshapes strategy and business models, and digital eCcosystem platforms rule. To excel in all four realities, digital leaders (1) embrace digital technologies as a way to rethink value propositions and relationships with customers, (2) deploy information technologies broadly to systematically experiment with value propositions, and respond by swiftly scaling propositions that work. Digital leaders (3) reconceive their businesses through the function of ecosystems of digitally connected partners that co-create and share value, and (4) understand that the most valuable digital partnerships are built around digital ecosystem platforms, carefully managed architectures of reusable and integratable digital resources [28].

Gottlieb and Wilmott [15] also recommend organizations to - once they understand digital value - structure themselves in such a way that they can take full advantage of new digital opportunities. This pressing challenge is further explained specifically for the public sector in the following section. Related work is presented that can shed a light on what digital technologies can mean in a government context, and how government can structure itself to take full advantage of these technologies.

### 2.1. Digital government context

In the context of government research, new digital technologies resulted in a new vision of how government should organize itself. Fishenden and Thompson [8] advocate a shift from New Public Management (NPM) to Digital Era Governance (DEG).

NPM represented the belief that the public sector could be improved by the adoption of private-sector business concepts [20]. However, the narrow focus on performance, competition, and incentivization created silos, and had a negative impact on service quality [2].

DEG, on the other hand, promotes the use of IT to define the way government and society interact. DEG can lead to a transformation to a more genuinely integrated, agile, transparent and holistic government [6]. DEG stresses three central themes: reintegration, needs-based holism, and digitization changes. “First, reintegration of the silo government agencies created by NPM provides key opportunities for exploiting digital-era technology opportunities. Second, needs-based holism even goes far beyond this joined-up governance, as it argues for a move towards a genuinely citizen-based, services-based or needs-based foundation of the organization. This consists of the following components: client-based or needs-based reorganization, one-stop provision, interactive and “ask once” information-seeking, data warehousing, end-to-end service reengineering, agile government processes. Third, digitization changes consist of completely embracing and embedding electronic delivery at the heart of the government business model, whenever possible.” [7]

The ExConomy framework describes a changing world and a need for mastering new capabilities, but it does not address how to get from A to B. In government, moving from NPM to DEG comes with several implications yet to be uncovered and articulated. We need to frame this IT-enabled radical change in the literature to answer questions concerning the impact of strategic, decision-making and innovative position. We cannot reach DEG in another way than starting from the current model. This implies that a change strategy that only deals with the IT systems is not enough, a more profound and complete socio-technical change needs to be addressed. The research chair with which this PhD is funded was set up precisely to investigate how government can move from NPM to DEG through digital business innovation of public services.

## 2.2. Digital transformation

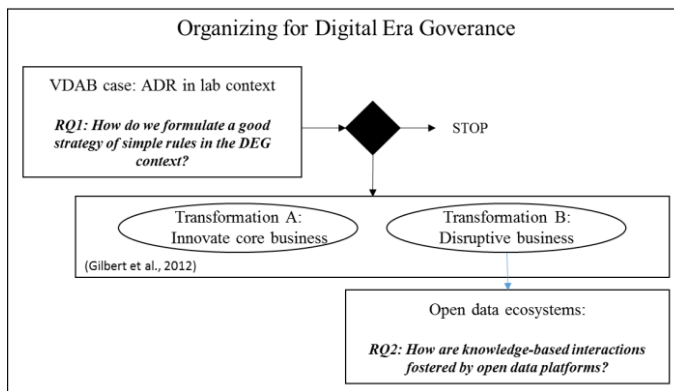
In a response to revolutionary business model transformation – remaining the exception rather than the norm - Bonnet & Westermann [1] suggest going for evolution rather than revolution. The authors believe it is sometimes better to start small to prepare for big results. Gilbert et al. [12] see digital transformation as simultaneously going for Transformation A, adapting the core business to its changing environment, and Transformation B, creating a new, disruptive business which will ensure future growth. To make both transformations work, it is crucial to exchange resources between the two. Because of the VDAB research chair, it was possible to take a deep dive into a government agency’s lab, set up with the ambition to come up with new “Transformation B” products and services. The first research question this PhD research aims to answer is what a (digital) strategy in such an environment looks like and how it can be developed (**RQ1**), see Figure 1. This research question helps in ‘sensing’ the four Ex-Co-nomy realities and provides a deeper understanding of the DEG context. Figure 1 shows that, despite the radical ambition of the lab, products or services coming out of the lab might be less disruptive than initially intended. In that case, they can either be stopped, or still serve internal innovation of the core business. These scenarios are however out of scope of this PhD research, which will only focus on radical “Transformation B” innovations.

### 2.3. Platforms and ecosystems

Ecosystem platforms are one of the hardest ExConomy realities to cope with [28], but they will be crucial for reaching a true DEG transformation that goes beyond internal innovation only. Thus, this research also focuses on radical “Transformation B” originating from ecosystem platform innovations. O’Reilly [25] was among the first to envision government as a digital platform, where government is “a convener and enabler rather than the first mover of civic action”. His proposition is rooted in the belief that if government realizes that it can be a digital platform provider, albeit in the making, it might make radically different management choices.

Technological platforms have been discussed from an economic perspective, with a focus on markets, and from an engineering perspective, with a focus on the technological architecture [9]. Both perspectives are necessary to grasp the complete view on platform innovation and competition. In an integrative definition, Gawer [9] conceptualized technological platforms as “evolving organizations or meta-organizations that: (1) federate and coordinate constitutive agents who can innovate and compete; (2) create value by generating and harnessing economies of scope in supply or/and in demand; and (3) entail a modular technological architecture composed of a core and a periphery”. To create a platform it is important to create and pre-serve complementors’ incentives to contribute and innovate [10].

An ecosystem has been defined by Ghazawneh and Henfridsson [11] as “a functional unit consisting of a set of actors (e.g., platform owner, third-party developers, platform’s partners and suers) and a set of technology elements (e.g., software platform, boundary resources) that are mutually interdependent. In the ecosystem literature [11][21], the rules that are set out for ecosystem participants determine the modalities of knowledge-based interactions to create value on top of the platform.



**Figure 1.** Organizing for Digital Era Governance: Research Questions

O’Reilly [25] identified the open data movement as one of the most promising forces driving this ecosystem platform vision forward. Up to now, the open data literature has mostly studied the supply of open data, rather than its use [24]. In an ecosystem approach, however, open data re-use does not automatically follow as a logical next step from open data publication. Re-use of the open data needs to be consciously fostered to elicit interactions by different ecosystem partners on top of the open data. Therefore, this PhD research will focus on how knowledge-based interactions are fostered by open data platforms (**RQ2**).



3. Methodology

This research is realized by means of a partnership and collaboration between a public-sector agency (VDAB) and KU Leuven. VDAB, the public employment service for the Flemish region in Belgium, funds a research chair at KU Leuven: “Digital Business Innovation of Public Services”. The aim is to investigate possibilities for further digitization of public services, by producing knowledge relevant for science and for practice. This concerns research in the innovation of business processes, services and service models in digital ecosystems for public services.

3.1. Research philosophy

Although a major part of the meta-scientific debate in IS research has concerned interpretivism vs. positivism [14], some authors have argued that a paradigm debate should also include pragmatism [13][23]. Since then, pragmatism has been very present in IS research, but mostly implicitly, with very few articles or authors explicitly acknowledge for it. A foundational idea in the pragmatism philosophy is that the meaning of an idea or a concept is the practical consequences of the idea/concept. Pragmatism is therefore concerned with action and change and the interplay between knowledge and action. The character of knowledge is not restricted to explanations and understanding, but includes also prescriptive, normative, and prospective knowledge. Together, giving guidelines, exhibiting values, and suggesting possibilities are described as constructive knowledge. The role of knowledge is to be useful for action. Data is generated through assessment and intervention. Local interventions are not believed to be limited to local improvements only, but are also instrumental in creating knowledge that may be useful for local as well as general practices. Pragmatism is appropriate as a basis for research approaches intervening into the world either by introducing organizational change, as is the case in action research, or by building artifacts, as is the case in design research.

3.2. Action Design Research

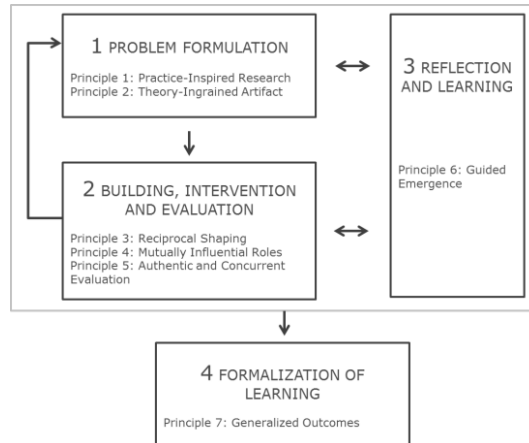
For this research, the Action Design Research (ADR) method is used, a special type of design research combined with action research elements [27].

Table 1. Comparing DR, AR, and ADR [15]

Property	DR	AR	ADR
Artifact	Central	Peripheral	Central
Organizational impact	Peripheral	Central	Central
Subject participation in research design	Possible	Mandatory	Mandatory
Subject feedback	Discrete	Continuous	Continuous
Transferability	Explicit	Implicit	Explicit
Success measure	Quantifiable measures of artifact behavior	Organizational impact	Organizational learning and artifact generalizability

“Design science research is a research paradigm in which a designer answers questions relevant to human problems via the creation of innovative artifacts, thereby contributing new knowledge to the body of scientific evidence. The designed artifacts are both useful and fundamental in understanding that problem” [19]. ADR is a research

method for generating prescriptive design knowledge through building and evaluating ensemble IS artifacts in an organizational setting. It extends the DSR paradigm with action research elements and, thus, avoids the separation problem of building and evaluation of previous DSR frameworks. Table 1 compares design research, action research, and ADR.



**Figure 2.** Action Design Research [21]

ADR researches IS artifacts as “ensembles shaped by the organizational context during development and use.” It deals with two main challenges: “First, it addresses a problem situation encountered in a specific organizational setting by intervening and evaluating. Second, it constructs and evaluates an IS artifact, generalized to the class of problems typified by the encountered situation in a specific organizational setting.” [27] ADR consists of four phases, which are represented in Figure 2: problem formulation, building, intervention and evaluation, reflection and learning, and formalization of learning.

### 3.3. Data collection techniques

For the first study, data was collected through participant-observation during project kick-off, 19 project steering committees, 4 workshops and 2 project reporting meetings with the CEO. One of the researchers consistently took notes, while the other intervened, in order to keep both activities separated. In addition, the researchers collected the notes of steering committee members, if any. They also observed the course of the project during several other project team meetings and attended informal meetings with the project manager. Analysis of both internal strategic documentation and previous case research. One

For the second study, which is ongoing, a literature review of open data case studies will be performed in the main forums for electronic government scholars [20]. 16 conferences and 8 journals will be reviewed, from 2009 up to now, for practical examples on how knowledge-based interactions are fostered by open data platforms. This study will look for combinations in title, abstract or text of “open data” AND “case study”, or “open data” AND “smart city”. For IS journals not specifically focusing on e-government the term “government” will be added to the keywords. The keywords are kept broad on purpose, to deliver a variety of cases.

#### 4. Preliminary results

This context-driven research has already resulted in a combination of both practical recommendations, and a number of important contributions to the general problem of moving towards DEG. In the first study, the local challenge of VDAB's transformation is used to study the more general problem of 'how to design a good strategy of simple rules in the DEG context'[3][4][5]. This first study gave the opportunity to sense the impact of all four ExConomy realities by taking a deep dive into a government agency's lab. First, general meta-requirements for an opportunity strategy of simple rules are defined by summarizing existing literature. This not only contributes to existing simple rules knowledge by providing meta-requirements for formulating simple rules, but it also ensures that VDAB's artefact is useful for a larger class of problems. Second, the study reports on the ADR process by which this strategy was designed. The result of the process, the artefact of VDAB's boundary breaking rules is presented. As this conceptual artefact was designed through a combination of rigor and relevance, it is valuable for other public services aiming for DEG transformation as well. Third, general design principles are derived for developing simple rules in a DEG context. These design principles propose how the meta-requirements can be addressed in practice and thus in the broader context of public services moving towards DEG. Fourth, we propose a design theory for simple rules by providing all components for an Information Systems Design Theory [16]. This can serve as a base for further research for validating and extending this design theory. Fifth, this study extended the application area of ADR, a relatively new design science research method. The aim of this first study is therefore also to contribute to the advancement of this method, which serves as a means to reunite academics and practice.

In a second study, an open data literature review will be performed to understand how visions for the future of government can be realized. These visions put a lot of stress on the importance of ecosystem platforms, which will be necessary to achieve true DEG transformation. This study will not be a summarizing or synthesizing review to find holes in the literature. Rather, the study will aim to propose suggestions and directions for further research in a formative setting. In this study, the autopoietic knowledge management epistemology is used as a lens to study case studies of open government data platforms. This lens is closely linked to the vision for the future of government in general, and the open data movement in particular, expressed by O'Reilly [25] and other open data visionaries [17][22]. The autopoietic lens is contrasted to two other knowledge management epistemologies, providing different views. The empirical open data literature will then be mapped on the three views, to identify whether research is paving the way towards this grand vision for open data as a platform. This will lead to the identification of new research areas needed to fully understand the management and governance issues related with government as the orchestrator of an ecosystem platform.

For future studies in the context of the PhD, the pragmatic philosophy will be applied further in rigorous research providing knowledge useful for action.

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# User Centric E-Government: The Modernization of National Migration Institute in the Southern Mexican Border

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**Abstract.** The objective of this research is to analyze two important aspects: e-government processes associated with migration and the centrality of the user in e-government projects. This study aims to address migration issues, in particular the modernization of National Migration Institute (NMI) at the Mexico's southern border, in the city of Tapachula state of Chiapas the border with Guatemala, specifically with those migrants who came to Mexico for labor objectives. Regarding the second, studies of e-government have not addressed in depth the centrality of the citizen. They have partially studied some way, either from the supply side or the demand side, so this study aims to analyze the three elements: organizational process, web portal, and necessities and capabilities from user's perspective.

**Keywords.** User centric, E-Government, migration management

## 1. Introduction

Many of the studies and research in e-government have focused on the technology, mainly in systems information, other studies mention the users of services and their expectations, while other studies analyzed the back offices and the organizational process. Nevertheless, it is necessary to study the three aspects in conjunction. That is to say, an integrative model for the whole process of e-government from organizational process to the user, across the technology enactment. According to [1] it is necessary to have a complete vision of the relationship between e-government and users, because the relationship is not only about the web portal and users, it goes behind scenes. It is a relationship that goes through the organization, the web portal and the feedback of the users.

The importance of the integrative model consist in enact technology that really benefits the users improving in effectiveness, efficiency, cost cuts, user satisfaction and a new relation between citizens and government. On the other hand, the migration management theme has been less tackle in relation to e-government whereby it became a current theme to study specially in the context of some countries like Mexico, which is a country of origin, pass and destiny of migration. Moreover most studies about e-government and migration have been focused on migrants integration on destiny countries, migrant's assimilation to society, or those countries who want to maintain the relations with their migrants outside the country.

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## 2. Setting the context

### 2.1 Migration of Guatemalan agricultural workers in southern Mexico

In Mexico, migration consists of migrants, immigrants and transmigrants. In this case we are interested in those legal immigrants from Guatemala, crossing the border for work purposes and who establish a relationship with the Mexican government. Guatemalans have crossed the border to work in the coffee farms since the late nineteenth century. This flow of immigrants was not recorded by Mexican authorities.

However, migration changed in the early 80's. Central American immigrants arrived in Mexico product of armed conflict, and started the refugee's immigration also. The presence of refugees created the need to record these Central American citizens and somehow legalize their stay in Mexico.

In the late 1990s it began a series of reforms in migration management in the southern border of Mexico, in order to keep track of foreigners who interned with labor purposes or for lawful activities on the border. In 1997 it began to consider registering Guatemalan workers crossing the border in order to work in agriculture in Chiapas, mainly in coffee farms, and that was when the Agricultural Visitor Migratory Form (FMVA) was created. Currently this immigration form is called Migratory Form for Frontier Workers (FMTF) since expanded to work in areas such as construction or services.

### 2.2 Technological modernization of the NMI

The National Migration Institute depends of the Ministry of the Interior. It was created in 1993 to take charge of implementing the immigration policy that the Interior Ministry designs. With regard to migration management in the southern border, it began to get the attention of the Mexican government in 2000-2006 administration, particularly in 2005, when they begin to create plans and programs to discuss immigration policy in southern country.

The modernization's program was created for the expansion of material, technological infrastructure and human resources to improve the documentation and recording of flows that penetrate through the southern border of Mexico [1]. It is included the point system modernization of documentation, registration and control of migration flows that penetrate through the southern border of Mexico.

According to NMI, in 2006 certain technology for best performance of the work of the Institute needs were recognized and to maintain connectivity between different offices of the Institute throughout the country and the need for a database that allows access to data of persons entering or leaving the country. In 2010 major reforms in regulation and then the adoption of ICT's were made to improve control of migration flows.

The issue of migration management involves a number of aspects of policy, legislation and administrative organization. In addition to these aspects in the management of migration related issues such as personal mobility, security, border control, human rights, international agreements. Currently this migration management is carried out using electronic means. In this case we are interested in migration management of migrant workers border.

Within the literature of e-government approach there is no consensus about the terms user-centered and citizen-centered. The difference in concepts could become a problem. User can be any individual or group, but the term citizen implies certain political involvement. The citizen is a subject of rights and obligations, while the user can be a citizen of the nation in which is offering the service or may be a citizen of another country. We argue that these differences are important in conceptualizing electronic government and its successful implementation.

### **3. Research Problem**

In addition, it seems that there is more literature related to citizens. To illustrate this, the theory that defines E-Government considers the relationship between Government and Citizens. One approach defines e-government as the interactions with several stakeholders Government to citizens G2C, Government to enterprises G2B, Government to Government G2G, and some scholars even talk about government to employees G2E [2]. In this sense we want to highlight that in the theory of e-government is considered the government aimed at citizens, not to more general users, such as individuals from foreign nations.

It is assumed that e-government is only for citizens, but little attention has been paid to e-government services provided to individuals from other countries. This discussion becomes more relevant when e-government is implemented in government agencies working for domestic and foreign users such as migration services. Foreigners are not within the category of citizens. Therefore, we have to consider e-government for non-citizens as an important phenomenon. But, this term could create confusion as immigrants are not citizens in the host country, but they are citizens in their country of origin. Without doubt this issue could lead to a broad discussion: e-government services for citizen, non-citizens or just for users.

However, the contribution to the literature on e-government citizen-centered is to start this discussion and especially to consider the relationship between e-government and immigration services, since this subject has been clearly underdeveloped. In addition, we propose a comprehensive approach that includes both the supply of government services and the demand of these services by users, who are not citizens of the country offering the services.

### **4. Research questions**

#### *4.1 General question*

Which are the organizational and institutional variables that have influenced on the technological characteristics of INM's web portal and how those characteristics produced benefits and respond to the user's expectations?

#### *4.2 Specific questions*

In order to answer the general questions, there are some specific questions to answer:

- How the organizational process and institutional arrangements affect the technology enactment (levels of functionality, usability and accessibility of the INM's web portal)?
- Which are the levels of functionality, usability and accessibility of INM's web portal and how these levels affect the results users obtain?
- How much the web portal respond to the necessities of the users and permit them to have benefits?
- Which is the perception of the users about the services offered by the INM through the web portal with respect to the benefits receive?

## **5. Theory**

The theoretical framework in the research consist in two aspects: the first part includes e-government definition, digital divide literature and citizen centric E-government literature, while the second part focus on the technology enactment framework, and additionally includes technical concepts as usability, functionality and accessibility, and environmental conditions.

The incorporation of technology in government has been called electronic government. Although the use of ICT's in government structures is not new, the concept of e-government came to be widely use in 1990's when it started to be seen as a policy strategy to improve the supply of services and reduction of cost as well as simplify administrative procedures, increment citizen participation, transparency and accountability of government activities [3].

There are mainly three different approach defining e-government, (1) an evolutionary approach which defines e-government in order to the stages, (2) related to the conceptual elements in the definition of electronic government, (3) related to the stakeholders of the e-government [4]. This research is considering the third one.

Contemplating this last definition on e-government based on who it establishes a relationship with, in the government an actor which becomes of certain relevance is the citizen, in this sense the first studies of e-government have mentioned the subject of the relation with the citizen very little, meanwhile a very important part of e-government and its benefits is to improve the relationship with the citizens, that their demands could be met and the efficiency reach could cover to the necessities of the users.

E-government tries to improve the processes and governmental organization trough digitalization and internet, but looking to offered citizens better services. It is for this idea that the concept of e-government has been legitimized and why it has had so much acception, because it proposes to be more citizen-friendly, offer faster procedures and better quality management.

In the literature about citizen centered e-government we can find two clearly defined lines. The first of which includes papers that refer to the theory about the importance of citizen-centered e-government and that convey the benefits that citizens and other actors would have with e-government [5] [3] [6], the second of which include papers that analyze the perception and preferences of citizens and that are empirical studies to know what the relationship between citizenry and e-government is, in these type of studies the quality of relationship existing between the citizen and e-government is revised. In this case we can find studies from the demand point of view, [7][8][5] in other words what the citizens think of government services and if their



demands were met and from the supply side [9] about what the services offered by the government are and what the characteristics of those services are.

According to Bertot and Jaeger [9], during the first ten years, e-government research studies focused on the techniques of gathering information and services online. "While important, this focus obscured a significant and important dimension of e-government –the needs of users of e-government services and resources" [9, p.163].

According to the previous paragraph which reviews the different studies of citizen-centered e-government it can be observed how the majority of studies focus on one area, the supply side or the demand side of services, but according to [3], it is necessary to have a full view of the relationship between e-government and users since the relationship that could result is not limited to the website but it is a relationship which includes everything from the organization to the website and the user feedback from the citizens.

One must not ignore the fact that citizens might use the e-government in a specific context in which some limitations such as the digital divide exist [10]. This is why an approach which includes every aspect, from organizational aspect of government agencies that have to remodel their processes in order to provide e-services to supply of services on the website reaching the user interaction considering his or her needs and capabilities. While studies about e-government had been in expansion at the same time the literature about digital divide has increased, in a parallel way [10]. Digital divide became important as the access and use of e-government by the users became a determinant variable to e-government success.

One of the main theories that explain the incorporation of technology depends of the issue problems is the Technology Enactment Framework [11] In government technology modify the structures and organizational routines but the use and implementation of the technology is transformed by the structures and organizational.

As reviewed above, in e-government studies little is said about the relation between the services provided by the government and demands of citizens. On the one hand, the expectations of citizens have not played a central role in the issues discussed e-government and on the other hand, has not been reviewed together what governments intend to do governments and service users obtain.

This study argued that for a truly user-centered approach should be considered at least three aspects: organizational processes, service to the users offered through the web portal and results for users considering their context [13]

In the case of the proposed model is considered three aspects, based on two references. On the one hand the theory of Technology Enactment Framework [11] on the other hand the model of successful enactment of e-government [13]. From Fountain's model have retaken the following theoretical constructs: organizational forms, institutional arrangements, technology enactment and the results. From the other model the variable environmental conditions is added to the new model. Thus the model of technological enactment user-centric considers the following theoretical constructs: technology enacted, processes and organizational structures, institutional arrangements, results and environmental conditions.

Each of the constructs is composed of certain variables that have been taken over by their presence in the literature both e-government and organizational theory. So each construct has an explanation itself, but there is also an explanation for the relationship according to the literature exists in the organization. Then the theoretical model of Enacting user centered e-government is presented in Figure 1.

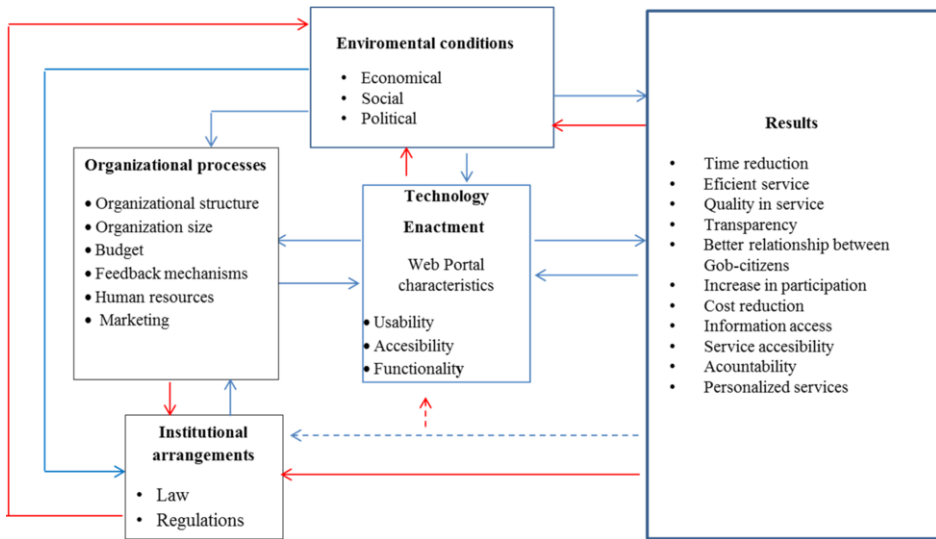


Figure 1. Enacting user centered e-government

## 6. Research Methodology

To address the research questions a mixed methodology is used, qualitative and quantitative, is planned, but where qualitative results are considered to be broader. The research pretend to be exploratory therefore descriptive. The research techniques proposed to answer the questions are semi-structured interviews to public servants working in ICT's Direction of NMI, and Guatemalan migrants and Mexican employers who have request the process for visited worker border card in order to hire Guatemalan migrants to work at the coffee harvest. Beside, a portal assessment will be done in order to deeply measure technical variables as usability, functionality and accesibility, with a methodology based on e-government theory [14] and international standards as W3C. There will be a documental review of official sources of NMI from which analyzes the organizational variables and institutional arrangements that were/are considered by the web portal operation.

### 6.1 Semi-structure interviews

For this research a nonrandom sample will be used to conduct interviews to Mexican employers, Guatemalan migrants and officials from Mexican government. In the case of Guatemalan migrants will interview on average have about 8 to 10 migrants, the main condition for interview Guatemalan migrants if they worked before the procedure is conducted online, and interviews will be made until saturation categories [15]

In the case of the Mexican employers, usually coffee growers who hire Guatemalan migrants are those who have large tracts of land for growing coffee, regularly over 25 hectares, which represents a minority of the coffee growers in Chiapas. In this case we will seek to conduct interviews in the city of Tapachula to consider it the municipality with more accesibility on the border with Guatemala, besides it is one of the leading coffee producers in Chiapas and in the municipality are

located large coffee farms. From interviews with the first farmers will seek more they recommend, what is known as "snowball" until reach a saturation categories.

Regarding NMI officials will seek to conduct interviews with officials of the General Direction for Communications Technologies particularly in the direction of technological infrastructure, management systems in telecommunications. In this case the sample depends on the availability of officials of the different directions for conducting interviews, it will seek to make as many as possible.

### *6.2 Portal web assessment*

Since the website is the main electronic means users have to communicate with NMI to perform certain procedures, then the NMI's web portal is evaluated, based on three basic aspects that are technically recommended a portal should include: usability, functionality, accessibility. In this case these technical requirements apply for any type of website, regardless if it is for a private or public organization.

To identify the variables to assess the technical elements an analysis from two perspectives was made, the technical vision that recommend standards for the Internet, but also through the vision of the studies of e-government to understand not only technical terms was done but also theoretical social and what are the implications of each of these aspects.

The evaluation of the portal takes up the methodology designed for measuring IGEE, by [16] which considered a number of indicators that are validated in the evaluation finding the elements that have been proposed. Measuring it is done under the concept of zero-sum -there is or there is not, thus the number of features found is divided by the total number of proposed features. This represents the part of quantitative methodology of the study.

### *6.3 Documental review*

The purpose of the document review is to describe the technology enactment made by the NMI. This technique information is used to complement the semi structured interviews NMI officials. The information collected through official documents issued by the NMI lets us know why NMI decided to adopt the technology in their processes and the management of migration services and how this was adopted, organizational characteristics (size of the organization, formal structures, budget), organizational factors (number of people working for IT, percentage of budget for IT training) and institutional arrangements that led to the choice of technology and the way it was adopted.

## **7. Preliminary results**

The outcome of this research will contribute with policy recommendations in the area of digital policy that currently coordinates the websites of the Mexican government and is making efforts to improve electronic services. These recommendations will help considering necessities and expectations from users.

In theoretical terms, this research can make several contributions. First is an integrated analysis of electronic government studies that include both supply side and

expectations of the demand side. In this work it is innovative. On the other hand this research proposes a theoretical model to analyze the incorporation of technology in government but with a user-centered approach.

In addition, this research has another contribution is that e-government services for citizens and users are analyzed. For user we understand those migrants who are not Mexican citizens, but demand e-government services. Therefore we can say that are e-government services to non-citizens and this idea can change many aspects of e-government approach.

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# Towards an eGovernment Interoperability Assessment Framework

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**Abstract.** The electronic cooperation of public organisations is a precondition for better public service provisioning to citizens and companies. Interoperability is a key challenge for electronic cooperation. Interoperability is a multilateral issue that incorporates technical, managerial and socioeconomic aspects. In this environment, assessing interoperability of systems and organisations is becoming increasingly important. However, interoperability assessment is a complex task. In the literature, a number of interoperability assessment models have been proposed. These incorporate different metrics and attributes to address one or some interoperability aspects. Currently, however, no commonly accepted eGovernment interoperability assessment framework exists. The aim of this PhD thesis is to develop and evaluate a comprehensive eGovernment interoperability assessment framework.

**Keywords.** Interoperability Assessment, Electronic Government, Public Services, Electronic Services

## 1. Introduction

Currently, a lot of Information Systems (ISs) have been developed and operate in the public sector. Most of them operate isolated from other ISs suggesting that interoperability has not been fully achieved yet, although guidelines have been available for many years. Moreover, a lot of experts claim that interoperability is a prerequisite for the reengineering of the organizational procedures in order to improve service provisioning to the citizens [7], [31], [33], [35], [37], [41]. Furthermore, technological advancements, (for example in social networks [6], [7] as well as cloud technology and open linked data) and new research areas, like service co-creation with citizens, can be considered when developing interoperability assessment frameworks.

Consequently, the following research questions could be raised:

- How can we practically assess and improve interoperability?
- What are the enablers and barriers for achieving interoperability? [35]
- Are consumers of public services (citizens and businesses) able to participate in the assessment of interoperability in the Web 2.0 era? [7]

In the era of the globalised economy, networking has become a key issue both for the private and the public sector. In the public sector, the electronic cooperation and sharing of information are the foundation for integrated electronic services provisioning to citizens and companies [31]. The electronic cooperation of

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organizations to achieve common goals could be defined as interoperability. More definitions for interoperability are provided in section 2.1.

Interoperability is a multilateral issue, which incorporates technical, managerial and socioeconomic issues. Moreover, interoperability could be examined from different perspectives. For example, the interoperability potential of a single system or organisation could be assessed using a reference model (*a priori* assessment). Alternatively, the interoperability level between two or more systems or organisations could be also assessed (*a posteriori* assessment) [24]. Thus, interoperability assessment is a complex issue. On the other hand, it is very important for an organisation in order to understand its interoperability status and plan its interoperability strategy.

Since 1995, the European Commission has launched a number of initiatives for eGovernment interoperability and, more recently, for eGovernment interoperability assessment (section 2.2). Moreover, many researchers have proposed interoperability assessment methods and models (section 2.3). Despite all this work however, currently no commonly accepted eGovernment Interoperability Assessment Framework exists.

In the following section, published documents about interoperability assessment are reviewed. Next, we describe our preliminary approach of the research method that we will follow in the future. Finally, we draw some conclusions and we outline our future work.

## 2. Related Work

In section 2.1 the main definitions of interoperability are given. Continuously, the relevant EU initiatives are presented in section 2.2. Following, much of the published work on interoperability assessment is reviewed (section 2.3).

### 2.1. Some definitions

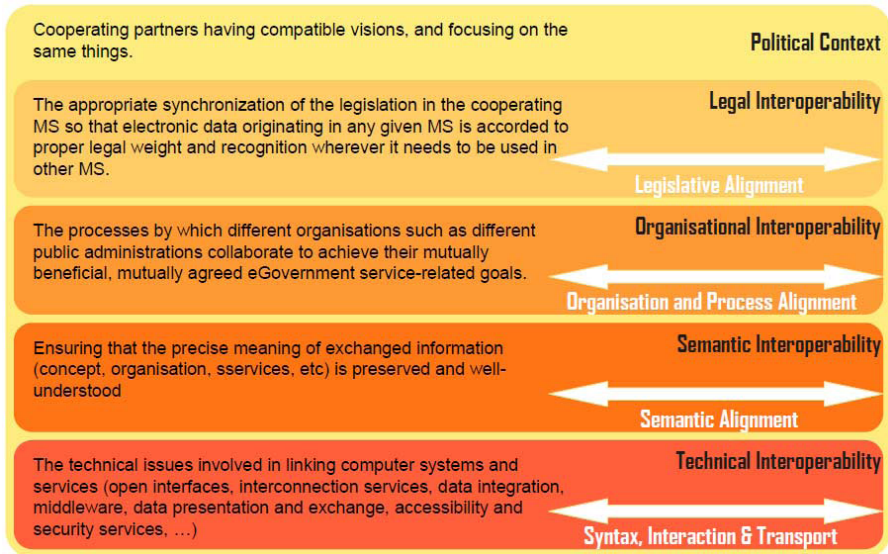
European Commission has defined eGovernment as follows: “*E Government is defined here as the use of information and communication technologies in public administrations combined with organizational change and new skills in order to improve public services and democratic processes and strengthen support to public policies.*” [14], [15].

In the European Interoperability Framework (EIF) for European public services [2], a definition of interoperability, concerning mainly public service delivery, is introduced: “*Interoperability, within the context of European public service delivery, is the ability of disparate and diverse organisations to interact towards mutually beneficial and agreed common goals, involving the sharing of information and knowledge between the organisations, through the business processes they support, by means of the exchange of data between their respective ICT systems.*”.

Also, a widely used definition for interoperability is that: “*Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged.*” [10], [11].

Although many definitions of interoperability are introduced in the literature ([6], [7], [8], [9], [31], [33], [34]), the core idea remains the same, as it is described in the above definitions. According to European Interoperability Framework (EIF v2) the study of interoperability could be separated into four levels (aspects): technical,

semantic, organizational and legal [16]. All of these levels should be analyzed and assessed taking into account the political context. (fig. 1).



**Figure 1.** The Interoperability Levels Dimension according to EIF v2.

## 2.2. Relevant EU initiatives

Since 1995 European Commission has launched three programmes to promote interoperability in the public sector of the Member States. In 1995 the IDA (Interchange of Data across Administrations) programme was started [12]. In 1999, the IDA programme was evolved to its second phase, referred to as IDA II that ended in 2004. IDA was focused on setting up infrastructure, establish common formats and integrate new ICT-based business processes for electronic government (A2A). IDA II maintained the initial target of IDA and additionally promoted the development of eGovernment services for businesses and citizens (A2B and A2C).

Between 2004 and 2009 the interoperability initiatives were funded by the IDABC (Interoperable Delivery of European eGovernment Services to public Administrations, Business and Citizens) programme [14]. At the beginning of 2004 the first version of European Interoperability Framework (EIF) was published ([2], [15]) that was prepared by the IDA and adopted by the IDABC.

The following programme for interoperability of the European Commission was the ISA (Interoperability Solutions for European Public Administrations) programme that ran from 2010-2015. At the end of 2015 ISA2 was adopted, which is the follow-up programme to ISA.

At the end of 2010 the European Commission announced the European Interoperability Strategy (EIS) [1] and the second version of the European Interoperability Framework (EIF) [13]. The EIS was prepared during the IDABC programme and finalized after a public consultation under the ISA programme, which maintains it. They are both targeting the goals of the action plan [3] in the framework

of Digital Agenda, the first of seven flagship initiatives under the Europe 2020 strategy [4] for smart, sustainable and inclusive growth.

Recently, European Commission has unveiled the European Interoperability Architecture (EIA) [5] to further promote interoperability in the public services across Europe.

### *2.3. Interoperability Assessment Frameworks (short literature review)*

As it is mentioned in the introduction, interoperability is a multidimensional subject, which is difficult to be assessed. Several Interoperability Evaluation Models can be found in literature [6]. Some of the most well known are the following: Spectrum of Interoperability Model [17], Quantification of Interoperability Methodology [6], Military Communications and Information Systems Interoperability [6], Levels of Information Systems Interoperability (LISI) [6], Organizational Interoperability Maturity Model [6], Levels of Conceptual Interoperability Model [23], Interoperability Assessment Methodology [6], Stoplight [6], Enterprise Interoperability Maturity Model (EIMM) [6], The Interoperability Score [18], Government Interoperability Maturity Matrix [19], Maturity Model for Enterprise Interoperability (MMEI) ([24], [25]), Interoperability Maturity Model [20]. Some of the aforementioned models have not been institutionalized. Below, we briefly describe those that are mostly referred in the literature.

The Levels of Information Systems Interoperability (LISI) model was developed in 1998 by The US Department of Defense, C4ISR Working Group [6]. The LISI is a hierarchical interoperability model. It has introduced a matrix for interoperability assessment. Each row of the matrix corresponds to an interoperability level. It has five interoperability levels (0–4), which are: Isolated, Connected, Functional, Domain, and Enterprise. The columns of the matrix correspond to the attributes, utilized in the assessment process, which are: Procedures, Applications, Infrastructure, and Data (PAID).

The LISI model focuses mainly on technical interoperability [23]. A mapping between the model and the implementation technologies of a system has been developed. A tool of the LISI model is an Interoperability Questionnaire. Consequently, the recorded information is analyzed, for the assessment of information systems interoperability.

There are three types of LISI metrics [6]: the generic level, the expected level and the specific level of interoperability. The interoperability generic level is calculated for single systems using as a benchmark the LISI reference model. The expected level of interoperability between two systems is defined as the lowest generic level of both systems. The specific level of interoperability between two systems is calculated from the comparison among the implementation alternatives each of the system has used [6]. A higher interoperability level between two particular systems does not mean higher interoperability maturity level for each of them [23].

The Organizational Interoperability Maturity Model extends the LISI model to assess organizational issues [23]. It is focused on Organizational Interoperability.

The Levels of Conceptual Interoperability Model (LCIM) assesses conceptual interoperability that goes beyond technical models like LISI [23].

The Interoperability Assessment Methodology model introduced nine components, which are the following: requirements, node connectivity, data elements, protocols, information flow, information utilization, interpretation, latency and standards.



Interoperability Assessment Methodology highlights that interoperability issues should be taken into account at the early design stage [6]. *A priori* assessment and proactive actions for interoperability problems that might occur are usually simpler and less costly [25]. In addition, a detailed conceptual model could be often very helpful ([21], [22]).

Moreover, semantic interoperability among ISs conceptual models is a critical issue ([21], [36], [40]). In [22] a measurement methodology of the semantic gaps between Cooperative Information Systems (CIS) conceptual models, using mathematical formalization, is introduced.

The Enterprise Interoperability Maturity Model (EIMM) was developed in the framework of ATHENA Integrated Project (Advanced Technologies for Interoperability of Heterogeneous Enterprise Networks and their Applications). It is a maturity model for assessing interoperability in the enterprise domain [6], [23], [26].

The Government Interoperability Maturity Matrix (GIMM) aims to provide administrations with a simple, self-evaluation method that can be used to assess their current eGovernment interoperability status. Moreover, the model provides guidance for interoperability improvement in respect to system implementation and services provision to citizens and businesses [19].

Maturity Model for Enterprise Interoperability (MMEI) defines a common framework for assessing and measuring potential interoperability maturity and additionally provides information about ‘best practices’ that allow enterprises to improve their interoperability potential [25].

In the end of this section, we briefly describe the Interoperability Maturity Model (IMM) that has recently become available in the framework of ISA2 programme of the European Commission.

The Interoperability Maturity Model IMM has two dimensions [27]:

- The assessment of the current interoperability maturity of a public service based on a set of defined interoperability attributes and maturity stages.
- The provision of guidelines towards the improvement of a public service interoperability maturity.

The Interoperability Maturity Model is focused on the improvement of public services provisioning to other public administrations, businesses and citizens. [27]

### 3. Preliminary Approach

A plan of our research for the development of an Interoperability Assessment Framework might include the following phases:

Phase 1: Carry out extended and systematic literature Review ([42], [43]).

Phase 2: Adopt and probably extend a current framework or proposing a new one ([28], [29], [30], [34], [36], [38], [39], [41]).

Phase 3: Build a case study to benchmark the proposed framework.

Phase 4: Analyze the results of Phase 3

Phase 5: Correct the framework that would be proposed in Phase 2.

It is possible that by the end of Phase 1 our research methodology might be adapted.

#### 4. Conclusions and Future Work

Our work has focused on interoperability assessment. We presented briefly the relevant EU initiatives and consequently we conducted a short literature review about “Interoperability Assessment”. Most of the relevant published papers suggest further research is needed in the area.

Concluding, from our research, it seems that a commonly accepted interoperability maturity model covering all aspects of interoperability is still missing [23]. In addition, different sets of interoperability attributes have been defined in each model [6]. An interoperability evaluation model should address all interoperability issues, such as social networks ([6], [7]), cloud interoperability, and ecosystems interoperability [6]. Moreover, existing maturity models need to be further developed to address the interoperability potential measurement of interoperability (a priori assessment) [23].

However, the success of an interoperability maturity model doesn't only depend on the scientific and technical qualities of the model but also on the willingness of the company (or the organization) to improve its interoperability ([25], [32]). This dimension is highlighted by the European Interoperability Framework (EIF), introducing political context around all the levels of the EIF model [16].

Our future work includes conducting a systematic literature review, developing a new eGovernment Interoperability Assessment Framework and evaluating its potential.

#### 5. Acknowledgements

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# Evaluation for Improving eGovernment in Least Developed Countries

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**Abstract.** E-government evaluation is challenging. However, it is important to design evaluations that support development towards the grand though often distant goal of better government. Although developing countries now have the same technology with developed ones, they still need to “leapfrog” in terms of administrative maturity. This is difficult as it requires changes not only in processes but also policies and organizational culture. The objective of this research is to contribute to finding ways of using evaluation effectively to support e-government development as a whole, including not just technology but also organizational maturity for least developed countries. Design science research methodology is used to investigate the problems involved, propose and develop an artifact to solve at least parts of the problems, and to test and evaluate the artifacts effectiveness. This research will also help to increase awareness among the e-government practitioners in Rwanda on how to achieve the ambitious e-government’s goals.

**Keywords.** E-government evaluation, formative evaluation, organizational change, technological change, Rwanda

## 1. Introduction

Many countries have adopted e-government and both success and failures stories are being recorded. Particularly, Africa’s e-government was reported to be slow and uneven, and causes are related to lack of human capital and on infrastructure gaps, lack of visionary strategies and of practical implementation plans [1]. The lack of both physical and human infrastructure was specifically found as impeding e-government in Sub-Saharan Africa [2]. Consequently, the digital divide is still observed between developed and developing countries.

This research will focus on Least Developed Countries (LDCs). These are poor countries in the world with low-income, human resource weakness, and economic vulnerability.

In the hope of closing that digital divide, Developing Countries (DCs) including LDCs have made plans to leapfrog new technologies from developed countries, to support many programs including the e-government. However, technology alone is not enough to close the digital divide and advance e-government. Organizational maturity is also needed and is even more difficult as it requires changes not only in processes but also in other organizational aspects: public agency structure, power distribution, strategic IT alignment strategy, prioritisation of services, future needs of the public agency, and organisational culture [3]. An example of difficulties in achieving the organizational

maturity is the case of the Document Tracking and Workflow Management System (e-Mboni) deployed in the public institutions in Rwanda in June 2011. The technological side was ready and training was provided, however, the use by intended users is still very low.

Evaluations would contribute to understanding what organizational elements to address in a given context, however, they -evaluations- tend to point to what is lacking but not on how to acquire what lacks or close the identified gap in developing e-government. An example is the UN e-government survey [1]. It is pointed out that “Today’s knowledge and evaluation research do not enable definitive prescriptions for the best e-government institutional model, especially given the diverse conditions facing both developing and developed countries” [4, pp.98]. Therefore, supplementary efforts are needed for evaluations to bring an understanding of what is needed for e-government to move from a stage of development to the next.

Evaluation generates benefits including evidence-based knowledge [5] and they would guide in leap-frogging technical and organizational aspects. The choice of timing of evaluations will also play different roles. Assessment done during the planning phase of an initiative establishes requirements for implementation, formative evaluations conducted during the development phase, are suggested to allow improvements of the ongoing initiatives [5]–[7], while post-implementation evaluation provides useful financial and statistical information [8] that would be used for future initiatives. Evaluation could as well be considered as an ongoing process in the life cycle of a project [9].

Hence the following research question: *How can evaluation contribute to improving e-government for least developed countries so as to reap e-government benefits?* This question has the following practical sub-questions:

- What is the status of research on e-government evaluation?
- What are the institutional strategic issues of e-government evaluation in Rwanda?
- How can evaluation contribute to improving e-government implementation in Rwanda?

This paper is structured as follows. After this introduction, related work is summarized. Then section 3 describes the research context and section 4 presents the research methodology. Finally, section 5 presents the expected results.

## 2. Related Work

E-government in developed and developing countries is being evaluated. Success and failure stories have been reported. Failures are mostly reported in DCs [10]–[12].

Research on e-government in DCs investigates different aspects. They include designing e-government [13]; implementation in general [14], [15]; adoption [16], [17], diffusion [14], [16]; user experience [18]; and assessment of the digital divide [19].

Though still limited, research on e-government in the LDCs explores e-government and related aspects. In general, e-government is found to be in its early stages [20]–[22]. This status of e-government in LDCs is linked to lack of human skills, technological infrastructure, legal infrastructure, reengineering administrative and service processes [23], limited integration of public services [20] corruption and poor monitoring [24], gaps between initiatives and reality [11], [12], [25], these problems are found mainly at the national level. Access divide, social divide, perceived intensity of civil conflict, and

perceived behavioural conflict were found to have effects on intentions to use e-government services [26], these factors are also at national or group level although the intentions for use may be at individual or group level. Adoption was found to be influenced by culture, cost, and other social dimensions or beliefs [27], and relative advantage [28]. These factors are at the national or group level while other adoption factors are mainly individual, such as perceived usefulness, perceived ease of use, and trust [27], [28]. Identified barriers to e-government are at national level and are related to issues of investment climate, market structure, infrastructural capacity, social contexts, political and cultural resistance [29], and the dominance of donor funded ICT initiatives [24]. In [21] challenges were identified to be technical, organizational and adoption challenges.

Positive elements of e-government and its implementation in LDCs were also recorded and are mainly at the national level. They include the development of policies and technological readiness [22], [24] like putting in place information and service centres to increase access [30]. Some work on evaluation is also done like in [22].

The need of more efforts in e-government evaluation are pointed out [31], and attention was drawn to the need of supervision of e-government implementation [25]. However, e-government evaluation literature is dominated by the work on developed countries, and in contrary to research on LDCs, the research on developed countries goes in depth to look into different aspects. My review of contemporary literature on e-government evaluation found five main factors for evaluation, including maturity levels [32]–[34]; evaluation object [7], [35], evaluation indicators [36], [33], evaluation timing [9], [37], and stakeholder involvement [7], [6]. It also discusses different types of models: ladder models and level models trying to measure output while preconditions models, or reason models, try to explain what makes e-government happen.

### 3. Research Context

This section provides some facts about Rwanda, the country where the case studies for the research were taken from.

Rwanda is an East African country, one of the 48 LDCs. It borders the Democratic Republic of Congo, Uganda, Tanzania and Burundi. Rwanda has three official languages Kinyarwanda, French and English. It has an area of about 26000 km<sup>2</sup>, slightly smaller than Belgium. The population is more than 12 million [38] and in 2013 life expectancy at birth was 63 years and the gross national income per capita USD 700 [39]. According to the ITU report in 2015 the literacy rate was 70.5%, the ICT Development Index was 2.04, there were 64 mobile phone subscriptions per 100 inhabitants, and the international internet bandwidth per internet user was 8.5 Bit/s [40]. In 2014, the Rwanda's e-government Development Index was 0.3589, the 140th of the 193 countries surveyed [1].

Rwanda's Vision 2020 aims at transforming the country into a middle-income nation by the year 2020 [42]. As means to attain its vision, Rwanda has identified a number of focus areas including Science, Technology, and ICT. *"The Government of Rwanda (GoR) strongly believes that Information and Communication Technology (ICT) can enable Rwanda to leap-frog the key stages of industrialization"* [43].

This vision has formed a basis for the development of, among others, the National ICT Strategic and Action Plan (NICI) to guide the implementation of ICT-related initiatives. The NICI has series of five-year plans since the year 2000. Efforts of NICI I were mainly on legal and regulatory aspects. For NICI II, the focus was on infrastructure

roll out while NICI III was about services with a focus on skills development, cyber security, community development, e-government, and private sector development. At the end of 2015, the 4<sup>th</sup> generation of the NICI plan was adopted to build on the previous plans; it is known as the Smart Rwanda 2020 Master Plan (SRMP) [44]. One of the ten objectives of SRMP is to transform Rwanda's government into a digital one. During NICI III (2011-2015), e-government was one of the key areas, and related projects were started including, for example, the Rwanda Online Project. It started in 2014 aiming at creating an integrated access point, "Irembo", to 100 selected government services [45].

The SRMP is spearheaded by the Ministry of Youth and ICT, which is in charge of development and coordination of ICT-related policies. The implementing arm of the Ministry is the ICT Department in the Rwanda Development Board (RDB) whose mission is "Fast tracking economic development in Rwanda by enabling private sector growth". ICT-related initiatives in Rwanda benefit from the top leadership support. The President's support is one of the important elements leading to a conducive environment.

## 4. Methodology

### 4.1. Research Design

The overall objective of this study is to contribute to finding effective ways to use evaluation to support the transition from low to higher levels of both technical and organizational maturity so as for LDCs to reap the benefits of good e-government.

This research will follow the design science research (DSR) methodology in its phases: awareness of problem, suggestion, development, evaluation and conclusion. "In the design science paradigm, knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artefact" [45, pp.75]. The design science research methodology will be used as follows.

*Awareness of problem.* Initially, the research has conducted a literature review on e-government evaluation and a case study on Rwanda investigating e-government evaluation in Rwanda. These two will lead to establishing the status of research on e-government evaluation in the literature and in Rwanda, and identifying institutional strategic issues of e-government evaluation in Rwanda. The identified problems will be used in the next phase.

*Suggestion.* Having identified the issues around e-government evaluation in Rwanda, the research will proceed to propose evaluation model to address institutional strategic issues for e-government. The output of this phase will lay the ground for the next step of development.

*Development and evaluation.* The proposed evaluation model in the suggestion phase will guide the development of an artefact that will address strategic issues for institutions, as discovered in the first phase (awareness of problem). This step will consider existing models and analyze them, if there is an existing model that can be customized it will be used, otherwise a new one will be developed. Then that model will be tested and evaluated in Rwanda to ensure that it meets the suggested proposal and that it will contribute to solving the problem as it was aimed at in the suggestion phase.

*Conclusion.* The results of the research will be communicated and lessons learnt shared.

Figure 1 gives an overview of the research process following the DSR steps and links them with the planned studies.



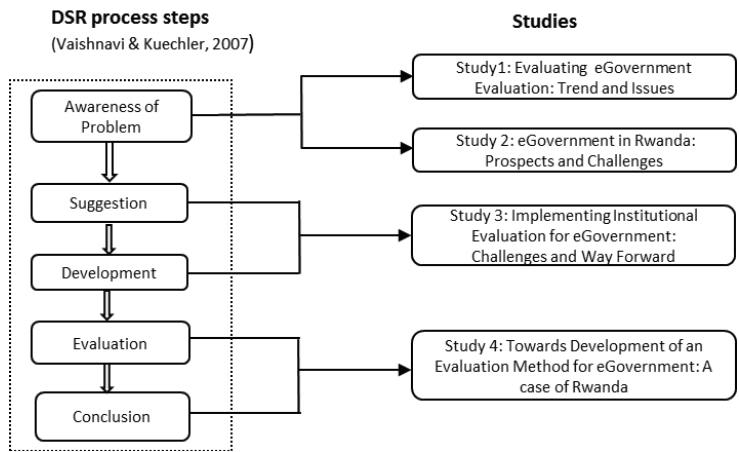


Figure 1. Overview of the research process using Design Science Research adapted from [46]

4.2. Methods for Empirical Studies

Studies 2, 3 and 4, are empirical using interviews as the main data collection technique. Interviews suit best the aim of the studies of gaining information about the status of e-government and its evaluations in Rwanda.

The chosen cases are the Kigali Online Construction Permit System of the City of Kigali and the Business Registration System of the Office of the Registrar General in RDB. The choice of the two cases was motivated by the fact that their services are in use for more than two years and this would allow the availability of data on the systems and their services as well as on their evaluation. The services provided so far are found to be at the initial stages of e-government development. For example, users of the systems can apply for and get services online. However, the back-end processes are mainly manual. Because of this status, the integration is a challenge for and beyond organizations providing services. ICT literacy is still an issue as well, which means that intermediaries are often required to help citizens apply for and get services they need.

Besides the service cases, RDB-ICT is the organizational case chosen for addressing the issues of evaluation practice. RDB-ICT was chosen because it is in charge of e-government and ICT initiatives in general at the national level. It is also responsible for evaluating those initiatives. RDB-ICT is involved in acquiring technologies and in recruiting technical staff for public institutions mainly the ministries while those institutions are responsible for their organizational processes themselves.

For the above-mentioned cases, so far, interviews have conducted for study 2 and 3. Informants were in different positions: policy makers, RDB-ICT-managers, e-government project managers, managers in the Office of the Registrar General, in the City of Kigali City and in Rwanda Online. Both front- and back-end users were among the interviewees. All the interviews were semi-structured and they were in two categories. The first category was on the status of the initiatives, systems, and services and related benefits, challenges and recommendations for improvement. The second category was on evaluation and questions were on who conducts evaluation; when, why and how it conducted; what is evaluated; how are the results used; faced challenges and suggestion

to improve the situation. The interviews were conducted in two phases. The first phase was from October 2014 to January 2015 with 23 interviewees and the second was from November 2015 to January 2016 with 20 interviewees. Each interview lasted 45 to 60 minutes.

All the studies in line with this research and related method are provided in Table 1.

**Table 1.** Studies and related methods

Study	Strategies	Methods
1: Evaluating eGovernment Evaluation: Trend and Issues	Literature review	Webster and Watson [47]
2: E-government in Rwanda: Prospects and Challenges	Case study	Interviews with questionnaires
3: Implementing Institutional Evaluation for E-government: Challenges and Way Forward	Case study	Interviews with questionnaires
4: Towards Development of an Evaluation Model for E-government: A Case of Rwanda	Case study	Design and test

## 5. Results and Contribution

The overall results from this work is a combination of results from the four studies. The studies will, respectively, lead to:

1. Understanding the state of the art in the field: A review of contemporary literature investigated the status of research on e-government evaluation
2. Understanding the status of e-government in Rwanda, current status, challenges, and prospects
3. Understanding of implementing institutional e-government evaluation in Rwanda
4. Development and evaluation of an e-government evaluation model for Rwanda

The first study “Evaluating eGovernment Evaluation: Trend and Issues” has found the issues involved in e-government evaluation to be described by five critical factors: maturity levels, evaluation object, type of indicators, evaluation timing, and stakeholder involvement. The study acknowledges that there is no best model, but that e-government evaluation has to be contextualized and take a formative approach to guide the following step. It also points to the need for a clear perspective on where e-government development is going and provides a model to conceptualize that development.

The objective of the second study is to gain an understanding of the status of e-government in Rwanda. The researcher met different e-government stakeholders in Rwanda to get insights on e-government status, the faced challenges, and future plans. Two cases were investigated to clarify the situation.

Moving on, in the third study, evaluation of e-government is being investigated to explore practices at the institutional level. The issues from this study will lead the research in finding practical solutions that will guide the next steps of e-government initiatives.

Based on the findings and understanding gained from the previous studies, the fourth study will suggest and develop an evaluation model that will take into consideration both the technological and organizational aspects. The developed artefact will be tested to

ensure that it meets the suggested requirements. The feedback from practitioners and decision makers will also be sought to increase the relevancy of the suggested model.

It is expected that this research will help to increase awareness of the need of complementarity of technical and organizational aspects among the e-government practitioners in order to achieve e-government goals in Rwanda. Those practitioners are mainly the RDB staff as well as the staff of the other institutions involved in the research.

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# A Trust-Enhanced Approach to the eParticipation Life Cycle

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**Abstract.** eParticipation provides a means to involve citizens in eGovernment decisions. The ease of access to eParticipation processes has raised the issue of the trustworthiness of both the institutions promoting processes and the citizens participating in these processes. Our research aims at obtaining a generic eParticipation framework enriched with trust management techniques like the ones used in e-Commerce and social networks. Our work plan includes the following steps: making a systematic review for extract the knowledge base, designing an eParticipation framework definition and incorporating trust techniques, developing support software, implementing several case studies in Spain and Ecuador, and providing results and evaluation.

**Keywords.** Public participation, eParticipation, method, framework, trust

## 1. Introduction

The use of the information and communication technologies (ICT) in the public participation process (leading to what is known as e-participation) [1] represents a big step towards the involvement of citizens in contexts traditionally reserved to governments. ICT innovation allowed achieving effective interaction, breaking barriers such as distance, time, communications, and this way reducing implementation costs and improving spaces for democracy.

Many research efforts have been developed with the aim of obtaining theoretical frameworks for public participation, which were complemented with an implementation in few cases. However, the public participation processes implemented are not managed according to the knowledge acquired after years of definition and implementation of classical (that is, non-ICT-based) participation processes. Several agencies have used different types of web applications like survey support systems (eg. SurveyMonkey<sup>1</sup>, Google forms<sup>2</sup>), social networks (especially, those with high usage rate among citizens) and, in other cases, projects tailored to meet specific needs. In all of the above cases, one can find a common weakness: the management of all stages of the life cycle of a project of public participation is not supported (only partial coverage is provided).

A global solution for the management of eParticipation processes is still to come. Specifically, such a solution requires methods, techniques and tools allowing the planning, definition, design, implementation, enactment and analysis of these

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<sup>1</sup> <https://www.surveymonkey.com/>

<sup>2</sup> <https://www.google.es/intl/es/forms/about/>

processes, using the knowledge developed along of experience in public participation processes. This is the main focus of our work, which is in its early stages. At this moment, we want to achieve the following research goals:

- To design a framework to manage eParticipation processes. The framework will include models and methods supporting the definition of the different types and stages of public participation processes.
- To develop a prototype implementation of the framework proposed, for the management of the public participation processes.

When planning new public participation processes, especially with large numbers of potential participants, the problem of trust arises naturally. Trust management techniques have been widely studied in the domains of e-commerce and social networks, and currently being incorporated into the eParticipation domain [2], where it is particularly relevant in helping citizens to decide whether to join public participation processes or not. Roughly speaking, modern eParticipation environments should support trust on technology, trust in the process, trust in the use of information and trust in the results of the process. With the addition of these techniques, originate the following research goals:

- To identify the critical points of "trust" in eParticipation.
- To incorporate trust techniques in the aforementioned eParticipation framework domain.
- To apply the support software in study cases in different countries like Spain and Ecuador, among others.

This paper is structured as follows. In the next section, we present background knowledge about eParticipation and trust management. In section 3 we describe a proposal for the generic framework. Section 4 describes the methodology to be used to achieve the goals. Finally, section 5 presents the preliminary and future results.

## 2. Background

### 2.1. Public participation and eParticipation

There is no single definition for public participation. In [3] we can read that *"Public participation is the process by which public concerns, needs, and values are incorporated into governmental and corporate decision making. It is two-way communication and interaction, with the overall goal of better decisions that are supported by the public"*. Another suitable definition is one that s public participation *"to the participation of various stakeholders in a collaborative process; they can be individuals, citizens' initiatives or common interest groups also known as organized public. Any participatory process should be open to all interested parties, like a wide audience"* [4]. The Federal Austrian Chancellery defines: *"Public participation means the chance of all those concerned and/or interested to preset and/or stand up for their interests or concerns in the development of plans, programs, policies, or legal instruments"* [5]. From the above definitions, we can draw several common aspects:

the various stakeholders (decision-makers and citizens or participants), the importance of citizen participation in a decision-making collaborative environment, and the bi-directionality of the process.

The use of ICT tools within the public participation context led to the term "eParticipation (electronic participation)". In Macintosh's words, e-Participation means *"ICT-supported participation in processes involved in government and governance. Processes may concern administration, service delivery, decision-making, and policy making"* [1]. In this paper, we use both terms interchangeably.

2.1.1. eParticipation levels

Traditionally, public participation processes have been defined in terms of the so-called levels of participation. A level relates to a specific characteristic of the process, which must be managed and enforced. Table 1 summarizes the levels of the most relevant public participation and eParticipation proposals, Arnstein [6] proposed eight levels to define the influence of citizens over policy as early as in 1969; such levels were the basis for subsequent proposals developed years later. The Organization for Economic Cooperation and Development (OECD) presented a three level view of eParticipation designed to improve representative democracy [7], from these models, Macintosh and Whyte [8] incorporate ICT into their proposal. Later, Lukensmeyer and Torres [9] created a set of guidelines for public deliberation, and defined four levels to participation, including collaboration as a relevant level. One of the most referenced is the framework of Tamborius et al. [10], which defined five levels adapted to the recommendations of The International Association for Public Participation (IAP2) [11].

The Standards of Public Participation published by Austrian Federal Chancellery [5] return to a vision with three basic levels. Teran and Drobnjak also present an approach based on the five levels of eParticipation proposed by the model of Tamborius et al. [10] and incorporate web 2.0 concepts in order to include community-building processes, and discussion between citizens and authorities [12]. Proposals for most authors are similar, in some cases it is named differently or new shares are included from others. As a base level has "information", "consultation" and "collaboration" in addition to various characteristics of empowering.

Table 1. Participation Levels

Author(s)	Year	Participation Levels
Arnstein	1969	Citizen control, delegated power, partnership, placation, consultation, informing, therapy, manipulation.
OECD	2001	Active Participation, consultation, information.
Macintosh	2004	eEmpowering, eEngaging, eEnabling.
Lukensmeyer & Torres	2006	Collaboration, engagement, consultation, communication.
IAP2	2007	Empower, collaborate, involve, consult, inform.
Tambouris et al.	2007	eEmpowerment, eCollaborating, eInvolving, eConsulting, eInforming.
Austrian Federal Chancellery	2011	Cooperative, consultative, informative.
Teran & Drobnjak	2014	eInforming, eConsulting, eDiscussion, eParticipation, eEmpowerment.

### 2.1.2. eParticipation Frameworks

Between 2000 and 2014, several works have conducted research on the creation of methods and frameworks that create, define, implement and evaluate eParticipation process. Encompassing features such as levels, areas, techniques, methodologies, tools, social factors and technologies embedded within this domain. Table 2 shows a chronological classification with several of the most referenced works, synthesizing their coverage or phases.

**Table 2.** eParticipation frameworks

Nº	Author (s)	Year	Title	Scope or phases
1	Rowe & Frewer [13]	2000	Framework for evaluation public participation	Evaluations of methods.
2	Macintosh [14]	2004	Characterization framework for eParticipation.	Characterizes: the level of participation, the technology used, the stage in the policy-making process.
3	Tambouris et al. [10]	2007	Framework for assessing eParticipation projects and tools	Process, areas, participatory techniques, tools, technologies.
4	Kalampolis et al. [15]	2008	Model domain of eParticipation	Define domain model to: stakeholder, participation process, ICT tools.
5	Islam [16]	2008	Sustainable eParticipation implementation model	This model describes seven consecutive phases: policy and capacity building, planning and goal setting, programs and contents development, process & tools, promotion, participation, and post implementation analysis.
6	Phang & Kankanhall [17]	2008	A Framework of ICT Exploitation for E-Participation Initiatives	Presents a three step procedure for eParticipation initiative implementation. 1) Identify objectives, 2) Select techniques and 3) Select ICT tools.
7	Aichholzer & Westholm [18]	2009	Evaluating eParticipation Projects: Evaluation Framework	Evaluation Perspectives: Democratic, Project, Socio- Technical.
8	Smith et al. [19]	2011	Framework for evaluating eParticipation	Model based on 3 levels: Operational outputs, outcomes and impacts.
9	Scherer & Wimmer [20]	2011	Reference Framework for eParticipation Projects	Model with: dimensions that build the scope of an e-participation project, a domain meta model, a procedural reference model, and a library with requirements, reference models and building blocks for eParticipation.
10	Terán & Drobnjak [12]	2013	Evaluation Framework for eParticipation: VAAs	Define levels: eInforming, eConsulting, eDiscussion, eParticipation, and eEmpowerment. Stages: 1) ICT tools are identified and filtered into each of the five participation levels and 2) evaluating by quantitative method.
11	Porwol et al. [21]	2013	Social Infrastructure Software for eParticipation	Define an integrated model for eParticipation for social software Infrastructure (SSI): design, information flow, requirements.
12	Yusuf et al. [22]	2014	Novel Framework of eParticipation	The framework includes factors: politics, economics, social, cultural, education and technology. Using Actor Network Theory (ANT).



2.2. Trust

Trust is a subject that has long been of interest in a variety of fields of human endeavor, like psychology, sociology, computer science; it has led to a diversity of conceptualizations, “a simple definition of trust is that it is the willingness of a party to expose itself to the possibility of being exploited by another party” [23]. The involvement of trust in ICT applications, such as eCommerce and social media networks have been widely studied. In the domain of eGovernment it is also has a keen interest, as demonstrated by researchers [23] [24]; since it is necessary to create an technological confidence environment so that citizens first, choose to participate in a process and, secondly provide clear and effective data through the various tools that are created for that purpose. Scherer & Wimmer [2] present a research on trust in eGovernment, eCommerce and eParticipation to define a trust model for eParticipation with two roles (trustor and trustee), besides proposing several emerging needs.

3. Proposal: A trust-enhanced approach to the eParticipation life cycle

Based on theory investigated and the several cases of study implemented until now, it can be determined that there is no global vision of a public participation architecture independent to application domain. The literature focuses on the development of theories and frameworks with little implementation and testing; the revised application cases provide solutions to specific problems focusing on gathering information from "citizens" or "participants" for a subsequent "analysis" of data oriented decision-making, leaving aside the work of "expert" in the public participation process or the institutions they represent; without a computer tool to manage their work.

In order to achieve the research goals, it has designed a generic method consisting of three main threads or sub-process: preparation, implementation, and evaluation (see Figure 1). The *preparation* subprocess aims to generate a planning process eParticipation made up of the following: definition of objectives, identification of participants, establishing the level of participation by next levels: informational and consultative or collaborative, choice of tool or method, define criteria evaluation, setting times for each activity. The *implementation* subprocess allows that the "expert" user notifies to participants and provide information related to the process by allowing the latter to choose whether to accept or not their participation. At this particular point, the proposed trust method incorporates techniques that ensure a higher rate of acceptance of denial. Finally, the *evaluation* subprocess allows you to generate reports and statistical data to support decision making. In method are includes trust management.

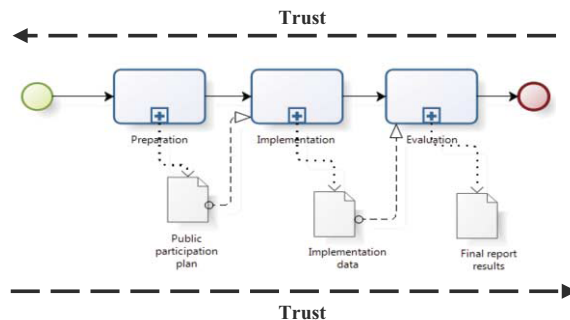
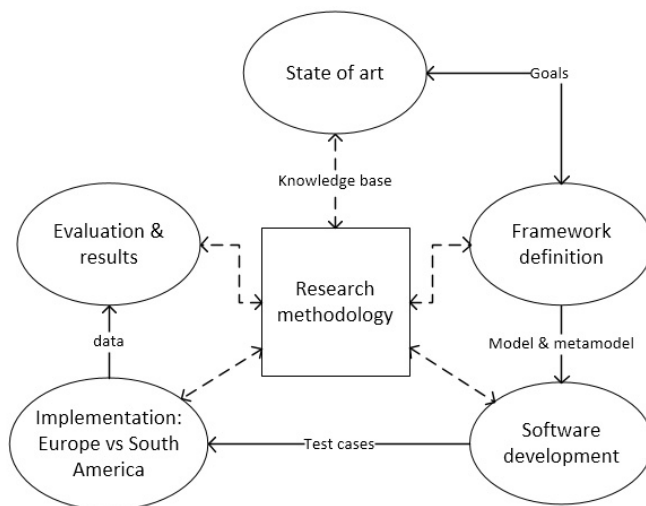


Figure 1. Trust in eParticipation life cycle

#### 4. Methodology

We use the “Design Science Research Methodology methodology (DSRM)” [25] which specifies the following steps: identify problem & motivate, define objectives of a solution, design & development, demonstration, evaluation and communication. Performing an adaptation to the particular context of this study, it is planned as depicted in Figure 2.



**Figure 2.** Research methodology

##### 4.1. Identify problem & motivate and define objectives of a solution

To perform the first task of the methodology was necessary to conduct a study of the state of the art through a systematic review method [26]. Using the search string created by [27] and adding the terms “trust; eParticipation and trust; trust management”; as primary sources of information to digital libraries: Springerlink, ACM Digital Library, IEEE Xplore Digital Library, Scopus and Web of Science; academic journals: Government Information Quarterly and Information Polity and various research questions, the following main research objectives were defined:

- Define a framework to support the definition of the different types of public participation processes, and the corresponding guidance to the users along the definition and implementation of the processes.
- Design and implement a support environment, incorporating trust techniques, that automates the steps defined in the proposed method.

##### 4.2. Design & development

The modeling of the overall public participation process is performed, covering the entire life cycle; three actors are defined: public participation expert, technology expert and participant.

The development phase provides a web tool featured with "responsive design, that can be performed on any portable device, and a mobile application oriented the expert user. The main module is the "process manager" responsible for automating the threads or sub-process of "preparation and implementation", which allows the creation of the process, these can be published (visible to participants), completed process (logs). Furthermore, this module offers a catalog of methods or tools to be used. The processes can be published in public or private environment, with a previous authentication to participate. The software managers also have methods, groups, users, shares, results, and adaptation to social networks.

#### *4.3. Demonstration and evaluation & communication.*

The application of this methodology is designed to perform with the implementation of several case studies in collaboration with government and educational institutions from Spain and Ecuador. At this point is important to make a comparison between entities of Europe and South America; that allows the analysis of the results obtained from the data related to the real living conditions among participants in these continents, due to these scenarios have not been studied yet.

### **5. Preliminary Results**

As preliminary results we have got the design of eParticipation framework (modeled in BPMN<sup>3</sup>), which is adaptable to any application domain. Also, we have stated the elicitation process with the specification of requirements represented with use cases methodology (diagrams and description) and, the preliminary design has been created of graphical interfaces of the application, through the use of mockups.

Additionally, we will acquire results about the realization of a meta-modeling technique that allows make instances in any application domain to be established as the basis for future development of software, this will integrate techniques in trust management eParticipation framework, this will be aimed to a future implementation and evaluation of the software through the use of case studies in institutions of Spain and Ecuador.

As a result of this research work, the public sector will have a tool that will allow to the experts users to build and perform any process of eParticipation, covering demographics aspects, integrating leaders and citizens, making decisions in a collaborative environment that favor to the construction of a better society based on transparency and public confidence generation. In the case of educational institutions, these are provided of a collaborative tool that would allow then act as government open, to allow the university community to participate in decisions that affect them.

Finally, this research work will provide to the scientific community a vision, that has never has been studied, taking into account comparative data between two countries in different continents with different problems, ideologies, and living conditions. In addition, it will give a basis for standardization of processes eParticipation, based on a framework, and the development of software that will incorporate techniques confidence between the civil society and the institutions.

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<sup>3</sup> <http://www.bpmn.org/>

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# Towards an Implementation of an Interoperable Identity Authentication Framework in e-Government: Case of Malawi

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**Abstract.** E-government has brought a lot of opportunities to public services. However, alongside opportunities, there are many challenges with e-government implementations, one of which is security. Security incidents in e-government have resulted in loss of money, revenue, resources and trust by the users of the systems. There are a number of possible measures to mitigate such security incidents, these include: physical security and system security. In this research we focus on one of the elements of system security - authentication. We propose an interoperable Identity Authentication Framework for e-government. The research will adopt a qualitative case study and design science. This will be complemented with behavioural research approach. To achieve the main objectives, there are a number of activities planned for this research. These activities are: investigation of maturity level for e-government systems; assessing information security maturity level; evaluation of authentication systems in use; design the interoperable identity authentication framework; and evaluation of the proposed framework. The framework will go through a number iterations in design and evaluations.

**Keywords.** Authentication, e-government, interoperable, security, design, framework

## 1. Introduction

E-government has been defined differently by different researchers [1, 2] in this research we adopt Almarabeh [1] definition which defines e-government as the use of information and communication technologies (ICT) by government agencies, that lets citizens and businesses have an opportunity to interact and do business with government, by using different types of electronic media such as telephone, internet/emails and smart cards. Maturity of e-governments varies and depends on different factors.

Factors affecting how an e-government matures include technological improvements, financial and human resources, political commitment and citizen participation [3]. However, in other developing countries current cultural and economic

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conditions may justify e-government programs that reflect the immediate needs and technical capacity of these societies [3].

In Malawi, like other developing countries, e-government projects are being implemented in a number of departments. These projects include Integrated Financial Management Information System (IFMIS), Passport Issuance System, Integrated Boarder Control System, Human Resource Management Information System, Government Wide area Network (GWAN), Malawi Traffic Information System (MALTIS), Education Management Information System, Plots, Titles and deed registration system, Agriculture Production Estimates Systems, Land Resource Management System, Freight Management System.

Although e-government has brought many opportunities to public services, there are many challenges with e-government implementations, one of the challenges concerns security and usually institutions act aftermath of a security incident. Security incidents in e-government have resulted in government losing a lot of money, resources and trust by the users of the systems. One of the possible ways to mitigate security incidents is authentication. In Malawi, not all users of e-government systems use authentication systems and there no policy for authentication systems in e-government in Malawi

## **2. Rationale**

The lack of authentication policy for e-government makes it difficult to reinforce use of authentication as a way of mitigating security incidents. This has lead to a situation where security in some government departments have been compromised leading to loss of financial resources. It has also been observed that most of the models used in implementing security in e-government in developing countries are developed without thorough empirical research bearing in mind that context and environmental factors differ from country to country and this may affect the implementation of systems in e-government.

It is reported that majority of e-government projects in developing countries fail as a result of problems resulting from use of models transferred directly from developed countries in their entirety [4]. Similarly, adopting authentication frameworks from the developed world may not work properly, as such, there is a need to develop interoperable identity authentication frameworks that work in a developing country context. The proposed authentication framework will be tailor made to the developing country context. This will ensure authentication coherence among e-government services.

This research will contribute to the knowledge through the analysis of current practices, challenges and opportunities of the current identity authentication systems in use and proposed solutions to problems of identity authentication in e-government in Malawi. The proposed framework will also help in the development of security policy related to identity authentication systems in e-government and will allow corporation of different systems in implementing efficient authentication system.

### 3. Literature Review

The concept of e-government is to provide e-government services anywhere, any time on open networks [5]. This is a concern on security and privacy issues in managing these e-government information systems. Not much has been researched and published, particularly on e-government in developing countries [5]. According to Dada [4], many studies have shown that, just like most information systems, many e-government applications fail in developing countries.

#### 3.1. Security in Information Systems

Information system resources need to be protected and at the same time shared to those who are authorised. "Security is traditionally concerned with information properties of confidentiality, integrity and availability. These properties underpin services such as user authentication, authorisation, accountability and reliability. Much has been published on the changing role of information security" [6, p. 484]. One of the important security measures is authentication, and with e-government systems that are accessed over open networks it's very important to have an efficient authentication system.

#### 3.2. Frameworks

The importance of having a framework for e-government is on integration of government's existing technologies, applications and information systems required for e-government operations [7]. Similarly, an authentication framework for e-government needs to be in a position where developers can use it in an environment where there is integration of systems within e-government. Hence, an authentication framework needs to be interoperable, such as an interoperable identity authentication framework for e-government that this research is proposing.

E-government interoperability is the "ability of two or more diverse government ICT systems or components to meaningfully and seamlessly exchange information and use the information that has been exchanged" [8, 9]. Lack of interoperable frameworks in e-government may lead to difficulties in exchanging information. For example, a user using an e-service of one department may not access e-services of another department unless he/she registers to this particular department basing on its specific policy. This makes users to do multiple registrations and have different authentication credentials [10].

#### 3.3. Authentication

Authentication is the process of verifying user's identities when they want to use the server resources based on a username and password [11]. The use of Electronic Data Interchange (EDI) has brought potential weakness since the reduction in physical paper transactions lead to other problems concerning legalities of businesses, such as contracts. Since contracts are based on the existence of a signed physical document, the absence of it, presents a range of potential problems [12]. With e-government systems, there is a need to have standards and guidelines on how to digitally sign on electronic/digital documents in e-government.

There are many ways of assessing an authentication. What is assessed is referred to as an identity factor [13]. This is what gives confidence to the identity of a user. Factors that are common today include username and password, digital certificate-enabled smart cards and many more. Multi-factor authentication systems use different types of factors to ensure that the factors fail independently [13]. Consistent is very important when choosing which factors to use in e-government and that is why a framework for authentication is ideal for e-government systems.

"Current approaches to multi-factor authentication are not optimal, they impose requirements on their use that add complexity, reduce flexibility, restrict the types of factors that can be used and in many cases may in fact add only the illusion of security. By applying quantitative techniques to authentication practices, many of these problems can be not only overcome, but authentication as a whole can be improved" [13]. There are many factors affecting the level of complexity, and this may vary from place to place. Hence, it may be difficult to implement an authentication framework adopted from elsewhere unless it is customised.

Different organizations have different requirements regarding authentication and they choose the authentication mechanism that satisfies their goal [14]. Khan [14] compare three schemes of authentication namely: Single Factor/Knowledge-Based Authentication, which uses secret information, based on what the user knows; Two Factor/Token Based Authentication, uses physical items called tokens such as smart cards, passports and physical keys, involves using "Something You Know" (like a PIN) and "Something You Have" (like a token); and Three Factor/Biometric-Based Authentication, involves using an access control token like a smart card, a PIN to access the smart card and a biometric value held in the central database. He concludes to say Three Factor/Biometric-based authentication technique is convenient, safe and reliable. This research will suggest factors to be used in the proposed interoperable identity authentication framework.

#### **4. Research Problem**

Perception that users and other stakeholders of e-government services have pertaining to trust of e-government affects the implementation of e-government systems. Authentication is one important component of security that increases the confidence users have on e-government services.

From the overview of e-government literature, there is no comprehensive interoperable identity authentication framework specifically developed to use in the implementation of authentication in e-government services, in a developing country such as Malawi. As such, there have been problems related to security of e-government systems, particularly in the area of identity authentication when accessing e-government services.

Other authentication systems that different government agencies use are not interoperable and there is no comprehensive guide to which factors and protocols to use when developing and implementing authentication systems in different maturity levels of e-government, case of Malawi. Lack of interoperable identity authentication frameworks causes government departments to have different architectures of authentication that may not be interoperable.



Systems that are not interoperable may lead to information redundancy, inconsistencies of information, time consuming and costs incurred as a result of trying to reconcile the data presented differently from different systems.

## 5. Objectives

The main objective of this research is to study the implementation of interoperable identity authentication framework in e-government in Malawi. Specifically to: i) investigate the state of e-government in Malawi; ii) state of Information security in e-government in Malawi; iii) investigate the factors affecting the implementation of authentication systems and authentication frameworks; analyse risks, challenges and opportunities of authentication systems and authentication frameworks; iv) develop best practices for implementing and develop an interoperable identity authentication framework; and v) evaluate the proposed interoperable identity authentication framework.

## 6. Methodology

This research is a qualitative case study and adopts the design science, complemented with behavioural research.

The design-science extend the boundaries of human and organizational capabilities by creating new and innovative artifacts. Both paradigms are foundational to the IS discipline [15].

The behavioural science develops and justifies theories that explain human or organizational behavior surrounding the analysis, design, implementation, management, and use of information systems and these affect the functionality, information content, etc. of the system [15].

In this study, we will propose an interoperable identity authentication framework. Firstly, we will analyse the current situation and maturity level of e-government in order to understand the environment in which the problem exists. Then after, we will determine risks associated with different e-services, security measures required and authentication requirements for each maturity level of the e-government maturity model. Finally we will design the intended framework and this will involve two main design processes: build and evaluate and the product will be an interoperable identity authentication framework (the artifact) (March and Smith, 1995 in [15]).

To achieve the main objectives for this research, there are a number of activities planned for this research. These activities are divided into four activities after which a product will be realised. Each activity is organised as a study, it has objectives, questions, data collection techniques, data analysis techniques and presentation of results. Below are the four activities that will be conducted i) Investigate and analyse challenges and opportunities, the state and the maturity level of e-government; ii) information security maturity Level of e-government in Malawi, this study will be done in order to understand the problem domain; iii) investigate the current state of authentication systems. Examine interoperability of the current identity authentication

systems, identify challenges, opportunities and risks associated with authentication systems and authentication frameworks; iv) develop an interoperable identity authentication framework for e-government; v) evaluate the proposed interoperable identity authentication Framework.

In activity i) To investigate the maturity level of e-government we will base our research on the Public Sector Process Rebuilding (PPR) maturity model which is an extension of the Layne and Lee model [16]

### 6.1. Data collection

During the research, we plan to use primary and secondary data from e-government to understand their policies, business processes, legal frameworks, workflows and activities. The study will use qualitative research methods.

We will collect both primary and secondary data from e-government documents, reports, journals, policies. We will collect primary data through Focus Discussion Groups, conducting interviews with stakeholders of e-government systems, through observations, through In-depth interviews and will administer questionnaires where possible to supplement the information collected. When collecting data, we will consider the two main groups to participate: the policy makers and the technical officials and staff.

### 6.2. Data analysis

We will conduct qualitative data analysis and consider four factors in establishing the trustworthiness of findings from qualitative research: credibility, transferability, dependability, and confirmability [17].

## 7. Conclusion

After literature review and analysis of the problem, this research seeks to develop tailor made interoperable identity authentication framework for e-government, context of Malawi

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# ICT-Driven Co-Creation in the Public Sector: Drivers, Barriers and Success Strategies

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**Abstract.** Information and communication technologies (ICTs) seem to offer rich opportunities for engaging citizens and businesses in the co-creation of public policies and services, promising to fundamentally transform the way public decisions are made. However, existing empirical evidence suggests the results of collaborative innovations in public administration tend to be mostly unimpressive and hardly transformational. This doctoral research project asks why this is the case and what factors shape the success and failure of ICT-driven co-creation. These questions are addressed by a qualitative investigation of the various drivers and barriers that affect the development, implementation, diffusion and outcomes of ICT-enabled co-creation initiatives. The thesis also explores the strategies that public sector organizations could employ to avoid failure and feed success.

**Keywords.** public sector innovation, co-creation, e-participation, drivers and barriers, success and failure

## 1. Introduction

In the age of e-government, information and communication technologies (ICTs) act both as a source and enabler of innovation in the public sector [1]. Public sector innovation, i.e. the adoption of new processes, products, services and delivery methods in the public sector [2], can have an internal or an external focus, the former referring to new or improved administrative and organizational processes, and the latter to policy and service innovation [3]. Hence, ICTs hold an innovative potential both in terms of giving an impetus for novel public services (such as online tax declarations or e-residency) and providing the means for transforming governance processes, *inter alia* by enabling the development of smarter and more collaborative methods of decision-making.

This PhD research focuses on collaborative innovation in public administration, exploring the ways in which ICTs have been used and could further be used for improving decision-making and service provision in the public sector, in particular through harnessing information, knowledge, skills and perspectives that have traditionally been external to or unavailable for public sector organizations. There are several ways in which new technologies can facilitate access to information. For example, ICT applications enable the collection, analysis and combination of vast amounts of public and private data such as big data, open data, linked data, or data crowdsourced directly from citizens and service users, which can provide governments hard evidence to back up policy decisions and indicate the aspects in which public services can be

improved. ICTs also enable the aggregation of more qualitative kinds of knowledge through direct interaction with citizens, businesses, interest groups and public sector organizations, using methods such as e-consultations, wikis and crowdsourcing platforms, e-petitions, discussions in social media or even simple e-mail communication. In other words, by giving governments access to diverse sources of information and giving diverse societal groups access to decision-making, ICT-enabled co-creation has the potential to produce effective, high-quality policy outcomes and increase the perceived legitimacy of the decisions taken on behalf of the public.

However, the opportunities of technology-driven collaboration have so far scarcely been seized. Existing evidence points to the lack of transformational impact of ICTs on public sector organizations and processes [4, 5]. At the same time, online collaboration and participation initiatives seem to have a hard time delivering the expected outcomes [6-8], mobilizing a sufficient number of active users [9, 10] and engaging the disengaged segments of society [11, 12]. In fact, many of these challenges seem to be characteristic to public sector ICT projects more generally (see, for example, [13, 14]). It is thus no wonder that the technological determinism of early proponents of e-government has become widely criticized as idealistic and erroneous [5, 15], and is now increasingly being replaced by calls for a more sophisticated understanding of the various factors that affect the use and outcomes of technological solutions [16].

In order to contribute to an improved theoretical and empirical understanding of the potential and limitations of ICT-driven collaborative innovations in the public sector, this research project undertakes a study of the factors that affect the success and impact of these innovations in different stages and in different contexts. The study is driven by the following research questions:

1. What factors drive or inhibit the development, implementation, adoption and diffusion of ICT-driven co-creation in the public sector?
2. What factors affect the outcomes and impacts of ICT-driven co-creation?
3. What strategies could governments use to overcome the barriers, capitalize on the drivers and maximize the positive effects of ICT-driven co-creation?

The theoretical framework combines literature from several relevant but complementary disciplines such as public sector innovation, e-participation and information systems management. In order to develop a deeper and more realistic understanding of the issue, the framework will be refined by gathering new empirical data and engaging the perspectives of key stakeholders involved in public sector co-creation processes.

## **2. Theoretical background**

A comprehensive account of the variety of factors that affect the acceptance, outcomes and impact of ICT-based co-creation innovations essentially calls for an interdisciplinary research approach. The research therefore amalgamates and synthesizes literature from several research fields, such as public sector innovation, information system success/failure models, e-participation and e-democracy. Some of the key research streams are briefly introduced in the following sections.

## 2.1. Public Sector Innovation

Over the past few decades, public sector innovation has evolved into a well-established field of study. Although the concept of public sector innovation has been criticized for a somewhat weak conceptualization in literature, some of its components commonly found in literature include the goal of producing long-lasting solutions to societal problems, breaking path dependencies and changing social relationships, enhancing collaboration and participation, and focusing on the outcomes as well as the process of innovation [1].

A large part of public sector innovation research focuses on the context of innovation, discussing the drivers and barriers that either limit or support the ability of public sector organizations to produce innovative solutions and the ability of these innovations to produce the intended social benefits. The array of potentially important factors that can affect the success of public sector innovations seems to be wide and encompassing different levels of analysis, from individuals to the broader environment. As a fitting example, a recent literature review [17] finds influential antecedents for innovation across four broad categories: environmental level, organization level, individual level and the characteristics of an innovation itself. While there seem to be no sovereign theories of ICT-driven public sector innovation more specifically, some attempts have been made (e.g. [18]) to extract the relevant drivers and barriers from different strands of literature such as public administration, management and e-government.

## 2.2. Information System Success/Failure

In the context of ICT projects, the issue of success and failure has received abundant attention in academic literature, evolving into a research stream in its own right. Despite varying definitions in literature of what counts as a success or failure, there is a shared understanding that the failure rate of ICT projects continues to be globally high [19]. This comes at a high price in terms of wasted resources, missed opportunities, unrealized benefits and damage to reputation [13, 20].

Therefore, much of information system (IS) management literature is devoted to researching the factors that affect IS success and failure. The issue has predominantly been approached from a rationalist angle, focusing on critical success/failure factors, which purport to predict the outcomes of ICT projects [21]. However, some authors (e.g. [20, 22]) have instead suggested more context- and process-oriented theories to better account for the social and political aspects of information systems. Indeed, IS literature highlights a number of influential factors that help explain the performance and impacts of technological innovations and have to do with environmental, organizational, social, political and cultural contexts [15, 16, 20-22].

## 2.3. E-Government and e-Participation

Although failure is a common problem in information systems projects both in the private and public sector, the issue has received much less attention in the context of public administration [16]. Several authors [15-16] emphasize the inherent complexity of public sector ICT projects, owing to the environmental constraints specific to the public sector and the wide range of stakeholders involved. Therefore, the challenges seem to be especially complex and stakes particularly high in the public sector. This implies the need to consider the specific context of e-government in addition to broader IS success/failure factors in studying the barriers to ICT-driven co-creation.

However, some studies explicitly point to the need to distinguish between different types of e-government projects. For example, [23] stresses the difference in the factors that matter in the success and failure of e-government projects in general and those that become important in the case of e-democracy and e-participation projects. While the focus of e-government literature has traditionally been more on online service provision and internal processes [24], the democratic functions of e-government are receiving increasing attention from both practitioner and research communities, illustrated by the growth of online participation initiatives and the emerging research fields of e-democracy and e-participation [25].

Part of the existing literature on e-participation and e-democracy also discusses the necessary preconditions for democratic participation and collaboration, which can provide helpful guidance for research on ICT-driven co-creation. However, as studies of the success of ICT-driven co-creation and e-participation projects seem to be much less frequent compared to other e-government initiatives, there is a need to develop a better understanding of the specificities of ICT projects involving citizen participation and democratic goals. An enhanced understanding of what makes for success in ICT-driven co-creation thus calls for asking to what extent the factors that affect the outcomes of collaborative and participatory projects are different from those that typically influence information systems.

Moreover, future studies of ICT projects have been suggested to further examine the relationships between the dependent and independent variables identified in existing research, study the contingencies affecting causal relationships in particular contexts [16] and conduct more interdisciplinary studies of the diverse contextual factors that affect the outcomes of e-government innovations [25].

### **3. Methodology**

The research aims to address the existing gaps in literature by taking an expressly interdisciplinary approach to the issue of ICT-driven innovation and co-creation in the public sector. Particular attention will be devoted to investigating the wide range of contextual factors that may affect the success/failure and impact of these projects, examining the relationship between technology and context, and considering the relationships and interdependencies between different aspects of context. The aim of the research is to develop a better understanding of what factors affect, promote and inhibit the initiation, design, development, implementation, adoption and diffusion of ICT-based participatory innovations and what impact these innovations are likely to have in different contexts and at different levels, from individuals and organizations to societies.

These research objectives, in particular the focus on context, almost naturally call for a qualitative research approach. The exact methodological steps in each stage of the research are still subject to a more detailed elaboration, which will depend on the further evolution of the research. However, three main research methods constitute the backbone of the research: 1) a thorough literature review of existing research in the fields of public sector innovation, e-participation, information systems success/failure and possibly additional relevant disciplines; 2) qualitative structured and semi-structured interviews with managers, participants and target groups of ICT-driven co-creation initiatives; and 3) in-depth studies of selected cases of co-creation. While the literature review helps map the diverse drivers, barriers and success factors that are likely to affect ICT-driven co-creation innovations, qualitative interviews help refine the inventory of influential



factors and assign them relative importance based on practical experiences. Case studies then allow for a deeper study of the ways in which these different factors interact in real-life situations and contribute to the outcomes of innovations.

The key selection criteria for sources of literature include their relevance to the topic of ICT-driven co-creation in the public sector (in particular the drivers, barriers, success factors and related policies and strategies) and language (only English-language sources are included). Both theoretical and empirical studies are included, mainly those published in international academic peer-reviewed journals, with the exception of a smaller number of policy papers and reports by international organizations (OECD, European Commission) that could be considered influential in shaping the research field and public administration practice. The selection of interviewees and case studies will, in addition to relevance, also be shaped by the goal of seeking variety, i.e. the aim is to explore co-creation initiatives that differ in type, goals, scope, level of government, participants, etc. in order to identify the possible commonalities across different contexts and discover the particularities of different kinds of collaborative exercises.

At the current stage, a minor part of the research (the first case study) has been completed, part (literature review and interviews) is under way, and the majority (most of the interviews and case studies) still in planning. The first case study scrutinized the Estonian government's official e-participation platform *Osale.ee*, which provides an online space for public consultations on draft legislation and the submission of spontaneous policy ideas from citizens to the government. The study was conducted in 2015, motivated by the curious reputation of *Osale.ee* as an e-participation project that has been live for almost a decade, while being generally perceived as a failure. The study involved a review of existing assessments and analyses, policy documents and media materials, observation of the participation activity on the site and six semi-structured interviews with key stakeholders of the project within and outside the administration.

The various steps of the research have been designed to create positive synergies with ongoing research projects such as *PUT773*<sup>1</sup> and *OpenGovIntelligence*<sup>2</sup>. The latter, focusing on public service co-creation driven by the use of linked open data, involves conducting a qualitative survey among key stakeholders in six European countries in order to collect information on the drivers and barriers to open data-driven co-creation of public services, identify the pressing needs and missing capacities in this context and learn what strategies might be successful in promoting data-driven co-creation. In combination with the literature review, the results from these interviews are expected to serve as a good first-hand source of information on open data-driven co-creation as a specific kind of public sector innovation. The results from the different research activities are analyzed using qualitative analysis techniques and developed into scientific articles and conference contributions, including descriptions of specific case studies (success and failure stories) as well as more generalized conclusions on the research topic.

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<sup>1</sup> The grant is financed by the Estonian Research and involves comparative empirical research on the governance of identity management viz. the interplay between state, business, and NGOs in the development and acceptance of identity management technologies. An interdisciplinary theoretical framework is used, synthesizing public sector innovation, public procurement and innovation and technology acceptance theories.

<sup>2</sup> The project "Fostering Innovation and Creativity in Europe through Public Administration Modernization towards Supplying and Exploiting Linked Open Statistical Data" involves twelve organizations from seven countries and is funded by the EU through the Horizon 2020 research and innovation program.

#### **4. Preliminary Findings**

While the majority of the research still lies ahead, the existing part of the literature review and the case study of the Estonian e-participation project Osale.ee allow for a cautious discussion of some of the possible drivers, barriers and success/failure factors that may turn out to be important for ICT-driven co-creation. However, the following paragraphs do not purport to be anything more than just some very first ideas.

Public sector innovation literature proposes a number of influential factors across different levels, from individuals to organizations to broader environmental enablers and constraints. For example, a recent comprehensive literature review [17] outlines the following drivers and barriers to the generation and diffusion of public sector innovations: environmental pressures (media attention, political demands, public demands), participation in networks and inter-organizational relationships, regulatory aspects, isomorphism, competition with other organizations, slack resources, leadership styles, degree of risk aversion/room for learning, incentives/rewards, conflicts, organizational structures, employee autonomy, organizational position, job-related knowledge and skills, creativity, age and gender, commitment to job, shared norms and innovation acceptance. They also find that the characteristics of the innovation itself become important in the adoption/diffusion phase – this includes ease of use, relative advantage, compatibility, cost, etc. Similarly, more practice-oriented expert reports [3] have emphasized the importance of barriers such as scattered competences, ineffective governance, diverse legal and administrative cultures, resource constraints, inadequate coordination, lack of leadership, rigid rules, risk-aversion, lacking innovation capabilities, lack of collaboration, lack of systematic measurement and monitoring of the outcomes of innovations.

In addition to this extensive inventory of potentially relevant factors, one of the interesting findings so far has been the context-specificity of these factors and their impact on innovation. Several sources [1, 17, 18] claim that one and the same factor can act as a driver in some contexts and as a barrier in others. Moreover, they argue that it is often the specific context that determines whether a factor acts as a driver or barrier in relation to an innovation.

In the narrower domain of ICT-driven public sector innovation, the following factors have been found to be of influence [18]: isomorphism, competitive pressures, economic growth, education and ICT literacy, social trust, organizational slack, inter-institutional collaboration, active innovation leadership by managers, strong political support, employee autonomy, employees' (ICT) skills, proper training and change management strategies as drivers; organizational silos, risk-avoidance, organizational inertia, reluctance to shut down failed projects and political conflict as barriers; and legislation, existing ICT infrastructures, demand-side behavior and the perceptions of the usefulness and benefits of innovation by public sector officials as significant determinants of adoption and diffusion.

Several of these factors reflect the findings from IS success and failure literature. Empirical studies in the IS field have outlined a multitude of factors that can affect the outcomes information systems, from technical flaws to the broader context in which information systems operate. For example, an extensive literature review [14] found far over fifty possible failure factors, related to project content, complexity, technology, management, users, resources, organizational context, broader environment, etc. However, failure much more often tends to be related to social and organizational than technical factors [21].

These conclusions were also confirmed in the case study of Estonia's Osale.ee. While the online environment was found to have several flaws in terms of design and usability, its users and stakeholders did not consider this a major failure factor. Instead, the complexity of the context of e-government and e-participation came into play, including the difficulty of stimulating its take-up by potential users, matching different stakeholder expectations, contested views on where and how democratic dialogue should happen and cultural barriers to collaboration, which were further complicated by lacking political support and administrative leadership, poor integration of the project into policy-making processes, and poor efforts of innovation management.

Against this background and the findings from literature, the drivers, barriers and success factors that could be potentially important for participatory and collaborative innovations in the public sector include broader environmental preconditions such as access to technology, existing ICT infrastructures, social trust and a well-developed civil society [26]; barriers related to the specific complex characteristics of the public sector (see the discussion in section 2.3); political support and innovation leadership [26, 27] as a critical driver; drivers and barriers related to the public sector organizations involved in co-creation initiatives, such as existing organizational routines and inertia, and slow pace of institutional reform as a barrier to impact [16]; culture and attitudes, in particular openness to innovation and citizen engagement [24, 26], risk-aversion and failure-avoidance [28]; demand-side barriers such as lack of take-up of e-participation initiatives [9, 11-12]; the characteristics of the innovation itself, including the extent to which stakeholders' expectations are met in its design, the need for information accessibility, feedback mechanisms and ease of use [25, 26, 29]; and finally, the level of integration of co-creation and participation projects into political and institutional procedures [29, 30]. In addition to political support, the latter seems to be one of the crucial factors in the success or failure of co-creation projects, which deserves particular attention.

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# Posters

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# “Hit the Bull's-Eye”- Electronic Participation Through Social Media

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**Abstract.** This paper presents research findings of reviewing 42 studies concerning electronic participation (e-Participation) through social media. Overall, such initiatives have reflected the prevalence of a one-way communication strategy, what do not considerably foster citizen involvement in policy decision making process.

**Keywords.** E-Participation, Social Media, E-Government, E-Democracy.

## 1. Introduction and Research Methodology

The evolving of e-Participation through social media initiatives has been quite intense in these latter times. These initiatives are enthusiastically seen as a way to enhance citizens' political engagement and to foster their involvement in government policy decision making process [1], [2]. This ongoing research poster aims to summarize and organize the literature concerning such topic. [Figure 1](#) presents the research methodology.

The search for relevant papers overlapped with other “neighboring” fields, namely e-Democracy and e-Government. In this sense, we developed and applied an assessment framework that includes three dimensions – 1) e-Participation as independent research area, 2) e-Participation as integral part of e-Democracy, and 3) e-Participation as integral part of e-Government. The three dimensions are depicted in [Figure 2](#).

## 2. Results

Based on the analysis done up to date, [Table 1](#) provides general findings related to each of the three dimensions depicted in [Figure 2](#).

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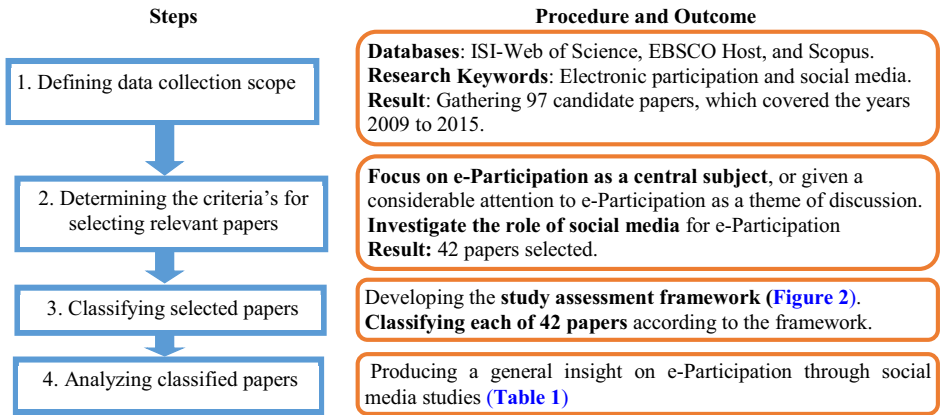


Figure 1. Literature Review Methodology

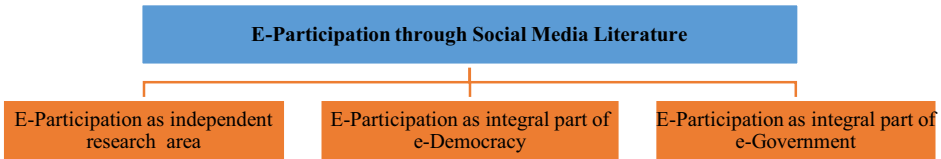


Figure 2. The Study Assessment Framework

Table 1. The Main Findings per E-Participation Dimension

Dimension	Main Findings and References Sample <sup>2</sup>
<b>E-Participation as independent research area</b>	<ul style="list-style-type: none"><li>• Politicians-citizens interaction and political activities (e.g. e-campaigns and e-voting) are the central interests of the majority of studies in this dimension [3]–[5].</li><li>• Little attention towards other e-Participation activities (e.g. e-consultation and online decision making) in government context [6].</li></ul>
<b>E-Participation as integral part of e-Democracy</b>	<ul style="list-style-type: none"><li>• Politicians often employ e-Participation through social media initiatives as additional communication channel. In particular, to promote themselves and to gain citizens votes during election time rather than conducting real dialogues with citizens [7], [8].</li></ul>
<b>E-Participation as integral part of e-Government</b>	<ul style="list-style-type: none"><li>• A few studies address e-Participation as a central theme of discussion. Instead, e-Participation is treated as a “micro” subject along with other government /governance topics (e-service, openness and transparency), for example [9]–[11]. However, such public policy principles do not necessarily means truly participation [12], and e-Participation should not being examined for such impact [13].</li></ul>

<sup>2</sup> Due lack of space the complete list of papers reviewed is not included. Few references have been cited.

### 3. Conclusions<sup>3</sup>

E-Participation through social media initiatives have achieved little success on attracting greater citizens' engagement. Three challenges of e-Participation through social media should be understood. First, the field of e-Participation research focuses more on political activities; it rarely examines the adoption of e-Participation through social media sponsored and driven by governments. Second, e-Participation initiatives through social media within e-Democracy context are largely communication initiatives rather than truly citizens' participation. Third, e-Participation through social media initiatives in government context are widely employed as information and service provision initiatives rather than actual citizen participation government decision making process initiatives.

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<sup>3</sup> Related authors' works including further discussions could be found in [14].

# Lessons Learned from Developing & Using an Online Platform for Public Participation in Federal Government Policymaking

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**Abstract.** In the United States, most members of the public don't know about the federal rulemaking process and don't participate even on major issues that affect them, like consumer-debt collection practices or airline passenger rights. Our team of researchers at Cornell set out to address this gap, working with federal agencies to take public comment during live, ongoing federal agency rulemakings while developing and testing an online platform paired with live human facilitation.

**Keywords.** eGovernment, eParticipation, CeRI, Cornell, Brooks, Newhart

## 1. Introduction & Explanation

What does it mean to participate in democracy? In the United States, people participate in government policymaking by voting, but still feel disconnected from their representatives and lack trust in their government. The process of making laws seems opaque and slow. Many feel the regulatory process is even worse—a veritable black box of bureaucratic decision-making. Ironically, the notice-and-comment regulatory process is designed to be highly transparent and participatory. Agencies are required to clearly spell out what a proposed regulation would do and the facts underlying it; they must publish notice of the opportunity to comment and, most importantly, must consider the facts and arguments raised by commenters. In fact, however, these participation rights are exercised unequally: corporate and professional stakeholders participate extensively in the process, while small businesses, individuals, and NGOs have little or no significant role. For the past eight years, the Cornell eRulemaking Initiative at Cornell Law School has been partnering with U.S. federal agencies to develop and use an advanced online platform to provide an accessible and transparent means for historically silent stakeholders to deliberate with one another and submit effective official comments to rulemaking agencies during the rulemaking process. In the graphic that follows, we present our research findings, our experiences, and our ongoing work.

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## Background

### Cornell eRulemaking Initiative (CeRI)

CeRI works with federal agencies to support public participation in rulemaking—the process used to develop new regulations. Motivated by President Obama's push for open government, we explore ways to use digital technology to make policymaking accessible to the public.

Drawing on deliberative and facilitative techniques, we have learned much about how to enable meaningful public discussion of complex policies online. The most significant lesson we have learned is that **technology alone cannot improve public participation - human support is essential.**

### What does democratic participation & deliberation mean for us?

The kinds of democratic participation most people think of—like voting—don't require that people give reasons or actively engage with and respond to the views of others.

The federal notice-and-comment rulemaking process, however, is driven by arguments, data, and other kinds of knowledge.

In this process, agencies are required by law to:

- (1) clearly explain the legal and factual basis of a proposed rule, as well as the goals it would accomplish and requirements it would impose;
- (2) publish notice of the proposal and provide opportunities to comment; and;
- (3) consider and respond to facts and arguments raised by commenters.

### Barriers to Effective Participation

**Lack of Awareness:** Most stakeholders are unaware that rulemakings of interest to them have been proposed.

**Information Overload:** Because rulemaking documents average 50-100 pages of dense, often technical, text, non-expert stakeholders have trouble accessing the information most relevant to them.

**Lack of Participation Literacy:** Participation in rulemaking is not just about opinions. Effective participation in rulemaking requires logical analysis, substantiated claims, and alternatives to the proposed rule. Stakeholders without training in argumentation, deliberation, and other techniques cannot persuade the agency as effectively as well-resourced participants like industrial organizations or lobbyists.

**Lack of Motivation:** Even if we mitigate the three barriers above, stakeholders may still lack the motivation to participate due to low trust in government, political apathy, feelings of low efficacy, or limited personal time paired with competing interests.

## Regulation Room™

Home | Open Rules | Closed Rules | Learn | About | Announcements

**Before you comment please review these tips:**

- Explain not only what the agency should do, but why. Share your information, a personal experience, or a good idea. One detail and specific examples.
- Focus on parts of the proposal that affect you directly that you know about, or have personal experience with. Explain how you know what you're talking about.
- Express your views, concerns, or ideas clearly. Use facts and logic. Avoid just repeating what you read. Consider pros and cons.
- It's okay to disagree with the proposal and other commenters, but be polite. Attacking others won't help the agency make a decision.

[Review comment](#) [Submit comment as is](#)

**Why should you participate?**

When you comment, the government has to listen. One good comment can change the outcome.

[Read More](#)

**What is a Regulation Room?**

**Why participate?**

**Consumer Debt Collection Practices (ANPRM)**

**Discussion: When consumers dispute a debt**

[Select other topics](#)

**Subtopics**

- 1. What's going on now with consumer disputes? - 47
- 2. What should exist as a "dispute"? - 30
- 3. How should collectors investigate and "verify" the debt? - 18

**Agency Proposal**

If a consumer properly disputes the debt, the collector has to get "verification of the debt" and send that (or a copy of a court judgment on the debt) to the consumer (DCA § 1000). **What is the law about this?**

Some people are concerned that collectors don't do much more than double-check that the amount in the validation notice matches what the creditor says the consumer owes. The FTC thinks the collector should have to do a "reasonable" investigation. (See the 2003 FTC Modernization Report, p. 33.) To decide whether this, or something else, should be the new federal rule, CFPB wants to know:

- How often are disputes actually investigated? What percentage of investigations find errors? Do collectors try to get more information from the consumer, or the original creditor, or anyone else – or do they just double-check what they told the consumer against what they already have in their files? Does the amount of investigation depend on the type of debt?
- Would requiring "reasonable" investigation be the best rule for consumers? For collectors? Or should specific actions be spelled out (for example, review account-specific documents) or consider the number and kinds of disputes they are getting about a group of debts?
- Would a "reasonable" investigation be different depending on the kind of dispute (for example, wrong amount vs. wrong person) or the type of debt (for example, credit card vs. car loan)?

Try to be as specific as possible about what reasonable investigation would involve in various common dispute scenarios.

**Comments 18**

[Comment](#) [Cancel](#)

**Forward**

November 18, 2013 - 9:10pm

For over 3 years I have been contacted by debt collectors for an alleged debt. I diligently send proof of payment and am ignored, and several months later a new firm sends the same letter re the same debt. The collector never responds, investigates or verifies the dispute. They should be forced to do so.

[Index](#) [New](#)

**Moderator**

November 18, 2013 - 12:26pm

Hi, Howard. Thank you for your comment, and welcome to RegulationRoom. CFPB is looking to find out more about consumers' experiences with debt collection. Can you share more details about what happened? Have you talked to the original creditor?

## Tools and Techniques

### Summary of User Statistics

377 people registered.

224 people made 956 comments.

18 CeRI moderators facilitated the discussion by responding to users a total of 251 times.



### Thoughtful Design to Support Online Engagement

- Dense rulemaking material is condensed, written in plain language, and organized by substantive topics and sub-topics.
- Hyperlinks provide participants with HTML versions of the original rulemaking text and other supporting material.
- A glossary function allows users to hover over technical terms for definitions.
- Video and text materials explain the rulemaking process and how to participate effectively.
- Comment tips—a recently released feature—prompt participants to add details, facts, arguments, and alternative proposals to their comments before submitting.

### Human Facilitative Moderation

Moderators—Cornell law students enrolled in CeRI's service-learning course—are trained in facilitation and conflict resolution by Cornell Law School faculty and professional mediators. These students then provide guidance and support to commenters on the process and substance of the rulemaking.

They also mentor effective commenting by encouraging participants to respond to specific agency questions, elaborate on arguments and factual claims, and respond to the points raised by other commenters.

### Bringing People to the Discussion

Set up searches for mentions of the rulemaking on news sites, blogs, Twitter, and other social media, and comment to alert stakeholders about RegulationRoom.

Coordinate with agency partners to develop press releases and statements to the media that emphasize the public's opportunity to comment.

Contact advocacy organizations representing stakeholders impacted by the proposed rule to stimulate member interest.

# Integrating Data Masking Standards and Applications into Open Government Data

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**Abstract.** This poster will present our work in progress in the development of a series of data masking standards and applications for the compliance of security policies in the context of open government data. Our current efforts focus on the feasibility analysis to use data masking technologies in datasets processing, access and download.

**Keywords.** Open Government Data, Data Masking, Standard, Data Security

## 1. Introduction

Utilizing government data to create value-added benefits via different Open Government Data actions may explicitly compromise the government and/or individuals' privacy. Therefore, alternative solutions for desensitizing government data must be explored. Data masking aims at identifying and removing the sensitive information in the "raw" data to make the data publishable where the utility of the published data can be maximized.

In this poster, we explore connections between OGD and data masking standards and applications, providing a brief review on the concepts of data masking technology and its standard uses and preliminary ideas of the application of these concepts in OGD.

## 2. Obstacles to Open Government Data

While OGD efforts can potentially provide numerous benefits, such efforts face a number of barriers. From the data provider's viewpoint, governments have concerns for privacy, confidentiality and liability [1] as major obstacles to the progress of OGD. Specifically, at the legislation level, privacy violation and security are mentioned most frequently. At technical level, absence of standards and lack of meta data standards are pointed out. Data quality and security are mentioned at all levels. In fact, data is spread and fragmented across different agencies, each of which is responsible for just some of the data, the security and privacy threats and lack of standardization are mentioned[2].

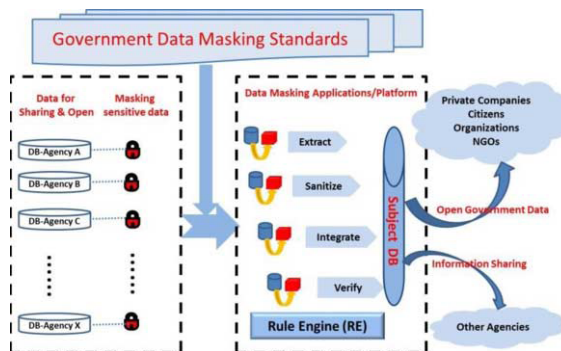
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Data masking technologies are one opportunity for protecting data from abuse and preserving data privacy during data sharing and exchanging inter-organizations. Such approaches should be introduced to the processing of raw datasets for use by the public.

### 3. Data Masking Meaning to OGD

Data masking standards and applications are key to OGD efforts. In the OGD ecosystem data will be shared and exchanged across agencies and organizations, and data will be opened to citizens, business companies and NGOs, it seems that data the capability of each agency to ensure compliance is very difficult if not impossible. Data masking is one approach to protecting privacy data, in that masking would be carried out before the data becomes “open”. The suggestion described as bellowing Figure 1:



**Figure 1.** Government Data Masking Process.

In the next OGD actions/framework, integrated novel data masking techniques should suppress the sensitive information mentioned above while maximizing the output utility of the desensitize data, and new data masking standards will be proposed to measure the privacy protection in the context of OGD. More specifically, data can be generalized or suppressed to satisfy a predefined privacy notion (e.g., k-anonymity [3]); a randomization mechanism can be developed to publish probabilistic OGD while the randomization satisfies a “differential privacy notion” [4].

#### 3.1. Conclusion and Future Work

Our current efforts focus on the development of a framework that uses the concepts of Data masking to take advantage of current Open Government Data experience. The concept will integrate standards, applications and governance structures to facilitate collaboration among government agencies in open government data practices.

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# Exploring on the Role of Open Government Data in Emergency Management

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**Abstract.** As a typical practice of Open Government Data, OnTheMap for Emergency Management Shows potential impact on jobs/workers and population for hurricanes, tropical storms, fires, floods, snow and freezing rain probability and disaster declaration areas based on real-time geographic data of disaster events are automatically updated. We can explore that Open Government Data can not only help city agencies make decision on staffing, communication and deployment of resource, but also improve city's resilience and recovery, to improve our ability to protect life, property and environment.

**Keywords.** Open Government Data, Emergency Management, LEHD program

## 1. Introduction

Emergency management (EM) typically involves multiple jurisdictions as well as a number of governmental ministries, departments and agencies, non-governmental organizations (NGOs), private sector entities, and citizens. In addition, the number and type of actors involved emergency response varies depending on the context and severity of the event[1]. Governments are among the largest creators and collectors of data. Increasingly, governments and other emergency management professionals are looking to both governmental and non-governmental actors to provide access to the vast store of government information to guide emergency response decision making. In particular pressure to provide open government data as input to emergency management and in particular emergency response efforts, is increasing.

In this poster we provide new understanding about US practices in the use of Open Government Data (OGD) in emergency response, and tried to find how OGD application can improve emergency management in the different phases.

## 2. Open Government Data Practice in Emergency Management: Case OnTheMap

EM functions in the U.S. are generally grouped into four phases: Mitigation, Preparedness, Response, and Recovery. The Longitudinal Employer-Household Dynamics (LEHD) program is part of the Center for Economic Studies at the U.S. Census Bureau and focuses on data gathered from economic-related agencies and all 50

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states of the U.S. OnTheMap, a mapping and reporting tool showing employment and home locations of workers with companion reports for user-defined areas[3]. OnTheMap for Emergency Management provides users this information for rapidly changing hazard event areas. OnTheMap automatically incorporates real time data updates from the National Weather Service's (NWS) National Hurricane Center, Department of Interior (DOI), Department of Agriculture (DOA), and the Federal Emergency Management Agency (FEMA). Recent improvements have been made that advance the utility of the tool and its data offerings for users including newly added social and housing data from the American Community Survey (ACS).

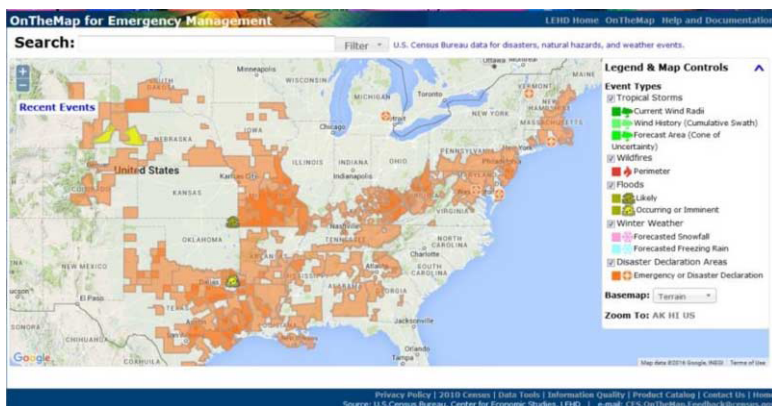


Figure 1. LEHD Application OnTheMap for Emergency Management (<http://onthemap.ces.census.gov/em/>)

### 3. Conclusion and future work

As one important step toward more effective use of OGD in emergency management, Data.gov disseminates emergency preparedness information with the goal of helping the public prepare for many different kinds of incidents. Data such as that provided by OnTheMap are also resources for the public, in particular other governments, the private sector and NGOs, to produce applications that provide tools to visualize the data and visualizations themselves, for example, to support more rapid response by all stakeholders and improve the accuracy of decisions in routine emergency preparedness and response. Drawing on the experiences in the U.S. we propose a set of scenarios where the use of OGD in EM could be highlighted and cultivated to increase EM response capability in all the 4 phases.

The complete study will focus on the US, the EU and China. This first paper will start with a focus on the United States. Once complete, the collected set of papers will propose a model of the use of OGD in emergency response, identify a common set of global practices and present a set of guidelines for the use of OGD in the various stages of EM.

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# Are Results from e-Government Agency-Centered or Citizen-Centered? A Review of the Literature

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## Abstract

Scholars and practitioners around the world frequently talk about the importance of focusing on the citizen when developing e-government applications. However, there is no clarity in terms of how much of the benefits from the use of information technologies impact citizens and/or government agencies. Based on a review of exiting literature, this poster identifies diverse results of electronic government and analyzes to what extent those results impact citizens and/or government agencies. We think that this understanding is a key aspect to develop and study better user-centered approaches. Results have been categorized in three clusters: (1) for users, (2) for government agencies, and (3) for both.

**Keywords.** E-Government, Results, User centrality, Benefits, Impacts.

## 1. Introduction

E-government promises regarding the advantages that this scheme will bring to government and society have been announced [1][2][3]. But the question is for whom are e-government results? At the beginning government was looking to use technology in order to improve managerial effectiveness while increasing government productivity [4] and in this sense the first studies on e-government focused on the technology side [5][6]. However, the success of e-government lies in spread the benefits of technology to citizens [7][8][9].

## 2. Literature review

Studies that address the issue of results, they also talk about the benefits of e-government and sometimes seem to be synonymous: benefits and results. Sometimes benefits are more used than results. Among the most frequently mentioned results are: Better relationships between citizens and government, through a more receptive government [10][11][3], transparency [2][9], effectiveness [12][2], increased efficiency [2][9], cost reduction [9], time reduction [2][9], accessibility of services [2], increase participation [12][2], and trust in government [2][3].

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### 3. Preliminary results

From this review of the literature, it is clear that the results have been seen mainly from the supply side as results for government organizations. In the analysis it was possible to identify that there are results for government organizations, results for users, and results for both users and the organization (see Figure 1).

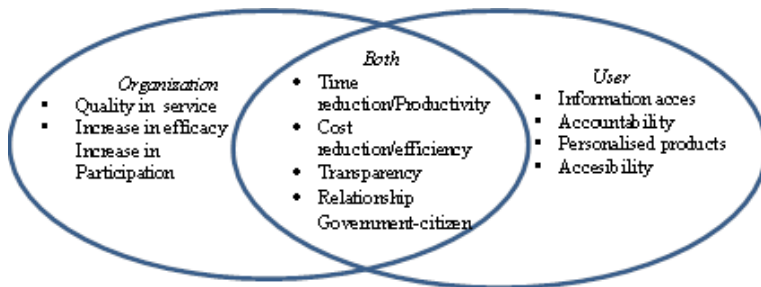


Figure 1. Results for users, for organization and both

In the case of e-government user-centered approach is very important to consider that results are not the same for governments and citizens. And this is because each of them has different goals and may be that some of them do not necessarily coincide with the interests of the other. However, there are other results being sought by government organizations that, in some ways, will also be beneficial to users (citizens, businesses, and other stakeholders). More research is needed, but we argue that identifying the beneficiaries of the results from e-government is an important endeavor.

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# IT Governance Enabling Long-Term Electronic Governance Initiatives

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**Abstract.** IT Governance must be part of e-governance initiatives as a way to promote long-term solutions and increment their effectiveness. We suggest a conceptual model to understand the demands in an integrated way focused on long-term solutions in order to add organicity and transparency throughout the process and to reduce the complexity. The higher the complexity, the higher the transaction costs, which may compromise future investments on new e-government initiatives.

**Keywords.** IT Governance, e-government, long-term initiatives

## 1. Introduction

Information and Communication Technologies (ICT) has made significant advances into diverse aspects of social life in the last decades [2]. The usage of ICT on governments, also known as electronic government (e-gov) has been considered a driver for social, economic and political changes such as government administrative reform, social transformation and organizational change [6]. As a result of this process, new models of the relationship between state and society have been arising, generating opportunities to transform the connection between government and citizens [1].

As the discussion about a new model of relationship between citizens and government evolves, it is possible to observe a gradual change in the government initiatives from tools that improve the services to tools that support the citizen participation [6]. This set of changes – citizen profile, government positioning and openness – generates new demands for data, information and services whose operationalization depends, evolves or is enhanced by ICT solutions. It may be a challenge also because changes related to technology and process are necessary.

However, the demands for fast reliable ICT solutions that could be accessed from highly available platforms are increasing. Considering this scenario, managing Information Technology (IT) is no longer enough; it is necessary to go one step further in a governance process. The differences between management and governance are related to time and business orientation: management involves short term and internal aspects, while governance deals with long term and external aspects [5]. Governing IT, consequently, can assist an organization in meticulous IT decision-making, increasing or maintaining the alignment between IT and stakeholders' expectations.

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Based on that, we consider that e-gov initiatives must encompass IT Governance (ITG) mechanisms as a way to have long-term solutions and increment their effectiveness. Governance can be considered as a set of organizational arrangements and patterns of authority for IT decisions and is characterized as a set of mechanisms that defines the decision-making structure, rights and responsibilities. We suggest a conceptual model (Figure 1) to understand, in an integrated and aligned way, the needs and the options considering a long-term view and the stakeholders' expectations in order to add organicity and transparency throughout the process.

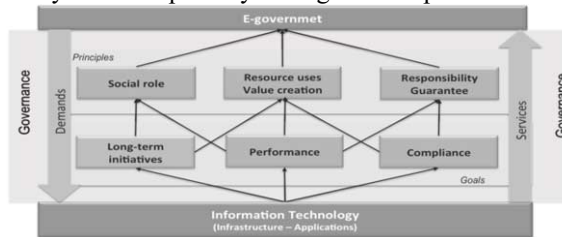


Figure 1. Conceptual model.

Numerous technologies are necessary to implement the diverse e-government initiatives that are in operation or under development. Therefore, it is necessary an formalized process to govern these initiatives in order to avoid the uncontrolled growth technologies. It is also necessary in public organizations to reduce the amount of ad hoc solutions [4]. Without a governance process it is easy to have duplicity of technologies and solutions and an unnecessary increase in complexity. The higher the complexity, the higher the transaction costs. More transaction costs mean more financial costs that may compromise future investments on new e-government initiatives, and also increase difficulties to plan new initiatives when managing the currents ones.

For a public organization, to consider long term and external aspects is mandatory, because an integrated operation of several actors is typically required to have the concretization of a service. A special challenge in public organizations is to turn the IT decisions perennial and related more to the state than to the government. As shown by Meijer and Bolivar [3], the demands of the population need to be thought in the long term. IT decisions that are not changed in every administration are more consistent and their implementation is more likely to be kept over the years within an ITG process.

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# An Exploration into Practice Intelligence in E-Government: A Way Forward

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**Abstract:** *Practice intelligence (PI)* is a new notion that refers to the learned expertise of sense making of problem spaces and the aligned learned expertise relating to appropriate decision/action in a particular problem space. Exploring Practice Intelligence in E-government research involves to specify and codify into academic knowledge the internal cognitive structures of designing and synthesizing the information used by e-government policy makers and practitioners.

In order to do this, we have defined two different policy processes from the wider set of decisions intervening in management practice: the **Website Impact and Outcome Translation Processes** which represent our object of study:



**Objective of the research:** To identify PI in the research problem (WIP & OTP).

Sub-objectives:

1. To reach a methodology to structure context for decision making
2. To gather academic knowledge on the field of study
3. To identify current patterns of professional practice in local government
4. To do the above but applied to different national context and identifying anchors and drivers
5. To propose a methodology to get PI by combining the above (context, academic knowledge and practical expertise) for decision making in each national context.

## Methodology

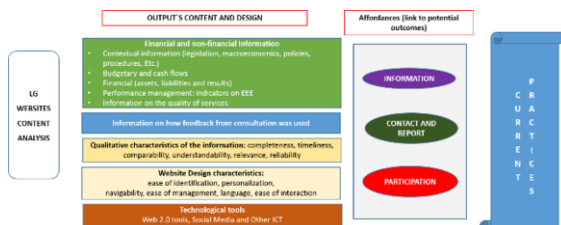


## Research phases and expected/obtained results

**1<sup>st</sup> Phase:** to map context affecting management practice in the defined processes WIP and OTP. The resulting map of the context will be described for particular national contexts.

DIMENSIONS	FACTORS	E-G FACTORS
Economic development	GDP per capita, income level, economic status, unemployment, telecommunications infrastructure, internet access, presence of e-government	
Socio-economic characteristics	Library, migration and multiculturalism, technology literacy, citizens' awareness of e-government, strength and freedom of media, development of the social media	
Demographic characteristics	Age, gender, ethnic diversity, population with disabilities, geographic dispersion, metropolitan status, population size	
Public Administration Style	Anglo-American/Confederal/European	
Political characteristics	Unitary vs federal government, type of Government, political competition, political role in ideology, political participation or reform	
External financial conditions	Dependency on EU/NGO grants, budget cycles, imposed financial priorities and/or budget restrictions, dependency on donors' and funding countries	
External cultural arrangements	External performance audits with scope on e-government	
National/regional regulations and strategic framework on e-government	Information and technology policies on standards, assessment models and methods, collaboration, information sharing and interoperability guidelines, risk management tools, other regulations affecting e-government	
Financial health	Budget/contribution, debt, level of capital investment	
Organizational culture	Objectives and values, arrangements for measuring and evaluating organizational performance and capabilities, resistance to change/organizational inertia, Orientation to innovation	
Organizational structure and Organizational structure and inter-organizational relationships arrangements	Hierarchy, decentralization and formal communications, organizational complexity and size, market-determined activities and marketization of public services, number of entities depending on the municipality, interorganizational collaboration arrangements and networks	
Human capital, IT infrastructure and information and data management	Qualification, technical skills, expertise and motivation, IT policies and standards and IT system properties, information and data management	

**2<sup>nd</sup> Phase:** to identify current professional practice /action on e-government (uncompleted)



**3<sup>rd</sup> Phase:** mapping and associating the identified contexts with particular actions/policies/decisions allowing us to specify practice intelligence for specific contexts and also potentially demonstrate how this practice intelligence is changing (future task).

## Implications/conclusions

We hope this work to interest other management researchers that the notion of practice intelligence is a fruitful area of work. We see knowledge relating to practice intelligence as adding to our understanding of management and its practice in addition to the long established models and conceptual frameworks developed through academic knowledge. The combination of academic knowledge and PI knowledge hopefully provides new and additional insight into management practices and particularly importantly, how management practices are changing.

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# A Platform to Research Presentation of Municipalities in Social Networks

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**Abstract.** Businesses already entered social networks and use them actively as communication, marketing, sales, and customer support channels. In the recent years, municipalities and state administrations started to use social networks to reach their constituents although this practice is not consistent. The research is devoted on a development of a platform that allows to monitor and to analyze the presence of municipalities in Facebook. Some initial results are presented. The presence in Facebook of 264 municipalities in Bulgaria was monitored and analyzed in years 2014 and 2016. The platform <http://socialpresence.azurewebsites.net/> is open to monitor and analyze municipalities' presence and performance in Facebook of municipalities all over the world.

**Keywords.** Municipalities, Social Networks, Facebook, Crowdsourcing, Open Data

## 1. Introduction

Facebook is the biggest online social network, which supports more than 70 languages. Launched in 2004, in April 2016 it counted for 1.59 billion active accounts [1]. In August last year, Facebook hit a new peak of 1 billion active users for a day [2]. More than 70% of Facebook users state that they log in the social network at least once a day and over 45% of them are using Facebook several times per day. Some people argue Facebook is one of the social networks with the most user-friendly interface for information presence and communication [3].

These advantages make Facebook the most desirable network for municipalities all over the world. It is the place for their social presence and communication with Facebook users that are interested in the municipality.

Municipalities' presence in this social network gives an opportunity for analysis over their current presentation and comparison other municipalities all over the world. The analysis can inform municipalities how their Facebook presence can become more efficient, how their Facebook sites become more popular and how their Facebook followers become more active.

A pilot research was conducted in the summer of 2014 on all 264 municipalities in Bulgaria [4]. All data were collected and stored in Excel spreadsheets. For the purpose of the pilot project, this was good enough and allowed for easy processing of the collected data. Only 73 (23%) of Bulgarian municipalities had official Facebook pages. Another 23 (9%) were also presented, but their presence was inconsistent: Facebook profiles were created instead of Facebook pages; Facebook profiles or pages were created for departments or for the Mayor instead of for Municipality; etc.

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## 2. Social Presence Editor

The results of the research [4] inspired development of a Web-based application to collect data for municipalities all over the world and their presence in Facebook using crowdsourcing <http://socialpresence.azurewebsites.net/>. The application provides tools for simple analysis of the available data and gives the opportunity to export data in .csv format for more sophisticated exploration. Pages of the application can be dynamically embedded in other portals.

Users are able to log in the application with their Facebook accounts and enter information about municipalities' pages in Facebook. Moderators review the data and correct or approve it. Data gathered are open and free. All entered data has time stamp therefore, it is possible to analyze the dynamics of the presence in Facebook of the municipalities all over the world. Currently one can find data for all 265 Bulgarian municipalities in years 2014 and 2016 and for some Albanian municipalities in 2016. The number of Bulgarian municipalities that created and supported their Facebook pages increased in 2016 in comparison to 2014. It is expected people who are interested in exploring the data to contribute to enriching the database entering data about their municipalities or municipalities of their interest.

Users are able to sort all data lists by any attribute. Both forward and reversed sorting are supported. Text attributes can be sorted alphabetically while numeric attributes by magnitude. Each attribute name has a tooltip that explains in more details its meaning.

Designing the web-based application it is planned to extend it to collect data for the presence of municipalities in other social networks e.g. tweeter, LinkedIn, etc.

## 3. Conclusions

A web-based platform <http://socialpresence.azurewebsites.net/> was developed. The platform allows to monitor and to analyze the presence of municipalities in Facebook. The platform is open for everybody to enter data about a municipality. All data is checked and confirmed by moderators. All data is open and freely available.

Based on the results from previous research [4] some recommendations were defined to Bulgarian municipalities. Grounded on the much wider data sets and the dynamics of the available data in the web-based application it is possible to formulate recommendations to municipalities and to state administrations for more efficient and effective use of social networks to communicate with citizens. As soon as the application is filled with data from the municipalities all over the world, it will be possible to present a global view of the use of Facebook as a communication channel in municipalities.

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# Workshops

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# The Smart Cities and Smart Government Research-Practice (SCSGRP) Consortium Workshop

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[IFIP EGOV 2016: General E-Government Track]

**Abstract.** This workshop is a working meeting of the Smart Cities Smart Government Research-Practice Consortium. The main goal of the workshop is to continue conversations started since 2012. This workshop will build on SCSGRP Consortium meetings held at dg.o 2015, IFIP/egov 2015, and HICSS 2016.

**Keywords.** Smart City, Smart Government, Smart Initiative, Smart Governance, Research Collaboration

## 1. Introduction

The Smart Cities Smart Government Research-Practice Consortium (SCSGRP) is a robust global research community focused on innovations in technology, management and policy. Created in 2012, the Consortium now includes 30 individuals from 25 institutions across 17 countries around the world. The main purposes of the consortium are:

- To formally connect those engaged in cutting edge research on smart cities.
- To support the development of a robust, global and well-connected smart cities research community.
- To create a foundation for the development of multi-institution, multi-national research teams focused on the use of ICTs in cities.

## **2. Workshop Description**

The workshop will be organized as a 3-hour session, including a series of brief presentations and facilitated discussions. The proposed agenda for the workshop will include the following items:

1. Welcome and brief introductions of participants.
2. Short presentation of SCSGRP, and discussion on tools and procedures for document, protocols and data sharing.
3. Discussion on current research frameworks and projects by members and other interested parties.
4. Discussions of collaborations and synergies.
5. Outreach plans and planning next Consortium meetings.

## **3. Potential Discussion Points**

The purpose of the workshop will be to advance the vision of the consortium. Potential topics for discussion include:

- Organize a series of face to face meetings at conferences and through teleconferences.
- Propose an outline of a Consortium governance structure.
- Develop strategies and agree on practices that maximize opportunity for data and results sharing among the members.
- Define a research framework to support efforts to conduct comparative studies.

## **4. About workshop facilitators**

J. Ramon Gil-Garcia, Ph.D., is an Associate Professor of Public Administration and Policy and the Research Director of the Center for Technology in Government (CTG), University at Albany. As the Research Director of CTG, Dr. Gil-Garcia has primary responsibility for developing and managing the Center's research portfolio.

Theresa Pardo, PhD. serves as Director of the Center for Technology in Government at the University at Albany, as well holding research professor appointments in Public Administration and Policy and Informatics. Under her leadership, CTG works closely with multi-sector and multi-disciplinary teams from the U.S. and around the world to carry out applied research and problem solving projects.

# Workshop on Simulating the Impact of Social Policy Innovations Enabled by ICTs Promoting Social Investment

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**Keywords:** Simulation modelling; impact assessment; social innovation; governance; policy making; ICTs, EU.

**Disclaimer:** *The views expressed in this document are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.*

## Background and introduction

According to the European Commission Communication on the Social Investment Package (SIP) Member States are urged to prioritise social investment and the modernisation of their welfare systems in order to address unemployment, poverty, and social exclusion challenges brought about by the economic crisis and sustainability challenges posed by the ageing population trends. ICT-Enabled Social Innovations have come to be considered a key pillar of the SIP. However, while many initiatives have been launched and funds allocated, yet there is no evidence on the results obtained and, especially, there is evidence that some of these initiatives were designed and fund disbursed bases on little ex ante assessment.

For this reason, the European Commission Joint Research Centre's Institute for Prospective Technological Studies (JRC-IPTS – <http://ipts.jrc.ec.europa.eu>) in collaboration with DG Employment, Social Affairs and Inclusion (DG-EMPL), is conducting a research project to explore the nature and impact of ICT-enabled social innovation in support to the implementation of the EU social investment package (IESI) (see: <http://is.jrc.ec.europa.eu/pages/eap/einclusion.iesi.html>).

One of the key goals of the IESI research is to develop a framework for conducting analysis of the social return on investment of initiatives which have as key component ICT-enabled social innovation, named i-FRAME. This will allow providing recommendations on how the European Commission and Member States could assess the impact of ICT-enabled social innovations initiatives promoting social investment through integrated approaches to social services delivery.

The current phase of the development of the theoretical and methodological approach for building the i-FRAME has been peer-reviewed by the scientific and practice community which has also been involved in the testing and validation phase.

To this end, the i-FRAME approach has been also tested on six 'scenarios of use' drawn from real life case studies conducted in six EU countries to analyse the implications and possible contribution of ICT-enabled social innovation initiatives promoting social investment to the modernisation of European Social Protection Systems.

## Objectives and approach

The objective of the workshop is to discuss and validate the methodological framework underpinning the i-FRAME. For this purpose the workshop will be highly interactive involving participants in group-model building and design of scenarios of use in order to identify possible applications of the model to key areas of analysis and to real-life case studies to be used as possible test-bed for its further development.

In fact, so far the i-FRAME generated high interest and it is planned to be further developed through a computerised based simulation modelling as a prototype and be further tested through its application to selected case studies.

Following a brief overview of the key findings of the IESI research and the proposed methodological approach underpinning the i-FRAME V1.5 concrete experiences of using simulation modelling in relation to social policy related activities will be presented by selected recognized researchers in the field, practitioners and policy-makers.

Participants in the workshop will be then invited to discuss how policy interventions enabled by ICTs should be assessed and what approaches would work better for promoting the social investment and the modernisation of EU welfare systems in order to address unemployment, poverty, social exclusion and the sustainability challenges posed by the ageing population trend.

To this end participants will be involved 'hand-on' presenting their experiences and contributing to build 'simulation models' customised to address specific policy problems based on real life cases, so to evaluate impacts among alternative policy options.

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# The Human Factor: How Can Information Security Awareness Be Sustainably Achieved in E-Government?

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**Abstract.** With the comprehensive digitalization of the workplace and of privacy, we face complex challenges. Information Security awareness is a necessary response. In the workshop we demonstrate analogue game-based awareness learning in a three phases procedure for the digital world.

**Keywords.** Digitalization, social media, social engineering, IT security en route, information security awareness, data protection, game-based learning

## 1. Introduction

E-Government focuses on innovations in technology, management and policy. New technologies and applications such as Social Media are new types of information production and sharing tools which are used in digital environments. The very interesting developments must be understood and designed in a user-friendly way. The thus connected and simultaneously embracing hazards abuse and organized crime must be prevented. Security awareness is a necessary response to the challenges ahead.

Game-based learning receives increasing recognition as an effective teaching and learning method for promoting motivation and inducing behavioural changes because simulation games enable active and experience-oriented learning by trial and error, repetition, team work and communication. They offer immediate feedback regarding the learning progress and are oriented towards the learners, their level of knowledge and their needs (learner-centred approach) [1].

## 2. An innovative method for awareness raising for information security

The idea of learning at different stations goes back to Ronald Ernest Morgan and Graham Thomas Adamson who developed the method “circuit training” for the sports sector [2]. The circuit training for awareness raising for information security works as follows: Four to six stations are arranged according to the purpose and the relevant topics of the security event. The stations are completed standing up synchronously by teams of five to ten participants. The procedure of each station is the same and is structured into three phases:

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In the first phase the participants get acquainted with the topic of the station. Therefor the moderator of the station explains some golden rules, communicates his/her experience, and encourages the participants to share their knowledge and experience they have with the special topic. During the second phase—the gaming phase—a simulation-game is used to make the topic tangible for the participants and to be experienced by them. At the end—in the third phase—the participants reflect their results with the moderator, receive game points for right solutions, and the moderator clears up obscurities, provides practical advice and refers to further information. Each phase only takes five minutes.

At the Social Media (SM) station, for example, participants are invited to sort given status messages in harmless and critical information with possible disciplinary actions or civil consequences. At the Social Engineering station participants face the challenge to separate given quotations according to the six social gateways that fraudsters use to get sensitive information. At the station IT security en route participants are confronted with a sequence of places during a business trip and their task is to identify possible information security risks and corresponding protective measures. This circuit training for awareness raising for information security should be regarded as teaser that trigger—by the high emotional charging of the event—a more comprehensive examination with information security by sharing knowledge about information security after the event. In the end, this should lead to strengthening their awareness for and influencing their behaviour to protect more consciously sensitive information.

The E-Government Research-Practice community comes together to share ideas, new knowledge, and research and practice innovations. In this face-to-face workshop, findings to serious games are presented to be touched in practice. Only a vibrant and practical teaching of threats will lead to a lasting awareness of information security. Therefore, the workshop shows narrative (analogue) scenarios and playful situations and will discuss them in order to promote sustainable awareness.

### **3. Workshop schedule**

Anyone with an interest on the topic is welcome to join this afternoon session.

1:00 - 1:15 Opening words: Background of research and projects

1:15 - 2:15 Playtime for all

Scenario 1: SM, Scenario 2: Social Engineering, Scenario 3: IT security en route

2:15 - 2:30 Paper presentation of more serious games

2:30 - 2:45 Break

2:45 - 3:45 Discussion

including Skype conference with the German research team and partners of German small medium enterprises (SME)

3:45 - 4:00 Closing remarks

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# Open and Big Data Partnerships for Public Good: Interactive Live Polling of Influential Factors

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**Abstract.** There is much potential for open and big data to be used for addressing societal challenges of today. This drives a new kind of partnership called “data collaborative” emphasizing the value of data for public good. Data collaboratives stand for cross-sector partnerships, whereby organizations in the private or public sector disclose their data, as an act of good will, in order to contribute to a societal cause (such as e.g. healthcare, humanitarian, or other policy issues). In this workshop we focus on this emerging topic which so far has deserved little attention in research. In our previous research an initial framework of influential factors for data collaboratives was introduced. The workshop objective is to validate and refine this initial framework by inviting participants to take part in an interactive live polling exercise and assess a number of propositions about influential factors.

**Keywords.** Big Data, Open Data, Collaboration, Public Private Partnership

## 1. Introduction

There is a general understanding that the data revolution can deliver tremendous value for the public good, and some high-level pathways for progress have been laid out by international actors [1, 2]. Enhanced collaboration between stakeholders in various sectors is crucial in this respect to accelerate data sharing and the use of data for public good [3]. This new type of partnership was labeled “data collaboratives” [4] and stands for the practice of organizations donating data for analysis in order to contribute to a societal cause. For example, in 2015 Uber shared their anonymized trip-level data with the city of Boston to help future development of the city.

While in practice an increasing number of examples of data collaboratives can be found, scientific research is yet to explain and understand this phenomenon fully. Focusing on influential factors can help accelerate the adoption of this new kind of partnerships in different contexts.

## 2. Workshop objectives and structure

First we will share the findings of our previous research outlining the proposed taxonomy of data collaboratives, alongside several examples from practice. One of the examples

concerns a project about Virtual Research Environments (the VRE4EIC project<sup>1</sup>) in which researchers can collaborate in data analysis and discussions about datasets concerning different societal challenges. The taxonomy will provide participants with insights into the different types of data collaboratives found in various sectors and into the dimensions and characteristics distinguishing them. Using the taxonomy as a point of reference, we will then present our initial framework of influential factors for data collaboratives. The workshop objective is to validate and refine this initial framework of influential factors by asking participants to assess the importance of different factors based on their expertise.

This will be carried out by inviting participants to take part in an interactive live polling exercise using Mentimeter<sup>2</sup>. The participants will be offered a series of propositions about various influential factors for data collaboratives and asked to indicate to which degree they agree or disagree with them. We therefore invite researchers with expertise in the field of information sharing, public-private partnerships, and/or open and big data to attend this workshop. The live polling exercise will be followed by a panel discussion, during which the participants can provide feedback on the framework of factors and brainstorm about additional issues not yet considered.

The workshop participants can benefit from the workshop by gaining insights into this cutting-edge topic and into the influential factors characterizing data collaboratives in practice. Thanks to using interactive live polling, results of the poll will be available to the workshop participants instantly. The participants can take away from the exercise a snapshot of importance of various factors according to their opinions.

## Acknowledgements

This work is funded by the Swedish Research Council in the context of the project "Data collaboratives as a new form of innovation for addressing societal challenges in the age of data" under the grant agreement 2015-06563. The organizers are grateful to their colleagues at The Governance Lab of New York University for facilitating this research.

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<sup>2</sup> <https://www.govote.at/>

# Open Statistical Data: Potential and Challenges

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**Abstract.** Opening up data is a political priority worldwide. Linked open data is considered as the most mature technology for publishing and reusing open data. A large number of open data is numerical and actually concerns statistics. In the literature, statistical data have been heavily studied using the data cube model. Recently, ICT tools have emerged aiming to exploit linked open data technologies for providing advanced visualizations and analytics of open statistical data residing in geographically dispersed open data portals. The aim of this panel is to discuss the potential and challenges of open statistical data.

**Keywords.** Open Data, Open Statistical Data

## 1. Introduction

Opening up governmental data is a political priority across the globe. As a result, a large number of European public authorities have launched and maintain relevant portals. However, the potential of Open Government Data (OGD) has been unrealized to a large extent [1].

The difficulty in exploiting open data seems surprising if we consider the huge importance data have in modern societies. Indeed, during the last years, businesses, academia and government employ various data analytics methods on their own data with great success. For example, business intelligence methods capitalize on the data cube model for multidimensional data to help enterprises survive in the global economy.

Looking at the actual data, it is evident that a large part of OGD is of a statistical nature, meaning that they consist of numeric values that are highly structured [2]. For example, the vast majority of datasets published on the Open Data Portal of the European Commission are of statistical nature. These data are important because they

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have the potential for innovative uses, e.g. performing advanced data analytics and visualizations on top of combined data that were previously isolated.

Moreover, Linked Data has been introduced as a promising paradigm for opening up data because it facilitates data integration on the Web. In the case of statistical data, Linked Data has the potential to realize the vision of performing data analytics on top of related but previously isolated statistical data across the Web. A fundamental step towards this vision is the RDF Data Cube vocabulary. Although several practical solutions have been developed during the last years for creating and exploiting Linked Open Statistical Data [3], these solutions are mainly technology-driven and are not able to address the complexity and dynamics of public sector organizations and public-private collaboration with regards to (a) opening up statistical data and (b) co-producing data-driven public services.

## 2. Panel Objectives and Structure

This panel gathers a number of experts aiming to discuss the potential and challenges of Open Statistical Data. The panel consists of a mixture of academics, IT industry and practitioners covering in this way different perspectives and viewpoints.

The discussion will cover the following topics amongst others:

- What is Open Statistical Data?
- What are the similarities with and differences from Open Government Data?
- What are the advantages of Open Statistical Data?
- What are the challenges in adopting Open Statistical Data?
- What are the key characteristics of relevant good practices?

It is expected that the discussions will not be limited to the panel. Instead the floor will be also provided to the participants in order to ask questions, express opinions and contribute with their experiences and views.

## Acknowledgements

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