The Role of National Culture on Citizen Adoption of eGovernment Services: An Empirical Study

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Abstract: Increasingly governments around the world have realized the imperative of providing the public with not only improved government information and services but also improved public governance, transparency and accountability through eGovernment services. However, many governments still face the problem of low level adoption of eGovernment websites. It is because the issue of eGovernment adoption is complex and multi-dimensional in nature. In consequence, it must be carefully addressed not only from technological perspectives but also from social, cultural, and organizational perspectives. The business case for developing sustainable successful eGovernment initiatives critically depends on our knowledge and understanding of how to increase citizen adoption of eGovernment websites. A review of the literature, however, shows that much of extant eGovernment research has focused on eGovernment adoption in developed countries. In consequence, little is known about national cultural factors that may influence eGovernment adoption in developing countries. This knowledge gap is particularly apparent in Jordan. Therefore, the objective of this paper is to examine national cultural factors that may influence citizen adoption of eGovernment websites in this culturally different part of the world. We developed an integrated model by extending the technology acceptance model (TAM) with Hofstede's national culture dimensions, which is used to evaluate the impact of national culture on eGovernment adoption in this paper. Based on survey data collected from a total of 197 Jordanian citizens, evidence shows that while two cultural dimensions: power distance and uncertainty avoidance had significant impacts on citizens' intention to adopt eGovernment, the other three cultural dimensions: individualism, masculinity, and long-term orientation had no discernible impacts. The results also indicate that perceived usefulness, perceived ease of use, attitude are significant indicators of citizens' intention to use state government services online.

Keywords: eGovernment adoption, technology acceptance model, culture, Jordan

1. Introduction

Information and communication technology (ICT) and resulting online capabilities such as the Internet provide the foundation for the transformation of the traditional government service. Over the past decade governments all over the world have realized the importance of providing government services and information via the Internet and world-wide-web to improve the efficiency, cost and quality of the government information and services provided to the public. However, although the adoption of eGovernment has the potential to provide better services to citizens at lower costs, it has acceptance problems. In fact, understanding why people accept or reject new information technology (IT) has proven to be one of the most challenging issues in IT/IS research (Al-Adawi et al., 2005). The acceptance and success of eGovernment is dependent upon citizen willingness to adopt this innovation (Carter and Bélanger, 2005). Yet, many governments worldwide still face the problem of low-level of citizen adoption of eGovernment websites (Belanger and Carter, 2008; Choudrie and Dwivedi, 2005; Gupta et al., 2008; Kumar et al., 2007; Fu et al., 2006; Wang, 2003). eGovernment adoption occurs in a turbulent social-political environment not only must be carefully addressed from a technological perspective, but also from social, political, and cultural perspectives. Without understanding what motivates the public to use eGovernment services, governments will not be able to take strategic actions to increase the eGovernment up-take (Gilbert et al., 2004). Hence, more empirical studies are required in the area of eGovernment adoption to help governments to improve their understanding of the issues that affect citizen adoption of eGovernment services and websites.

In addition, while the academic literature on eGovernment adoption has mainly focused upon the adoption of eGovernment websites in developed countries, relatively little attention has been given to the citizen adoption of eGovernment websites in developing countries (Alhujran and Chatfield, 2008). This study, therefore, aims to fill a gap in the literature by conducting empirical field research on eGovernment adoption in the Arab world, specifically in Jordan. Grounded on the Technology Acceptance Model (TAM) (Davis et al., 1989), this study develops a conceptual model by integrating the TAM with two of Hofstede’s national culture dimensions - power distance, uncertainty avoidance.
The extended TAM model is exploited to examine the impacts of these cultural dimensions upon citizen adoption of eGovernment websites in developing countries with different national cultures and values.

Moreover, although culture is being considered as a contributing factor in the IT/IS adoption, very limited research has attempted to explore the impact of the culture on IT/IS adoption in the Arab region. Most of the previous research has only focused on economical, political, and technological factors that impact technology transfer to the Arab world (e.g. Al-Gahtani, 2004; Straub et al., 2001). Furthermore, to date, almost no prior research has considered the influence of national culture on eGovernment adoption in the Arab world, in general, and Jordan, in particular.

In terms of achievements, efforts of Jordan to provide eGovernment services to the public have been internationally recognized. Recently, the ministry of Information and Communication Technologies (MoICT) has introduced more than three main eGovernment services to the public. Examples of these services are: police clearance, higher education admissions, and public jobs applications and tracking. However, despite some success, the eGovernment services and websites in Jordan are facing the challenge of increasing the usage level of these services and websites (Al-Hujran and Shahateet, 2010). Therefore, a better understanding of the factors that influence citizen adoption of eGovernment is a critically important policy issue in this country. This study provides the eGovernment officials with a useful guideline for achieving better eGovernment websites and increasing the citizen's adoption of these websites.

The remainder of this paper is organized as follows. Section 2 presents a background about eGovernment adoption in Jordan. Section 3 presents the theoretical background and the research model. Section 4 describes the research methodology of this study. Section 5 presents the analysis and results. Finally, we present our discussions, practical implications, limitations and conclusion.

2. Background: eGovernment adoption in Jordan

There is no clear definition of eGovernment adoption (Kumar et al., 2007). Researchers refer to it as the ‘intention’ (Carter and Bélanger, 2005; Warkentin et al., 2002) or ‘willingness’ (Gilbert et al., 2004) to use eGovernment information and services. Warkentin et al. (2002, p.159) define eGovernment adoption as “the intention to ‘engage in eGovernment’, which encompasses the intentions to receive information, to provide information, and to request eGovernment services”. Similarly, Kumar et al. (2007, p. 69) define it as “a simple decision of using, or not using, online [eGovernment] services”. For the purposes of this study, eGovernment adoption refers to the intention of citizens to use eGovernment websites and online services and.

Jordan is developing a strong ICT with the aim of becoming a knowledge-based country and a regional IT center. In terms of achievements, Jordan's efforts to provide eGovernment services to the public have been recognized worldwide. Recently, the Jordanian Ministry of Information and Communication Technologies (MoICT) has introduced several eGovernment services to the public. Examples include: police clearance, higher education admissions, and public jobs applications and tracking. However, despite some success the government is facing the challenge of increasing the low usage levels of these services and websites (Al-Hujran and Al-dalahmeh, 2011; Al-Hujran and Shahateet, 2010; Al-Jaghoub et al. 2010; Mofleh and Wanous, 2008). Specifically, Al-Jaghoub et al (2010) found that despite the government's growing investment in electronic services in Jordan, 85% of the citizens never logged in to an eGovernment website.

Although the literature reported that there are several studies exploring factors that influence eGovernment adoption in the developed countries (e.g. Carter and Belanger 2004; Carter and Bélanger, 2005; Gilbert et al., 2004; Fu et al. 2006; Kumar et al. 2007; Phang et al. 2005; Warkentin et al. 2002; Wang 2003), there appears to be a lack of understanding of the factors that influence the citizen intention to use eGovernment services and websites in Jordan (Al-Hujran and Al-dalahmeh, 2011; Al-Hujran and Shahateet, 2010; Alomari et al, 2010). Hence, a better understanding of the factors that influence citizen adoption of eGovernment is a critically important policy issue in Jordan. In this context, this study is aiming to provide the eGovernment officials in Jordan with a useful guideline for achieving better eGovernment websites and channeling their strategies toward increasing the citizen adoption of these websites. The results would help authorities understand the key factors that influence citizen’s adoption of eGovernment services and websites. Particularly, the results of this study are expected to help government agencies cultivate the positively correlating
factors to enhance citizen adoption of eGovernment while trying to reduce the effects of the negative factors. As mentioned earlier, the success of any eGovernment is highly dependent upon the citizen willingness to use these electronic services.

3. Theoretical background and research model

The research model used to guide the study is shown in Figure 1. In the following sections, the meaning and the theories supporting the relationships are presented.

![Diagram](attachment://research_model.png)

**Figure 1**: Research model of citizen's intention to use eGovernment services and websites

### 3.1 Technology Acceptance Model (TAM)

The technology acceptance model (TAM) (Davis, 1989; Davis et al., 1989), is one of several models that IT/IS researchers have used to predict and explain the underlying factors that motivate users to accept and adopt new information technology systems. This model (Figure 2) is derived from the theory of reasoned action (TRA) (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980).

According to TRA, the individual attitude and subjective norms influence the user’s behavioral intention, which, in turn, influences his or her actual behavior. Building upon this, TAM was proposed to explain and predict users’ acceptance of IT and IS systems by assuming that the constructs - perceived ease of use (PEOU) and perceived usefulness (PU) - are the key determinants of IT and IS acceptance behavior. Davis (1989, p.320) defined perceived usefulness as “the degree to which a person believes that using a particular system would enhance his or her job performance”, and defined perceived ease of use as “the degree to which a person believes that using a particular system would be free of effort”. Fishbein and Ajzen (1975, p.216) defined behavioral intention as “the strength of one's intention to perform a specified behavior”. In TAM, the perceived usefulness of the system is predicted to be positively influenced by its perceived ease of use. TAM also theorizes that all other external variables are fully mediated by PU and PEOU (Heijden, 2003). Figure 2 illustrates TAM constructs and their relations. According to TAM, greater PU and PEOU of an IT/IS system would positively influence an attitude toward this system. The attitude, in turn, leads to a greater intention to use the system, which positively affects one’s actual use of the system (Davis, 1989).

Several meta-analysis studies have provided sufficient data about TAM to be highly credible (King and He, 2006; Shumaila et al., 2007). It also received substantial empirical support by means of validations and replications from numerous researchers (Adams et al., 1992; Davis, 1993; Venkatesh and Davis, 2000). In addition, several studies have applied TAM to evaluate users’ adoption in different settings such as e-mail, voice-mail, graphics, spreadsheet, and word processing, electronic commerce electronic learning, internet banking, and eGovernment. Furthermore, TAM has reliable instruments, and is empirically sound (Pavlou, 2003). TAM has routinely explained up to 40 per cent of the behavioral intentions to use (Venkatesh and Davis, 2000). This is despite the fact that TAM is usually criticized for ignoring the social influence on technology adoption (Mathieson, 1991), but social and human factors could actually be integrated with TAM to improve its predictive powers (Venkatesh and Davis, 2000).

However, most of prior TAM research relatively focused on IT/IS adoption by employees in organizations context (Phang et al. 2005), where the use in most cases is mandatory. Therefore,
researchers need to be cautious when applying the results of these studies to a different context such as eGovernment, where the use of technology is voluntary. Accordingly, it is essential to study the adoption of new IT/IS with different population such as citizens.

![Diagram of TAM model]

**Figure 2:** TAM source: Davis (1989)

Based on the above-mentioned assumptions of the original TAM, the following hypotheses are proposed in this study:

**H1:** There is a direct and positive relationship between perceived usefulness and attitude toward using eGovernment websites.

**H2:** There is a direct and positive relationship between perceived ease of use and attitude toward using eGovernment websites.

**H3:** There is a direct and positive relationship between attitude and behavioural intentions to use eGovernment websites.

**H4:** There is a direct and positive relationship between perceived ease of use and the perceived usefulness of eGovernment websites.

**H5:** There is a direct and positive relationship between perceived usefulness and the behavioural intentions to use eGovernment websites.

### 3.1 eGovernment adoption and TAM

Although TAM has been applied to a wide range of IS/IT settings, only a few empirical and conceptual studies have explored citizen adoption of eGovernment using TAM as a theoretical framework. Table 1 summarizes the findings of these studies. Conceptual but not empirical studies are marked with a single asterisk (*).

**Table 1:** eGovernment adoption studies using TAM

<table>
<thead>
<tr>
<th>TAM core variables</th>
<th>Authors</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived usefulness (PU)</td>
<td>Carter and Belanger 2004; Fu et al. 2006; Kumar et al. 2007*; Phang et al. 2005; Warkentin et al. 2002*; Wang 2003</td>
<td>Citizens’ PU is a significant predictor of their intention to use eGovernment.</td>
</tr>
<tr>
<td>Perceived ease of use (PEOU)</td>
<td>Carter and Belanger 2005; Fu et al. 2006; Kumar et al. 2007*; Phang et al. 2005; Warkentin et al. 2002*; Wang 2003; Fu et al. 2006; Phang et al. 2005; Wang 2002</td>
<td>Citizens’ PEOU is a significant predictor of their intention to use eGovernment.</td>
</tr>
<tr>
<td>Culture</td>
<td>Warkentin et al. 2002*</td>
<td>They hypothesized that the cultural dimensions (power distance and uncertainty avoidance) were most likely associated with eGovernment adoption.</td>
</tr>
</tbody>
</table>

### 3.2 National culture

The culture is not an easy concept to define (Davison and Martinsons, 2003). In addition, there is no generally accepted definition for national culture. Hofstede (1997 p.21) defines national culture as “the
collective programming of the mind which distinguishes the members in one human group from another."

Although Hofstede’s national culture framework has been criticized due to some methodological weaknesses (Baskerville, 2003), Leidner and Kayworth, (2006) found after an extensive literature review of national culture studies that over 60 per cent of these studies used one or more of Hofstede’s cultural dimensions. In fact, Hofstede’s work still has a great impact even today. According to McCoy et al (2007), most research on national culture uses Hofstede’s measures and concepts, including those who disagreed with his dimensions. Therefore, as Hofstede’s definition of culture and his theoretical framework are widely recognized and accepted, they have also been chosen in this research as a theoretical background to assess the impact of the national culture on eGovernment adoption in Jordan.

Hofstede (1997) identified five dimensions of cultural variation. These dimensions have been conceptually defined as follows:

- **Power Distance (PD):** the extent to which the less powerful members of group or society accept and expect that power is unequally distributed;
- **Uncertainty Avoidance (UA):** the extent to which the members of group or society feel threatened by unknown situations;
- **Individualism vs. Collectivism (IDV):** the extent to which individuals are integrated into groups;
- **Masculinity vs. Femininity (MAS):** the extent to which gender roles are assigned in a culture;
- **Long-Term vs. Short-Term Orientation (LTO):** a society’s preference to be more forward looking or future oriented.

As motioned earlier, the Arab world is considered as one of the most complex cultural and social systems in the world. Different than western countries, religion plays a significant role in determining the different aspects of social and traditional life. Religion is also considered as one of the main determinant of internet usage in these countries (Hofheinz, 2005). People in the Arab world find the internet as an approach to break up the limitations of the traditional and social life (Alomari et al, 2010). Therefore, this complex cultural system offers a different yet a rich context to study the influence of the national culture on citizen adoption of eGovernment services and websites.

Figure 3 shows a comparison between the Arab world and the United States in terms of the index values of Hofstede’s cultural dimensions. The Figure demonstrates the cultural differences between the Arab world and the Western countries. While the Arab culture is high in power distance (80 vs. 40) and uncertainty avoidance (68 vs. 46), the American culture is high in individualism (91 vs. 38) and masculinity (62 vs. 53). Scores for Hofstede’s fifth dimension (LTO) were not found for the Arab countries; therefore, LTO was omitted from the comparisons.

![Hofstede's Cultural Dimensions](image-url)

**Figure 3:** A comparison of Hofstede's cultural dimensions (Arab world vs. USA)
The importance of both national and organizational culture to the success of IS/IT adoption has been also widely recognized (e.g. Bagchi et al., 2003; Erumban and Jong, 2006; Leidner & Kayworth, 2006; Straub, 1994; Twati, 2006). These studies underscored the importance of the culture, and how it is linked to the success of IS/IT adoption and use. For example, Erumban and Jong (2006) found a significant relationship between cultural factors and the adoption decisions of new technologies across countries. Results of this study indicated that the power distance and uncertainty avoidance dimensions are the most significant cultural factors by which some of the differences in ICT adoption rates among countries can be explained. Countries with high scores in UA and PD, such as the Arab countries, have a lower rate of ICT adoption than countries with low UA and PD scores (Erumban and Jong, 2006). Similarly, Leidner & Kayworth (2006) stated that UA plays a significant role in determining how groups will potentially adopt and diffuse ICT. Countries high in UA are less likely to adopt frame relay technology (Leidner & Kayworth, 2006). Since ICT is inherently risky, those less comfortable with uncertainty will be less likely to adopt new technologies.

Researchers also explored the impact of the national culture on TAM variables (e.g. Twati, 2006; Veiga et al., 2001). Their studies concluded that the cultural dimensions influence the model variables. However, in a study by Warkentin et al. (2002), they proposed that of the five cultural dimensions, PD and UA are the most likely to differentiate eGovernment adoption and use. Erumban and Jong (2006) also found that the PD and UA dimensions are the most significant cultural factors by which some of the differences in ICT adoption rates among countries can be explained. Therefore, the following hypotheses are proposed:

**H6a:** There is a direct and positive relationship between uncertainty avoidance and the perceived usefulness of eGovernment websites.

**H6b:** There is a direct and positive relationship between power distance and the perceived usefulness of eGovernment websites.

**H7a:** There is a direct and positive relationship between uncertainty avoidance and the perceived ease of use of eGovernment websites.

**H7b:** There is a direct and positive relationship between power distance and the perceived ease of use of eGovernment websites.

4. Methodology

4.1 Instrument development

The survey items were adopted from prior research. The TAM scales of PU and PEOU were measured using items adopted from Davis (1989) and Davis et al. (1989). TAM scales of ATU were adopted from Taylor and Todd (1995). BI items were adopted from Malhotra & Galletta (1999) and Pavlou (2003). Culture items were adopted from Al-Sukkar (2005). All items were measured using a five-point Likert-type scale, ranging from "strongly agree" to "strongly disagree".

Sekaran (2003) stresses the importance of choosing the questionnaire language that approximates the level of understanding of the respondents. Given that the majority of the Jordanians are communicating in Arabic language, questionnaire items of this study have been translated into Arabic language. The English version of the questionnaire has been translated into Arabic by two independent translators. The Arabic version which has been translated by the first translator has then been translated back to English by the second translator. The same was repeated to the second translator's version. The two versions in both languages have been then compared to resolve any differences. The final version has been used for the study.

4.2 Evaluating the validity and the reliability of the instrument

Content validity is concerned with the degree to which the scale items represent the domain of the concept under study. According to Sekaran (2003), face validity is a basic index of content validity. Experts in the field can be solicited to advice on whether scale items have face validity (Straub et al., 2005). Therefore, instrument was pre-tested with three academics and one student in the field of Information Systems. An academically excellent student has been asked to fill the survey. When he finished it, he was asked to find out if there were any problems to understand the survey questions.
Based on this feedback, the wording of some questions was modified to improve clarity. After this step, three academics were asked to answer the survey questions and to provide their feedback on whether the questions would accurately measure each construct, whether the questions were vague, ambiguous, difficult to understand, or contained contradictions. The instrument was then modified to reflect the feedback received from the three academics. Final survey items are found in Appendix 1.

To insure that the instrument items are measuring the same construct, Cronbach’s alpha was used to evaluate the reliability of the instrument items (Cronbach, 1970). Although researchers suggest 0.7 as the accepted reliability cut-off of Cronbach’s alpha test, a value more than 0.6 is regarded as a satisfactory level (Hair et al., 2006). The reliability function in the SPSS 17 was used to test the internal consistency of the items for each scale. The results are presented in Table 2. The outcomes of the statistical analysis demonstrate satisfactory reliabilities, ranging from 0.745 to 0.867 for all scales.

| Table 2: Reliability statistics |
|-------------------------------|--------|--------|------------------|
| Scale                         | No. of Items | Mean   | Cronbach Alpha (α) |
| Perceived Usefulness (PU)     | 5       | 3.995  | .798             |
| Perceived ease of use (PEOU)  | 5       | 3.698  | .831             |
| Attitude Toward Using (ATU)   | 3       | 4.198  | .745             |
| Behavioral Intention to Use (BI)| 2     | 4.028  | .756             |
| Culture: Uncertainty Avoidance| 4       | 4.199  | .781             |
| Power Distance                | 5       | 2.459  | .867             |
| Total                         | 24      |        |                  |

4.3 Data collection and participants

Prior research showed that the educated Jordanian citizens are the early adopters of the Internet (Al-Jaghoub and Westrup, 2003) and are likely users of eGovernment services and websites in Jordan. Therefore, for this study we identify the university students and internet cafes users who are Jordanian citizens as the targeted population of this study. A face-to-face personally administered survey was the research method adopted in this study. The final survey (see Appendix 1) was distributed to a sample of 265 students drawn from different Universities and internet cafes in Jordan. A total of 208 surveys were returned, achieving a 78.4% survey response rate. Eleven incomplete surveys were exempted from the analysis. Thus, 197 of the returned surveys were usable responses.

Demographic characteristics of the overall participants are presented in Table 3. Of the surveys analyzed, 69 respondents (52.3%) were female and 128 (65.0%) were male. Most of them are between 20-30 years of age (67.0%), have a bachelor’s degree (79.8%). In addition, most of the respondents have considerable experience in using a computer. 81.8% of the respondents had more than 3 years of computer use and around 60% of them are using the Internet in daily or weekly bases. These results indicated that university students in Jordan have considerable experience in using computers and the Internet. Demographic characteristics of the overall participants are presented in Table 3.

4.4 Data analyses

A set of multiple linear regressions and analyses of variance (ANOVA) were used to analyze the sample data, and to test the hypothesis associated with the research model. Multiple regression analysis is a statistical technique used to explore the relationship between a single dependent variable and several predictors (independent variables) (Hair et al, 2006). In addition, the tests of the regression assumptions were conducted. The results of testing the regression assumptions and the outcomes of the regression analyses are provided in the following sections.

4.5 Tests of multiple regression assumptions

It is important that researchers assess whether their analyses meet the underlying assumptions of multiple regression when testing the relationship between dependent and independent variables, based on a regression analysis conducted on sample data (Hair et al, 2006). These assumptions are: ‘linearity’, ‘normality of residuals’, ‘multicollinearity’ and ‘residual independence’. In this study, there was no indication of any violation of the regression assumptions. For example, before testing hypotheses H7a and H7b, the tests of the regression assumptions were performed (same tests were
repeated for the whole set of multiple linear regressions). The following subsections will provide a brief discussion on each of these assumptions.

Table 3: Demographic characteristics of participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>128</td>
<td>65.0</td>
</tr>
<tr>
<td>Female</td>
<td>69</td>
<td>35.0</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 20</td>
<td>29</td>
<td>14.7</td>
</tr>
<tr>
<td>20-30</td>
<td>132</td>
<td>67.0</td>
</tr>
<tr>
<td>31-40</td>
<td>25</td>
<td>12.7</td>
</tr>
<tr>
<td>41-50</td>
<td>10</td>
<td>5.1</td>
</tr>
<tr>
<td>More than 50</td>
<td>1</td>
<td>.5</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>9</td>
<td>4.6</td>
</tr>
<tr>
<td>Community College</td>
<td>11</td>
<td>5.6</td>
</tr>
<tr>
<td>Bachelor</td>
<td>156</td>
<td>79.2</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>21</td>
<td>10.7</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 200</td>
<td>99</td>
<td>50.3</td>
</tr>
<tr>
<td>201-500</td>
<td>65</td>
<td>33.0</td>
</tr>
<tr>
<td>501-800</td>
<td>14</td>
<td>7.1</td>
</tr>
<tr>
<td>More than 800</td>
<td>19</td>
<td>9.6</td>
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<tr>
<td>Occupation</td>
<td></td>
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<tr>
<td>Private sector employee</td>
<td>23</td>
<td>11.7</td>
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<td>Public sector employee</td>
<td>43</td>
<td>21.8</td>
</tr>
<tr>
<td>Student</td>
<td>131</td>
<td>66.5</td>
</tr>
<tr>
<td>Computer experience</td>
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<td>Less than 3 years</td>
<td>36</td>
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<td>3-5</td>
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<tr>
<td>More than 5 years</td>
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<td>57.9</td>
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<td>Internet usage frequencies</td>
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</tr>
<tr>
<td>Once a month</td>
<td>39</td>
<td>19.8</td>
</tr>
<tr>
<td>Several times monthly</td>
<td>42</td>
<td>21.3</td>
</tr>
<tr>
<td>Several times weekly</td>
<td>55</td>
<td>27.9</td>
</tr>
<tr>
<td>Once a day</td>
<td>20</td>
<td>10.2</td>
</tr>
<tr>
<td>Several times daily</td>
<td>41</td>
<td>20.8</td>
</tr>
</tbody>
</table>

4.5.1 Linearity

Linearity was examined through the analysis of residuals and partial regression scatter plots. For example, by looking at the scatter plots in Figure 4, the residuals scatter plot does not exhibit any nonlinear pattern, and shows that the points are randomly and evenly dispersed throughout the scatter plot. This is an indication that the assumption of linearity and homoscedasticity for all variables has been met (Hair et al, 2006).

4.5.2 Normality of residuals

In this study, it is reasonable to assume normality in the variables since the sample size of the study is large enough (i.e. greater than 100) (StatSoft Inc, 2003).

4.5.3 Multicollinearity

Hair et al (2006) recommended examining the variable inflation factor (VIF) and tolerance level (TOL) to diagnose multicollinearity within multiple regression procedure. TOL is acceptable over 0.1 and VIF below 10 (Hair et al, 2006, Field, 2005). Table 3 shows the values of both TOL and VIF. Both of them were in the acceptable range. All the values of VIF are less than 10 and all the tolerance values are greater than 0.1. Hence, these tests confirmed that multicollinearity among the variables was not a problem.

4.5.4 Independence of residuals

The Durbin-Watson statistic was used to test whether the assumption of residual independence is acceptable or not. The Durbin-Watson statistic tests whether or not adjacent residuals are correlated.
Field, 2005), and is better if the values are closer to 2 (Field, 2005). Table 3 shows that the Durbin-Watson value is 1.895. Thus, the independence of residuals assumption does not violate, because the value is very close to 2.

![Scatter plot: Cultural dimensions (PD and AU) vs. PEOU](image)

**Figure 4:** Scatter plot: Cultural dimensions (PD and AU) vs. PEOU

**Table 3:** Collinearity statistics: cultural dimensions vs. PEOU

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Collinearity Statistics</th>
<th>Durbin-Watson</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tolerance</td>
<td>VIF</td>
</tr>
<tr>
<td>Uncertainty Avoidance (UA)</td>
<td>.816</td>
<td>1.531</td>
</tr>
<tr>
<td>Power distance (PD)</td>
<td>.717</td>
<td>1.487</td>
</tr>
</tbody>
</table>

5. Analysis and results

Table 4 shows the results of the regression analysis based on the relationships proposed in the research model. Figure 5 is a graphical representation of the analysis results (only significant relations appear in this Figure). To investigate the research hypotheses, several multiple regression analyses were performed using SPSS 17.0 package for Windows. For example, to investigate hypotheses H6a and H6b, UA and PD were simultaneously regressed on perceived usefulness. A summary of the research hypotheses and test results are provided in Table 4 and Figure 5. The nine research hypotheses H1, H2, H3, H4, H5, H6a, H6b, H7a, and H7b have been supported from the empirical test. In addition, the results indicated that the research model explained around 43% of the variance in citizens’ intention to adopt and use eGovernment websites ($R^2 = 0.433$).

**Table 4:** Path coefficients and hypothesis testing

<table>
<thead>
<tr>
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<td></td>
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<td>-</td>
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<td>BI</td>
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<td>0.534***</td>
<td>Yes</td>
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</table>

*** Correlation is Significant at <0.001

** Correlation is Significant at <0.01

* Correlation is Significant at <0.05

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**Figure 5:** Significant relationships in the research model

6. Discussions

As hypothesized and consistent with TAM research, the results showed that perceived usefulness and attitude toward using eGovernment websites enhanced the level of citizen intention to use eGovernment websites, and together, accounted for 43.3% of the variance in the intention to use eGovernment services ($R^2 = 0.433$). The results also indicated that perceived usefulness and perceived ease of use were significant predictors of the citizen attitude toward using eGovernment services and websites, suggesting that the government should make eGovernment websites more useful and usable. For example, they could achieve this by increasing the general public awareness about the usefulness of using eGovernment; providing eGovernment and ICT training workshops; and refining IS/IT systems selections to meet different citizens’ needs. However, perceived usefulness was the strongest predictor of the citizen attitude toward using eGovernment websites. This finding is in accordance with earlier TAM research that consistently found perceived usefulness a more powerful predictor than the perceived ease of use (e.g. Davis, 1989; Fu et al., 2006). This outcome yields the implication that usefulness is more interesting to some citizens than others. The possible justification may be that the effect of perceived ease of use on IS/IT usage often decreases with the familiarity of the user with the IS/IT (Venkatesh et al., 2003; Chang et al, 2005). In this study, only respondents who were familiar with eGovernment services and websites were selected for the model testing. Therefore, the effect of perceived ease of use on eGovernment services adoption was not as important as the perceived usefulness. Still, perceived ease of use of eGovernment websites indirectly enhanced citizen attitude toward using eGovernment websites through perceived usefulness. The influence of perceived ease of use on perceived usefulness was strong. This supports TAM which asserts the easier a system is to use, the more useful it can be. Hence, developing eGovernment websites that are easy to use will enhance the usefulness of the services and websites and indirectly influence citizen attitude positively toward using eGovernment services and websites.
This study also hypothesized there would be a positive relationship between national culture dimensions and TAM core constructs (i.e., perceived usefulness and perceived ease of use). The findings showed that only two cultural dimensions: power distance and uncertainty avoidance had a significant positive impact on perceived ease of use and perceived usefulness. In their study, Warkentin et al. (2002) proposed that of the five cultural dimensions, power distance and uncertainty avoidance are the two dimensions that most likely differentiate eGovernment adoption and use. Countries that are high in UA are less likely to adopt frame relay technology (Leidner & Kayworth, 2006). Since ICT is inherently risky, those less comfortable with uncertainty will be less likely to adopt new technologies. Similarly, cultures with high power distance are expected to have lower openness for new ideas such as eGovernment as it involves decision-making on issues where there is very little information about them (Lee and Peterson, 2000).

7. Practical implications and Limitations

7.1 Practical implications

The primary objective of this study was to identify the impact of the national culture on citizen adoption of eGovernment services and websites in developing countries, in particular Jordan. The study has fulfilled this objective. This research provides eGovernment officials and policy makers in Jordan with a practical and communicable checklist of the cultural and technological factors, which are seamlessly integrated; and that cover the perspectives of the citizens. This checklist should be considered as the cornerstone for any current and future eGovernment project. A survey on Jordanian citizens showed that the cultural dimensions - power distance and uncertainty avoidance; perceived usefulness; perceived ease of use; and the attitude - contribute significantly to the citizen adoption of eGovernment services and websites in Jordan. Since Jordan and other Arab countries are facing the problem of low-level citizen adoption of eGovernment services, the research outcomes are believed to assist eGovernment officials and policy makers from Jordan and also from the other Arab countries, that share many similar cultural characteristics to Jordan, to better position their strategies to encourage faster and more efficient adoption of these services.

Particularly, the outcomes of this study suggested that eGovernment officials need to pay attention to the dominant culture. For example, by providing the necessary training to alleviate anxiety could lead to better acceptance of IS/IT applications (Al-Gahtani, 2004), such as the eGovernment. Also, government agencies should provide services that are easy to use. Carter and Belenger (2005) suggested different ways to increase the perceived ease of use. One is to provide online tutorials through the eGovernment websites to illustrate how citizens can use and transact with eGovernment services and websites. Government agencies should also improve help and search facilities in their websites to enable citizens to effectively find relevant information. In addition, feedback from citizens about eGovernment services and websites should be encouraged, elicited and analyzed. This will enable government agencies to redesign their websites to present eGovernment services and information in a way that is easier for citizens to use. In addition, given the dominant effect of perceived usefulness, it is important for the government agencies to incorporate useful information and services into their websites. Also, these agencies should employ training and promotion approaches to develop citizens’ beliefs of the usefulness and the public value of the eGovernment services.

7.2 Limitations

As with all studies, this study has its limitations also. This study adopted cross-sectional design. The cross sectional study represents a slice of time and does not show how the citizen attitude and behavior may change over time. Further study employing a longitudinal design would ascertain whether or not the citizen attitude toward using eGovernment services change over time. In addition, this study applied Hofstede’s national culture framework. Although it has been widely applied and cited, several researchers have criticized, as mentioned earlier, the framework due to some methodological weaknesses (Baskerville, 2003; Fang, 2003).

8. Conclusion

This study integrates the technology acceptance model (TAM) and Hofstede’s national culture dimensions to evaluate citizen adoption of eGovernment. The results of a multiple regression analysis indicate that perceived usefulness, perceived ease of use, and attitude are significant indicators of citizen intention to use state government services online. In addition, the results show that the two
cultural dimensions: power distance and uncertainty avoidance have significant impacts on citizens’ intention to adopt eGovernment. As government agencies continue to invest in eGovernment services, it is very important for agencies to enhance their understanding of the factors that influence citizen adoption of eGovernment websites and services.

9. Appendix 1: Survey items

**Behavioral Intention to Use (BI)**

| BI1   | I intend to use the eGovernment portal and/or Ministry's website(s) to access government services frequently. |
| BI2   | I predict that I should use the eGovernment portal and/or Ministry's website(s) to access government services in the future. |

**Attitude toward Using (ATU)**

| ATU1  | Using the eGovernment portal and/or Ministry's website(s) to access government services is a good idea. |
| ATU2  | I like the use of eGovernment portal and/or Ministry's website(s) to access government services. |
| ATU3  | Using the eGovernment portal and/or Ministry's website(s) to access government services would be pleasant. |

**Perceived Usefulness (PU)**

| PU1   | Using eGovernment portal and/or Ministry's website(s) enable me to access government services (e.g. getting national exam result online, getting national number) more quickly. |
| PU2   | Using eGovernment portal and/or Ministry's website(s) enhances my effectiveness in accessing government services (e.g. find the most relevant information about a service). |
| PU3   | Using eGovernment portal and/or Ministry's website(s) allows me to access more government services than would otherwise possible. |
| PU4   | Using eGovernment portal and/or Ministry's website(s) to access government services increases my productivity (e.g. find information about services within shortest time frame). |
| PU5   | Overall, I find eGovernment portal and/or Ministry's website(s) useful for me to access government services. |

**Perceived Ease of Use (PEOU)**

| PEOU1 | Learning how to use eGovernment portal and/or Ministry's website(s) to access government services is easy for me. |
| PEOU2 | I find it easy to use eGovernment portal and/or Ministry's website(s) to find what I want. |
| PEOU3 | My interaction with eGovernment portal and/or Ministry's website(s) to access government services is clear and understandable. |
| PEOU4 | EGovernment portal and/or Ministry's website(s) is flexible to interact with. |
| PEOU5 | Overall, I find using eGovernment portal and/or Ministry's website(s) to access government services easy to use. |

**Uncertainty Avoidance (UA)**

| UA1   | It is important to have job requirements and instructions spelled out in detail so that people always know what they are expected to do. |
| UA2   | Rules and regulation are important because they inform workers what the organization expects of them. |
| UA3   | Order and structure are very important in a work environment. |
| UA4   | Working in a structured environment is better than working (rules and regulations) in an unstructured work environment. |

**Power Distance (PD)**

| PD1   | Managers should be careful not to ask the opinions of subordinates too frequently, otherwise the manager might appear to be weak and incompetent. |
| PD2   | Manager should make most decisions without consulting subordinates. |
| PD3   | Employees should not question their manager’s decisions. |
Manager should not ask subordinates for advice, because they might appear less powerful

Decision making power should stay with top management in the organization and not be delegated to lower level employees

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The use of Web 2.0 on Mexican State Websites: A Three-Year Assessment

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Abstract: Web 2.0 tools and applications (e.g., blogs, wikis, forums, RSS, podcasts and videocasts) as well as social markers (e.g., Del.icio.us, Technorati, Facebook and Digg) have reached government and commerce sites; however, there is still a dearth of research related to the adoption levels of such tools. The purpose of this research is to contribute toward filling this gap by assessing the impact of this trend on Mexican local government sites by asking the following question: to what extent have local eGovernment websites in Mexico adopted Web 2.0 tools and applications? To answer this question, the paper starts by reviewing key concepts of Web 2.0 applications in government portals. On the basis of a longitudinal evaluation of Mexican local government sites, we found that most of the websites analyzed have increased their use of Web 2.0 tools and applications; however, we also found that not all applications are equally well-developed or used on the local websites. Web 2.0 is only in the initial stages of adoption in Mexican government websites.

Keywords: government 2.0, eGovernment, social media, Twitter, Web 2.0, websites

1. Introduction

The use of technology in government has a long tradition. In many senses, public administrations devote great amounts of effort to generating valuable information to provide services, as well as for decision and policymaking purposes (Bozeman and Brezschneider, 1986; Rubin, 1986; Tapscott and Williams, 2006). O'Toole (1998) supports the advantages of using information technology to reduce costs and improve government efficiency. The use of Internet, and most recently Web 2.0 applications, represents an evolution in the use of information technologies in government. These advanced applications facilitate higher levels of interaction between Web content, information users and information producers. More specifically, ‘Web 2.0’ refers to a new collection of applications and tools based on the concept of creation of content produced and shared by the very same users of a website. In other words, consumers of information have become “prosumers” or producers of part of the information that they consume (Tapscott and Williams, 2006).

Some of these applications are the social networks, micro-formats, social labeling, RSS (content syndication), blogs, videoblogs, podcasts, wikis and forums. Examples of commercial websites that implement these applications include Technorati, Digg, Facebook, Flickr, YouTube, MySpace, Twitter and Del.icio.us, amongst others. Some government sites are also starting to include some of these applications. Web 2.0 applications may be considered the next step in Internet development technologies.

As part of this study, we evaluated the use of Web 2.0 tools on state sites. Specifically, we focus on the use of blogs, wikis, forums, RSS, APIs (such as Google Maps), podcasts, videocasts, social markers (such as Del.icio.us, Technorati, Facebook or Digg) and social networks. All of these applications, although they may appear to be very different, share certain characteristics, such as the generation and classification of information and content in a collective manner, the integration of communities, and the production and consumption of socially distributed knowledge.

These common characteristics allow them to be categorized as Web 2.0 tools and applications. These tools have proven themselves to be efficient mechanisms for developing political activism (Yang, 2009; Mesgari and Bassellier, 2011; Trechsel et al.; 2003, Krishna and Jai, 2011), perhaps the most well-known case of which is that of the Obama presidential campaign in the United States (Dochartaigh, 2001). They have also proven useful as tools for handling relationships with the media (e.g., Twitter), and as an alternative way of disseminating content in the face of social problems or political crises, such as the recent elections in Iran, the coup d’état in Honduras, and the deposition of
the presidents of Egypt, Tunisia and Libya (Hewson and Laurent, 2008). Government sites that use Web 2.0 applications have the potential to generate greater interaction between different social actors (Attia et al., 2011), and as a consequence, greater citizen participation in government processes, which have recently been termed ‘Government 2.0’. These applications are beginning to be used at all three levels of government and within diverse areas of public policy.

A recent study revealed that Mexicans between the ages of 18 and 28 years were dissatisfied with the level of communication established between them and political parties, and suggests that more interaction, concrete proposals and more direct messages are needed (Juarez and Marchant, 2011). Previous studies mentioned that Internet users propose that Web 2.0 tools could be an effective mechanism for opening alternative channels of communication. Although the use of these tools is developing very quickly in the relationship between government and citizens, we know little about the outcomes reached by the use of Web 2.0, and even about levels of adoption by government. Given the scarcity of research in this field, we started this research on Mexican state sites that have already worked with Web 2.0 tools. Based on measurements of these technologies taken from Mexican state sites in 2008, 2010 and 2011, this paper will show the extent to which they are currently used, and in which areas of state government these sites are used more frequently.

In this way, following this introduction, the paper is organized into four sections: Section II includes a review of the literature on electronic government, state portals and Web 2.0 as it relates to state portals; Section III is a description of the research methods; and Section IV includes the main findings, and the final section draws conclusions and discusses implications.

2. Electronic government and Web 2.0

This section of the paper constitutes a review of the relevant literature on electronic government, Web portals and Web 2.0. The first subsections include key concepts of electronic government and Web portals. The final subsection introduces the main Web 2.0 applications and their relationships with electronic government and Web portals.

2.1 Electronic government and websites

There are different definitions of ‘electronic government’, but all concern the use of Information and Communication Technologies (ICT) in carrying out the activities of governments (Gil-Garcia and Luna-Reyes, 2008). Some emphasize the use of ICT applications for undertaking administrative tasks, and others for providing services, and yet others for developing democracy. Government sites are just one example of these types of applications and their use is spreading, not just in Mexico, but in many countries around the world. According to the United Nations Organization, only three out of the 192 UN member states have no presence on the Internet (United Nations Public Administration Program, 2008, UNAP, 2008). In Mexico, in addition to the Federal Government’s significant presence on the Internet, which is the 56th place on the last UN ranking (United Nations Public Administration Program, 2010), all state governments and a significant number of municipal governments have a presence on the Internet. Internet sites are now one of the primary means of providing information, dealing with applications and services, and interacting with different government dependencies. Web 2.0 tools have the potential to take these relationships to the next level and change interaction schemes between citizens and their participation in government processes and decision-making (Yáñez, 2009).

There is still no consensus on how best to define the term ‘electronic government’. From analysis of the literature on the topic, Gil-Garcia and Luna-Reyes (2008) concluded that electronic government is or should be “the selection, implementation and use of information and communication technologies in government to provide public services, improve the effectiveness of administration and promote democratic values and mechanisms, as well as to create a legal framework that facilitates the development of intensive initiatives for the use of information resources and promote the development of the knowledge society.” State government sites are just one example of the application of electronic government. The development of these applications is not only due to pressure from the public to receive the same service it receives from the private sector, but also to the government managers’ perception of a multitude of potential benefits to public administration (Luna-Reyes et al., 2009). A government site is understood as “an access point integrated into a state government Internet site which provides both external entities and government personnel with a single online access point to state resources and information” (Burley-Gant et al., 2002).
2.2 Government sites as communication systems

State sites can be considered government-citizen communication systems that function via computers and Internet. This communication system is characterized by the integration of different media and their interactive potential. Multimedia extends the reach of electronic communication to every aspect of life (from home to the workplace, from schools to hospitals, from entertainment to trips) (Castells, 1998). In the mid nineties, governments and companies were searching frantically for ways to position themselves and establish this new system (Castells, 1998).

In this sense, state sites are immersed in a new multimedia system that includes and covers all expressions of culture. In this new kind of society, all types of messages work in a binary fashion of presence/absence, whereby presence enables the communicability and socialization of the message. While the function of communicability is present in all state sites, socialization is only present in some given that not all have the tools and applications needed for this socialization to take place between users and government. From a society perspective, communication based on electronic means (typographic, audiovisual or via computer) is communication (Castells, 1998). This means that the media – in this case, the site – is immersed in this multimedia universe and fulfills the role of communicating Government information. Furthermore, due to the multimodality and versatility inherent to multimedia, it is capable of covering the full range of expressions, as well as diverse interests, values and imaginations, including the expression of social conflicts.

2.3 The evolution of sites and models for communication and socialization

There are various different models that explain the processes of development and evolution of Internet sites (Layne and Lee, 2001). A few years ago, and taking these evolutionary models as a base, an evaluation of state government sites in Mexico was conducted (Almazan, Gil-Garcia, and Luna-Reyes, 2007, 2008). The stages of Information, Interaction, Transaction, Integration and Participation were proposed as complementary but not mutually exclusive components that can be used to characterize the development of government sites (Sandoval-Almazán et al., 2008).

Furthermore, this reference framework can be reinterpreted from a theoretical standpoint in relation to the communication systems included in the previous section. The communication that arises from the interaction between government and citizens can take place in different ways, as explained below.

**Information Stage.** The characteristics of the sites that belong to the information stage are comprised by those that only display information on the activities of public administration. Examples of these characteristics include news or announcements about events, as well as services available to citizens. The communication that takes place between the government and citizens at this stage is one of sender to receiver, which is horizontal and one way. In this, as well as other levels of site development, the receiver plays both roles mentioned by Castells (1998). They can be interactors by choosing their communication path as well as deciding and selecting the topic and the knowledge that they hope to obtain, as well as the media; or they can be interacted with by users that, within their own capabilities and possibilities, select and seek out knowledge from inside a media which provides them with limited options. Nevertheless, the inherent characteristics of the information stage limit the users’ capacity to interact, relegating them to the position of interacted. The interactor, in addition to being able to use the information provided on the site, will access information from other sources, such as the radio, television, and newspaper.

**Interaction Stage.** Characteristics inherent to sites in the interaction stage include applications that allow interaction between citizens and the government, such as forms for asking questions and making enquiries, forums, or automated applications such as virtual public servers. Communication between citizens and the government at this stage is two-way, from the sender to the receiver and vice versa, establishing channels for interaction, such as electronic mail or those mentioned previously. At this stage of two-way communication, there are more opportunities for interactors to choose their means of communication.

**Transaction Stage.** Characteristics of Internet sites at the transaction stage mainly include what have been topics of electronic commerce. The main difference between this and the interaction stage is the interchange of services and application processes with a well defined cycle and on many occasions, the payment of fees. Communication between the government and citizens at the transaction stage takes place from the sender to the receiver and vice versa in much the same way as in the Interaction stage. Nevertheless, since these are services with clearly defined cycles and processes, it is more
common to find an interest in obtaining feedback on how they have performed. One example is online services that can be carried out by citizens.

**Integration Stage.** Characteristics inherent to the integration stage make reference to the capability of the site to present itself as a single window for providing services to the citizen and transparently making known which agency or agencies are in charge of delivering the services or information. At this stage, not only does communication take place between the government and citizen but also between government dependencies, which in turn communicate this information to the citizen and provide feedback from the government to the citizen, the citizen to the government and between government dependencies. For example, municipal government sites that make it easy to obtain construction permits and licenses needed to start a business on the same site required different agencies that participate in this process to coordinate and work together. This coordination can be achieved in different ways ranging from using an agent to process all the applications submitted by citizens to the technical integration of data and processes between different agencies that enabled them to offer the service without the need for an agent.

**Participation Stage.** Government sites that demonstrate traits of the participation stage offer citizens the ability to socialize and in this way obtain full interaction. At this stage, communication is most extensive, taking place between government and citizen, between dependencies, between citizens and providing feedback.

Communication produced through the use of Web 2.0 tools takes place according to the type of population and media they choose to obtain information from. In the case of interactors, as mentioned by (Castells, 1998), Web 2.0 tools are useful applications for obtaining information without needing to search for it, which simplifies the job for the user. For example, once configured on your personal webpage or email, RSS feeds enable information to be filtered so that you only receive the information you want, without the need to enter the site that produces it.

As for interaction, searching for and finding information within media is made easier by the introduction of these tools on the site; however, it is important not only due to the type of population using the media but because Web 2.0 is implementing applications that make communication possible between different actors within a site, in which communication takes place in settings where citizens and government communicate with each other.

### 2.4 Web 2.0 internet sites and tools

The term ‘Web 2.0’ has yet to be fully defined in a manner widely accepted by experts in the field. It was coined by O’Reilly in 2005 who defines it as “a platform that extends to all connected devices,” although these devices are not just limited to being interconnected: instead, much of their functionality rests on the fact that they use technologies that allow users to build the content and format of sites. Table 1 shows a comparison made by O’Reilly (2005) between Web 2.0 applications and traditional applications.

**Table 1: Comparison between Web 1.0 and 2.0**

<table>
<thead>
<tr>
<th>Web 1.0</th>
<th>Web 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double click</td>
<td>Google AdSense</td>
</tr>
<tr>
<td>Ofoto</td>
<td>Flickr</td>
</tr>
<tr>
<td>Akamai</td>
<td>BitTorrent</td>
</tr>
<tr>
<td>mp3.com</td>
<td>Napster</td>
</tr>
<tr>
<td>Encyclopedia Britannica Online</td>
<td>Wikipedia</td>
</tr>
<tr>
<td>Personal websites</td>
<td>Blogging</td>
</tr>
<tr>
<td>Screen scraping</td>
<td>Web services</td>
</tr>
<tr>
<td>Page views</td>
<td>Cost per Click</td>
</tr>
<tr>
<td>Domain name speculation</td>
<td>Search engine optimization</td>
</tr>
<tr>
<td>Directories (taxonomy)</td>
<td>Tagging ('folksonomy')</td>
</tr>
<tr>
<td>Publishing</td>
<td>Participation</td>
</tr>
<tr>
<td>Content management systems</td>
<td>Wikis</td>
</tr>
<tr>
<td>Stickiness</td>
<td>Syndication</td>
</tr>
</tbody>
</table>
O’Reilly says that Web 2.0 is a mechanism for social cohesion and cooperation. More recent works, such as that undertaken by Tapscott and Williams (2006) describe the phenomenon as follows: “The new Web is fundamentally different in both its architecture and applications. Instead of a digital newspaper, it is a canvas where every splash of paint contributed by a user enriches the tapestry; whether people are creating, sharing or socializing, the new Web is about participating rather than passively receiving information” (p. 37).

The term Web 2.0 is still under debate. Wilson mentions that a lot of concepts have been causing confusion and ambiguity about the term. He proposes that Web 2.0 must be understood as follows: “Web 2.0 refers to the second generation of the Web, wherein interoperable, user-centered Web applications and services promote social connectedness, media and information sharing, user-created content, and collaboration among individuals and organizations” (Sandoval-Almazan and Alonzo, 2011).

According to this idea Web 2.0, reveals itself as a revolutionary way of gathering, organizing and sharing information. Some of its better-known examples include Google, weblogs, Wikipedia, YouTube, MySpace, Twitter and Second Life. Other authors have pointed out some differences:

- Web 2.0 facilitates flexible design, creative reuse and updating;
- Offers the user an enriched and interactive interface;
- Facilitates collaboration for creating and modifying content;
- Allows new applications to be created by reusing and combining data and sources;
- Establishes social networks between people who have the same interests; and
- Supports cooperation in gathering collective intelligence. (AMIPCI, 2011)

Murugesan (2007) defines ‘Web 2.0’ according to its distinctive applications: blogs, RSS (Really Simple Syndication), Wiki (Web-based tool for massive collaboration in the management of content) or a system to create or manage content, tags, (keywords added to articles or blogs, and shared via social webpages), folksonomy, information taxonomies created by users as social markers. Lastly, another tool is mash-ups (websites that combine services and information from multiple sources on the network). Wilson and his colleagues (2011) gather several concepts of Web 2.0 and their authors (see Fig. 1).

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
<th>Sample Reference</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mashups</td>
<td>The “mashing” together of two or more Web services or applications (Sutter, 2009)</td>
<td>(Sutter, 2009)</td>
<td>PadMapper.com, Flickr Maps</td>
</tr>
<tr>
<td>Information-sharing Sites</td>
<td>Sites whose primary purpose is the sharing of information or media, from videos to photos to articles to bookmarks/links</td>
<td>(Sutter, 2009)</td>
<td>YouTube.com, Flickr.com, del.icio.us</td>
</tr>
<tr>
<td>Social Networking</td>
<td>Online social networks help users keep in contact and receive updates from their friends, family, and colleagues</td>
<td>(Sutter, 2009)</td>
<td>Facebook.com, Orkus.com</td>
</tr>
<tr>
<td>Syndication</td>
<td>A service that tracks updates to various sites on the Web, aggregating the various “feeds” for later consumption</td>
<td>(Sun, He, and Leu, 2007)</td>
<td>RSS, Atom</td>
</tr>
<tr>
<td>Weblogs (Blogs)</td>
<td>A personal Web page or diary, easily updated and generally displayed in reverse chronological order</td>
<td>(Ip and Wagner, 2008)</td>
<td>HuffingtonPost.com, Engadget.com</td>
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<tr>
<td>Wikis</td>
<td>A website that anyone can edit</td>
<td>(Kane and Fichman, 2009)</td>
<td>Wikipedia.org, Wikihow.com</td>
</tr>
</tbody>
</table>


**Figure 1**: Web 2.0 features and concepts
Wamelen and Kool (2008) promote the idea of a second society built on the basis of this platform. They present a series of distinctive platform characteristics and compare them against those of Web 1.0, such as generic vs. specific, static vs. dynamic, closed vs. open, and personal vs. collective. Additionally, they present precise functions that Web 2.0 applications must fulfill, such as sharing information, mobilization, scheduling meetings, support and transaction capabilities. Lastly, Yamakami (2007) proposes that mobile content may also evolve towards mobile Web 2.0 content.

Web 2.0 is a social network platform because its content is user-generated – as if it were a collective intelligence – transforming users into co-producers of content and not just passive subjects who only receive the information. Interaction plays a vital role in this platform. This capacity for interaction is vital, and to achieve it, governments must consider this type of tool very seriously (Woods, 2007), not just as a way to enable the bureaucracy to reduce its costs and allow a greater flow of information, but also as a way of approaching citizens and making sure their participation enriches government efforts.

Although relatively new, Web 2.0 tools and applications have been used on government websites in such countries as Germany where de Kool and Van Wamelen (2008) proposed six categories for analyzing electronic government using Web 2.0, gathering case studies in their country to demonstrate the use of Web 2.0. Web 2.0 has also been suggested as a way of solving problems related to information transparency in governments. Kubicek (2008), who submitted those ticket systems used for providing services, suggested that this tool could also be employed to improve transparency and rendering of accounts, through the use of social networks (Kubicek, 2008). A number of other studies have presented different cases of electronic government and the use of Web 2.0 tools applied to public administration, such as mass collaboration, digital democracy and the use of distributed computing – cloud computing – as a means of improving attention and services both at the state and municipal level (Chenok, 2008). Lastly, Eliason and Lundberg (2006) focused their attention on investigating the specific use of Web 2.0 in designing municipal websites using gender as a tool to reduce the complexity of sites and better organize content. These researchers gathered data from seven Swiss municipalities in order to evaluate the impact of Web 2.0.

The current public administration trend of open government (o-government) or transparent government has begun to use Web 2.0 tools to interact with the citizenry and request their opinions on just how open federal government should be to its citizens. This initiative from the United States' President, Barack Obama (Memorandum of Transparency and Open Government), and the White House website, which invites citizens to participate in this initiative through discussion forums whose purpose is to establish principles (Gobierno-de-Estados-Unidos, 2009b) and come up with proposals for law reform (Gobierno-de-Estados-Unidos, 2009a) are clear examples of how these technologies can be used by government. These alternatives, which have opened up the North American government online to promoting citizen participation in specific issues and policy creation, are innovative for governments, and represent the first time that these alternatives have been used as examples of online government.

Some of the risks that may arise from the use of Web 2.0 tools and applications are data isolation, exclusion of content, privacy issues and the risk of improper use of the information (de Kool and van Wamelen, 2008). Even though the usefulness of Web 2.0 in governments is promising, the great question that prevails is whether public sector organizations are able to commit to this new way of interrelating with their citizens, and improving user-experience and their perceptions of public services (Juarez and Marchant, 2011). Recent research points in that direction, as the most frequent use of Web 2.0 features has changed the behavior and organization of the governments, adapting these kinds of technologies to their tasks (Hewson, 2008) and improving the way in which they interrelate with citizens (Wilson et al., 2011; Warkentin et al., 2002). That is why it is important to make an exploratory research and provide empirical evidence to assess the extent to which Web 2.0 has been involved in government websites, as a first approach to the field.

3. Research design and methods

This section describes the data collection methods and the procedures followed to analyze the data. Online research has become a common practice nowadays; however, very few methodologies and research models have been developed to this end. This situation creates confusion and difficulty about validity and trust in research findings that collect data online (Linders, 2011). Using innovative data collection strategies, however, does not compromise the validity of the findings; Gallup (2007) mentions that current information systems (IS) research seems more concerned with “how” the
research is conducted than “what” research is conducted and “why”. Yang (2009) develops the concept of Internet-mediated research (IMR): “Internet-mediated research involves the gathering of novel, original data to be subjected to analysis in order to provide new evidence in relation to a particular research questions” (p. 58). This kind of research, though, like any other study, requires careful planning, design, and piloting. Its most obvious advantage is cost and time efficiency.

For this research on Web 2.0, the target population is comprised by the websites of the 31 Mexican states and the Federal District. Three independent observers viewed sites in three different periods of time. The first one took place during the first half of 2008; the second observation was on March and October 2010, and the third and last observation was held on March and October 2011. These last two observations focused only on collecting data from Web 2.0 features. Researchers from the 2008 observation used a guide to evaluate the state sites and record the inclusion of Web 2.0 tools, as well as the sections of the site that used these tools. Data from these observations were collected by each observer and summarized by one of them. In order to get the results related to the use and the frequency of Web 2.0, it was first determined whether the Web 2.0 tools were used, followed by their frequency. In other words, the number of times a tool was used in the sections of the different state sites.

To complement this initial measurement in 2008, two more observations were made in 2010 and 2011 that only looked at Web 2.0 tools linked to the Twitter and Facebook social networking sites in order to understand what impact this social media technology has on the web pages of state governments. We choose these two Web 2.0 tools because they are the most used nowadays with more members than any other. More specific questions include: “How do these governments currently use social media tools?” and “Which state governments use Facebook and Twitter to raise awareness?”

Once the sample from the 32 states and the two social networking platforms were chosen, the procedure was as follows: each platform was visited to determine whether the government web pages had valid accounts – Twitter or Facebook – which were validated by entering them and verifying that they did in fact belong to the selected government and not a fictitious or erroneous name. During this validation process, data provided by the sites were noted down, such as the amount of individuals that follow in the case of Twitter and the number of “friends” in the case of Facebook. This information was collected during the months of March and October 2010 and again in 2011, using the Web browsers Firefox and Safari, and a broadband Internet connection, with an approximate time of 15-20 minutes spent on each website.

4. Findings and discussion

In this section of the paper, we introduce the main findings of the longitudinal observations of the adoption and use of Web 2.0 applications and tools in Mexican State sites. We start by showing the general trend of adoption of Web 2.0 tools and applications from 2008 to 2011. After this initial comparison, we focus more specifically on the evolution of the use of Facebook and Twitter, two of the more widely adopted Web 2.0 applications.

4.1 Web 2.0 adoption trends in Mexican State sites

The first observation was held in 2008, to identify the main features of Web 2.0 described in the first section of this paper. Table 2, presents a list of the sections where Web 2.0 tools were found. It is important to mention that many portals did not use Web 2.0 features. Regarding the frequency of use of Web 2.0 tools in the different sections of the sites, we found that tools located in the Citizens section generally received the most use, followed by those in the Government and Tourism sections. The most commonly used tool in the Citizens section was APIs, which suggests that states are interested in creating interactive applications in this section of the website. Also, the Government section demonstrates the greatest diversity of tool use, which reflects wide-ranging interest on the part of the states in terms of the type of communication they seek to create with their citizens in this section. The Tourism section showed a pattern for including multimedia information in audio and video formats. This same pattern was observed in the culture section, albeit with less frequency. It is interesting to note that only a couple of sites used content syndication services (RSS) in the press area.
Table 2: Sections where Web 2.0 tools were found in 2008

<table>
<thead>
<tr>
<th>Tools/Sections</th>
<th>Government</th>
<th>Citizen</th>
<th>Tourism</th>
<th>Culture</th>
<th>Applications and Services</th>
<th>Transparency</th>
<th>Press</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podcasts</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>RSS</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Blogs</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Forums</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Videocasts</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Chat</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>API</td>
<td>4</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Red Social</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12</td>
<td>25</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Three years later, a completely different perspective on the use of Web 2.0 features was found, as displayed in Table 3. Clearly, there was a notable increase in the use of the different tools. Again, the Citizens sections of the local government websites have more features, followed by the Government sections. The use of social networks was the most common feature among the 32 states, and the least used were blogs and online forums. The use of podcast, videocast, and RSS were still important for most of the sample states. Finally, it is important to mention that the use of APIs is frequently found in the applications and services; for transparency purposes, social networking and videocasts were the most common for the Mexican websites.

Table 3: Sections where Web 2.0 tools were found in 2011

<table>
<thead>
<tr>
<th>Tools/Sections</th>
<th>Government</th>
<th>Citizen</th>
<th>Tourism</th>
<th>Culture</th>
<th>Applications and Services</th>
<th>Transparency</th>
<th>Press</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podcasts</td>
<td>11</td>
<td>11</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>RSS</td>
<td>14</td>
<td>11</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Blogs</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Forums</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Videocasts</td>
<td>21</td>
<td>23</td>
<td>21</td>
<td>19</td>
<td>12</td>
<td>12</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>Chat</td>
<td>8</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>API</td>
<td>9</td>
<td>14</td>
<td>9</td>
<td>6</td>
<td>14</td>
<td>7</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Social Networks</td>
<td>23</td>
<td>22</td>
<td>12</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>Social Markers</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>95</td>
<td>98</td>
<td>65</td>
<td>61</td>
<td>61</td>
<td>49</td>
<td>59</td>
<td>88</td>
</tr>
</tbody>
</table>

A comparison between these two measures from 2008 and 2011 is presented in Figure 2, where the increase in the use of different tools on Web 2.0 is remarkable. Most of the features that showed growth were related to interaction – i.e., social networking, chat, videocast – and those that were reduced were one-way communication channels – blogs. This could be explained by the expansion of this kind of features among the users. In fact, potential users of government websites are interacting more and more with Web 2.0 tools and applications such as Facebook and Twitter.

As shown by Figure 2, the most commonly used tools were social networks, which rose from 6.3% in 2008 to 48.8% in 2011; almost half of all Mexican state government sites now use this tool to display dynamic content to users. The RSS and social markers maintain the same average of use. The least used mechanisms were forums, podcasts and APIs, which dramatically dropped from 2008 to 2011. According to this, it is clear that state government electronic sites focused mostly on displaying informative content in text, video and audio formats (podcasts, videocasts and RSS) in 2008; but this changed by 2011 with the use of applications that allow easy communication between public officials and citizens.

Another important comparison shown in Appendix 1 was the number of local websites with Twitter and Facebook accounts. Of the 32 states, in 2008, only 16 had both Twitter and Facebook accounts, three states (9%) had just a Facebook account, five states had just a Twitter account, and eight states...
have neither account. In 2011, however, 20 states have both types of accounts: only two states (Chiapas and Colima) have just a Twitter account and eight states (25%) have no account with either social networking platform.

![Web 2.0 Tools in Local Sites](image)

**Figure 2**: Percentage use of tools by state sites 2008

### 4.2 Facebook

The total percentage growth of the amount of friends on Facebook during 2008 to 2011 is 94.92%; however, several Mexican states show no potential growth in the number of registered friends (See Table 4). The figures for states like Colima, Sonora and Campeche, which had number of friends in some measurements, are reported as zero in the fifth column because the link was not available in the moment of the measurement. On the other hand, Querétaro, State of Mexico, and Veracruz stand out from the rest with more than ten thousand users each. States that have shown growth consistently in terms of the number of “friends” on this platform are Federal District, Guerrero, Guanajuato, Hidalgo, Michoacán, Nuevo León, Querétaro, and Morelos.

**Table 4**: Evolution of Facebook Friends on state websites

<table>
<thead>
<tr>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baja California Sur</td>
<td>0</td>
<td>381</td>
<td>N/A</td>
<td>Nuevo Leon</td>
<td>5662</td>
<td>8521</td>
<td>50.49%</td>
</tr>
<tr>
<td>Chiapas</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Sinaloa</td>
<td>2373</td>
<td>3529</td>
<td>48.71%</td>
</tr>
<tr>
<td>Nayarit</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Queretaro</td>
<td>9056</td>
<td>12238</td>
<td>35.14%</td>
</tr>
<tr>
<td>San Luis Potosí</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Hidalgo</td>
<td>2770</td>
<td>3719</td>
<td>34.26%</td>
</tr>
<tr>
<td>Tabasco</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Michoacán</td>
<td>2160</td>
<td>2884</td>
<td>33.52%</td>
</tr>
<tr>
<td>Tamaulipas</td>
<td>0</td>
<td>848</td>
<td>N/A</td>
<td>Guerrero</td>
<td>3094</td>
<td>3996</td>
<td>29.15%</td>
</tr>
<tr>
<td>TLaxcala</td>
<td>0</td>
<td>617</td>
<td>N/A</td>
<td>Veracruz</td>
<td>8592</td>
<td>10960</td>
<td>27.56%</td>
</tr>
<tr>
<td>Yucatan</td>
<td>0</td>
<td>42717</td>
<td>N/A</td>
<td>Durango</td>
<td>4988</td>
<td>4960</td>
<td>-0.56%</td>
</tr>
<tr>
<td>Quintana Roo</td>
<td>219</td>
<td>835</td>
<td>281.28%</td>
<td>Morelos</td>
<td>4996</td>
<td>3208</td>
<td>-35.79%</td>
</tr>
<tr>
<td>Zacatecas</td>
<td>2470</td>
<td>8874</td>
<td>259.27%</td>
<td>Campeche</td>
<td>311</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>530</td>
<td>1764</td>
<td>232.83%</td>
<td>Chihuahua</td>
<td>2158</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>State of Mexico</td>
<td>3893</td>
<td>11391</td>
<td>192.60%</td>
<td>Coahuila</td>
<td>313</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>633</td>
<td>1402</td>
<td>121.48%</td>
<td>Colima</td>
<td>4053</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Aguascalientes</td>
<td>1097</td>
<td>3228</td>
<td>112.22%</td>
<td>Jalisco</td>
<td>4451</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Baja California</td>
<td>1978</td>
<td>4070</td>
<td>105.76%</td>
<td>Puebla</td>
<td>74</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Federal District</td>
<td>3744</td>
<td>7429</td>
<td>98.42%</td>
<td>Sonora</td>
<td>500</td>
<td>0</td>
<td>-100.00%</td>
</tr>
</tbody>
</table>

**TOTAL**: 70115 | 136671 | 94.92%
4.3 Twitter

Twitter will be analyzed in terms of its main components – followers, following, lists and tweets – for 2011. The first component of Twitter is its followers. Undoubtedly, this is one of the most interesting categories as it relates to the number of individuals or institutions that want to have a connection with government through the use of this technological tool. Table 5 presents the results of followers. As can be seen, the states of Tamaulipas, Quintana Roo and Oaxaca stand out with a growth of more than 3 times. The number of followers for the rest of the states grew significantly. Other states experiencing more modest growth included the State of Mexico, Michoacan and Zacatecas.

Table 5: Twitter - followers on Mexican local government websites

<table>
<thead>
<tr>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campeche</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Hidalgo</td>
<td>14712</td>
<td>33463</td>
<td>127.45%</td>
</tr>
<tr>
<td>Chihuahua</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Colima</td>
<td>10881</td>
<td>24234</td>
<td>122.72%</td>
</tr>
<tr>
<td>Coahuila</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Queretaro</td>
<td>16953</td>
<td>36809</td>
<td>117.12%</td>
</tr>
<tr>
<td>San Luis Potosi</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Morelos</td>
<td>1441</td>
<td>2989</td>
<td>107.43%</td>
</tr>
<tr>
<td>Tabasco</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Nuevo Leon</td>
<td>13778</td>
<td>28184</td>
<td>104.56%</td>
</tr>
<tr>
<td>Tlaxcala</td>
<td>0</td>
<td>471</td>
<td>N/A</td>
<td>Guerrero</td>
<td>2671</td>
<td>5285</td>
<td>97.87%</td>
</tr>
<tr>
<td>Tamaulipas</td>
<td>409</td>
<td>3077</td>
<td>652.32%</td>
<td>Federal District</td>
<td>27120</td>
<td>49680</td>
<td>83.19%</td>
</tr>
<tr>
<td>Quintana Roo</td>
<td>156</td>
<td>871</td>
<td>458.33%</td>
<td>Baja California</td>
<td>2361</td>
<td>4299</td>
<td>82.08%</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>633</td>
<td>3019</td>
<td>376.94%</td>
<td>State of Mexico</td>
<td>8550</td>
<td>15547</td>
<td>81.84%</td>
</tr>
<tr>
<td>Yucatan</td>
<td>13308</td>
<td>41783</td>
<td>213.97%</td>
<td>Michoacan</td>
<td>2296</td>
<td>3951</td>
<td>72.08%</td>
</tr>
<tr>
<td>Chiapas</td>
<td>15355</td>
<td>36871</td>
<td>140.12%</td>
<td>Zacatecas</td>
<td>1236</td>
<td>2082</td>
<td>68.45%</td>
</tr>
<tr>
<td>Veracruz</td>
<td>5230</td>
<td>12375</td>
<td>136.62%</td>
<td>Baja California Sur</td>
<td>9531</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Sinaloa</td>
<td>14070</td>
<td>32671</td>
<td>132.20%</td>
<td>Jalisco</td>
<td>5659</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Aguascalientes</td>
<td>725</td>
<td>1679</td>
<td>131.59%</td>
<td>Nayarit</td>
<td>1584</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Durango</td>
<td>11492</td>
<td>26446</td>
<td>130.13%</td>
<td>Puebla</td>
<td>724</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>14341</td>
<td>32845</td>
<td>129.03%</td>
<td>Sonora</td>
<td>2162</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>197378</td>
<td>398631</td>
<td>101.96%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

People following the Twitter account is another component (see Table 6). This is more meaningful in terms of website acceptance and the strategy of the government. For example, Nuevo Leon, Queretaro and Veracruz have an interesting consistent growth in the two-year sample. The State of Mexico and Guerrero show a small but consistent growth. The total percentage number of followers grows by 45.94% percent in both years.

Table 6: Twitter - following by Mexican local government websites

<table>
<thead>
<tr>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zacatecas</td>
<td>0</td>
<td>1170</td>
<td>N/A</td>
<td>State of Mexico</td>
<td>4424</td>
<td>7094</td>
<td>60.35%</td>
</tr>
<tr>
<td>Tlaxcala</td>
<td>0</td>
<td>50</td>
<td>N/A</td>
<td>Michoacan</td>
<td>2</td>
<td>3</td>
<td>50.00%</td>
</tr>
<tr>
<td>Baja California Sur</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Queretaro</td>
<td>15135</td>
<td>21409</td>
<td>41.45%</td>
</tr>
<tr>
<td>Campeche</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Aguascalientes</td>
<td>123</td>
<td>152</td>
<td>21.60%</td>
</tr>
<tr>
<td>Chihuahua</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Tamaulipas</td>
<td>395</td>
<td>467</td>
<td>18.23%</td>
</tr>
<tr>
<td>Coahuila</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Morelos</td>
<td>870</td>
<td>1002</td>
<td>15.12%</td>
</tr>
<tr>
<td>San Luis Potosi</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Chiapas</td>
<td>2827</td>
<td>2908</td>
<td>2.87%</td>
</tr>
<tr>
<td>Tabasco</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Federal District</td>
<td>1774</td>
<td>1778</td>
<td>0.23%</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>1</td>
<td>10</td>
<td>900.00%</td>
<td>Quintana Roo</td>
<td>19</td>
<td>19</td>
<td>0.00%</td>
</tr>
<tr>
<td>Baja California</td>
<td>37</td>
<td>209</td>
<td>454.86%</td>
<td>Guerrero</td>
<td>1487</td>
<td>1482</td>
<td>-0.34%</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>657</td>
<td>3074</td>
<td>367.88%</td>
<td>Yucatan</td>
<td>441</td>
<td>296</td>
<td>-32.88%</td>
</tr>
<tr>
<td>Durango</td>
<td>41</td>
<td>112</td>
<td>173.17%</td>
<td>Colima</td>
<td>118</td>
<td>54</td>
<td>-54.24%</td>
</tr>
<tr>
<td>Sinaloa</td>
<td>28</td>
<td>65</td>
<td>132.14%</td>
<td>Jalisco</td>
<td>71</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>16</td>
<td>37</td>
<td>131.25%</td>
<td>Nayarit</td>
<td>67</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Nuevo Leon</td>
<td>3562</td>
<td>6838</td>
<td>91.97%</td>
<td>Puebla</td>
<td>487</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Veracruz</td>
<td>2301</td>
<td>4068</td>
<td>76.79%</td>
<td>Sonora</td>
<td>949</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>35834</td>
<td>52297</td>
<td>45.94%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.4 Twitter lists

The lists on Twitter is the component that makes it possible to organize followers, which could be meaningful if governments use it as a strategy to define certain profiles of people to send customized messages and proposals for different segments of people. In this case, according to data shown in Table 7, the behavior of the governments is very random: some states like Hidalgo, Veracruz, Colima and Morelos are increasing the number of their lists in order to have more defined profiles; others like Yucatan, Jalisco and Sonora are reducing the number of their lists; and finally some states like Nuevo Leon, Sinaloa, Durango, Queretaro, and Baja California have a consistently growing number of lists. The percentage total growth in the lists is 37.27%, but an important number of the local websites have a growth beyond 50% in the study period.

Table 7: Twitter Lists on Mexican local government websites

<table>
<thead>
<tr>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tlaxcala</td>
<td>0</td>
<td>19</td>
<td>N/A</td>
<td>Chiapas</td>
<td>226</td>
<td>374</td>
<td>65.49%</td>
</tr>
<tr>
<td>Campeche</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Queretaro</td>
<td>311</td>
<td>504</td>
<td>62.08%</td>
</tr>
<tr>
<td>Chihuahua</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Veracruz</td>
<td>173</td>
<td>262</td>
<td>51.45%</td>
</tr>
<tr>
<td>Coahuila</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Nuevo Leon</td>
<td>423</td>
<td>635</td>
<td>50.12%</td>
</tr>
<tr>
<td>San Luis Potosi</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Guerrero</td>
<td>101</td>
<td>151</td>
<td>49.50%</td>
</tr>
<tr>
<td>Tabasco</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Baja California</td>
<td>118</td>
<td>168</td>
<td>42.37%</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>11</td>
<td>60</td>
<td>445.45%</td>
<td>Michoacan</td>
<td>87</td>
<td>121</td>
<td>39.08%</td>
</tr>
<tr>
<td>Tamaulipas</td>
<td>8</td>
<td>43</td>
<td>437.50%</td>
<td>Distrito Federal</td>
<td>1216</td>
<td>1674</td>
<td>37.66%</td>
</tr>
<tr>
<td>Quintana Roo</td>
<td>9</td>
<td>32</td>
<td>255.56%</td>
<td>State of Mexico</td>
<td>310</td>
<td>419</td>
<td>35.16%</td>
</tr>
<tr>
<td>Aguascalientes</td>
<td>20</td>
<td>48</td>
<td>140.00%</td>
<td>Zacatecas</td>
<td>34</td>
<td>40</td>
<td>17.65%</td>
</tr>
<tr>
<td>Colima</td>
<td>105</td>
<td>230</td>
<td>119.05%</td>
<td>Baja California Sur</td>
<td>68</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Durango</td>
<td>128</td>
<td>256</td>
<td>100.00%</td>
<td>Jalisco</td>
<td>214</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>155</td>
<td>302</td>
<td>94.84%</td>
<td>Nayarit</td>
<td>50</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Sinaloa</td>
<td>185</td>
<td>338</td>
<td>81.72%</td>
<td>Puebla</td>
<td>19</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>163</td>
<td>282</td>
<td>73.01%</td>
<td>Sonora</td>
<td>83</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Morelos</td>
<td>63</td>
<td>105</td>
<td>66.67%</td>
<td>Yucatan</td>
<td>136</td>
<td>0</td>
<td>-100.00%</td>
</tr>
</tbody>
</table>

TOTAL | 4417 | 6063 | 37.27% |

4.5 Tweets

The most important way of communication in Web 2.0 technologies is that of microblogging as represented by Twitter. These short messages of 140 characters are used to send information and links to different media – photos, audio and video – and are shared by people with a Twitter connection. The behavior of local government sites is to increase the number of messages sent to their recipients; but more messages does not necessarily mean that users will interact with the sender. On Twitter, that is another kind of measure – the retweet – which is not analyzed in this sample.

According to data presented in Table 8, the states that are more active in sending Twitter messages are Durango, Morelos, and the Federal District; those that are consistently growing in their number of messages are Zacatecas, Tlaxcala, Tamaulipas, Oaxaca, and Aguascalientes; and those that are not sending messages to their followers are Baja California Sur, Nayarit, Puebla, Sonora and Yucatan. The total percentage growth in the number of messages over the two-year sample was 82.13%.

The phenomenon related to increases in the number of followers is explained in the section on individual followers. Nevertheless, it should be added that the number of followers also depends upon the viral effect (Boynton, 2009), the replication and spreading of links among citizens and government officials who promote the page, which can lead to a significant explosion in the number of followers within just a few days.

5. Conclusions

Web 2.0 tools and applications seem to be an important alternative for governments and their websites in the not too distant future. The so-called Government 2.0 has the potential to bring governments and their citizens closer together in a simple and effective way. These types of tools will allow greater citizen participation and enable government dependencies to transmit more and better information; however, it is also clear that these tools and applications are currently receiving little use.
on state government sites. This evaluation reveals some preliminary data on the use of Web 2.0 by state government sites in Mexico. Given the speed at which Web 2.0 tools change and their availability on the Internet, many sites could be using them already. Nevertheless, this initial data offers up a first look at this phenomenon and serves as the grounds for future studies on the topic.

**Table 8:** Amount of Tweets on Mexican local government websites

<table>
<thead>
<tr>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
<th>GOVERNMENT</th>
<th>MARCH 2011</th>
<th>OCTOBER 2011</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zacatecas</td>
<td>0</td>
<td>1689</td>
<td>N/A</td>
<td>Hidalgo</td>
<td>1457</td>
<td>2989</td>
<td>105.15%</td>
</tr>
<tr>
<td>Tlaxcala</td>
<td>851</td>
<td>N/A</td>
<td>N/A</td>
<td>Nuevo Leon</td>
<td>3015</td>
<td>6072</td>
<td>101.39%</td>
</tr>
<tr>
<td>Campeche</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Sinaloa</td>
<td>3916</td>
<td>7639</td>
<td>95.07%</td>
</tr>
<tr>
<td>Chiapas</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Chiapas</td>
<td>4181</td>
<td>6990</td>
<td>67.18%</td>
</tr>
<tr>
<td>Coahuila</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Queretaro</td>
<td>3744</td>
<td>7411</td>
<td>63.22%</td>
</tr>
<tr>
<td>San Luis</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>Guerrero</td>
<td>3302</td>
<td>4827</td>
<td>46.16%</td>
</tr>
<tr>
<td>Tabasco</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>State of Mexico</td>
<td>5363</td>
<td>7748</td>
<td>44.47%</td>
</tr>
<tr>
<td>Tamaulipas</td>
<td>198</td>
<td>1987</td>
<td>903.51%</td>
<td>Guanajuato</td>
<td>720</td>
<td>967</td>
<td>34.31%</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>2990</td>
<td>620.48%</td>
<td></td>
<td>Veracruz</td>
<td>1861</td>
<td>2171</td>
<td>16.66%</td>
</tr>
<tr>
<td>Aguascalientes</td>
<td>236</td>
<td>1111</td>
<td>370.76%</td>
<td>Michoacan</td>
<td>431</td>
<td>475</td>
<td>10.21%</td>
</tr>
<tr>
<td>Colima</td>
<td>1046</td>
<td>4638</td>
<td>343.40%</td>
<td>Baja California Sur</td>
<td>1</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Morelos</td>
<td>3214</td>
<td>8844</td>
<td>175.17%</td>
<td>Jalisco</td>
<td>2699</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Quintana Roo</td>
<td>101</td>
<td>246</td>
<td>143.56%</td>
<td>Nayarit</td>
<td>4280</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Durango</td>
<td>8544</td>
<td>2082</td>
<td>127.07%</td>
<td>Puebla</td>
<td>101</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Distrito Federal</td>
<td>4525</td>
<td>9754</td>
<td>110.90%</td>
<td>Sonora</td>
<td>284</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>Baja California</td>
<td>964</td>
<td>2016</td>
<td>109.13%</td>
<td>Yucatan</td>
<td>17</td>
<td>0</td>
<td>-100.00%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>55015</td>
<td>100197</td>
<td>82.13%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In regard to the implementation of Web 2.0 tools, progress on these sites is taking place slowly. It seems that site administrators are considering the use of these applications to achieve greater interaction and integration with the citizenry through the presence and functionality of these tools, but many have yet to be implemented. From a communications approach, Web 2.0 applications fulfill their purpose of communication according to the characteristics of each tool, although some of them also allow greater socialization, through social networks or social markers, between users and the government. A next stage for the Mexican states that have begun using these tools is to hold a dialog (Boyd et al., 2010) – an exchange of Tweets and retweets – between users to bring about a citizen-government collaboration (Honeycutt and Herring, 2009) using Facebook or Twitter.

In reality, Twitter can help to both exchange information and recommend news, data or relevant information (Phelan et al., 2009). In recent research into the impact of Twitter on the government, Wigand (2010) tried to analyze the participation of Twitter in the government using four theories – Diffusion of Innovation, Social Influence, Social Presence and Collective Intelligence Theories – through which social networking tools can interact with the government. In our case, we can conclude that the Mexican states we evaluated are beginning to use social networking tools in a rudimentary fashion. More research is needed to observe the level of interaction with the citizenry, their use to generate value within an organization – and that they are not simply a waste of time – as well as to determine whether these technologies are useful for improving local government practices and the relationship with citizens.

Future studies could focus on discovering users’ opinions of the functionality and use of the site in order to complement and consider aspects of site functionality not included in this evaluation. This would provide a better view from a citizen’s perspective of the suitability and usefulness of the communication channels at their disposal. Another line of research would be to evaluate the advantages and disadvantages for state governments of maintaining a website with Web 2.0 characteristics, due to the time and cost it may involve for some governments, in contrast to the benefits it could yield.

Finally, the use of Web 2.0 tools on electronic government sites is not just limited to posting the tool. Including tools and applications on the sites is just the first step; there needs to be a strategy and clear approach as to what these tools are expected to achieve. Government 2.0 has great potential to transform and improve relations between government, citizens, companies and other interest groups, but these tools must be combined with a clear vision and effective strategies if their effects are to be
valuable and meaningful to governments and citizens alike, as well as to society as a whole. We hope that this first look at the topic proves useful and arouses greater interest in these types of applications, and leads us in the near future to Internet sites that can truly be considered shining examples of Government 2.0.

6. Appendix 1: Mexican States’ Facebook and Twitter account addresses

<table>
<thead>
<tr>
<th>Government</th>
<th>URL Facebook</th>
<th>URL Twitter</th>
<th>Government</th>
<th>URL Facebook</th>
<th>URL Twitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campeche</td>
<td></td>
<td></td>
<td>Oaxaca</td>
<td><a href="http://www.facebook.com/GobOax">http://www.facebook.com/GobOax</a></td>
<td></td>
</tr>
<tr>
<td>Chiapas</td>
<td><a href="http://www.facebook.com/GobiernoChiapas">http://www.facebook.com/GobiernoChiapas</a></td>
<td></td>
<td>Puebla</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chihuahua</td>
<td></td>
<td></td>
<td>Querétaro</td>
<td><a href="http://www.facebook.com/GobGto">http://www.facebook.com/GobGto</a></td>
<td></td>
</tr>
<tr>
<td>Coahuila</td>
<td></td>
<td></td>
<td>Quintana Roo</td>
<td><a href="http://www.facebook.com/pages/Gobierno-del-Estado-de-Quintana-Roo/132175496800498">http://www.facebook.com/pages/Gobierno-del-Estado-de-Quintana-Roo/132175496800498</a></td>
<td></td>
</tr>
<tr>
<td>Colima</td>
<td><a href="http://www.facebook.com/GobiernoColima">http://www.facebook.com/GobiernoColima</a></td>
<td></td>
<td>San Luis Potosí</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durango</td>
<td><a href="https://www.facebook.com/Gobierno">https://www.facebook.com/Gobierno</a></td>
<td></td>
<td>Sonora</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Pan-European Services in Slovenia

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Abstract: In 2009 we conducted a study on pan-European electronic services. The main focus was on eGovernment and eHealth. First, qualitative interviews were performed to determine key areas of priority and essential problems in this area; for a small country such as Slovenia, not all topics may be equally relevant. In addition, a telephone survey was conducted in individuals between the ages of 18 and 75 years. Not surprisingly, the respondents showed the most interest in pan-European eHealth services, remote access to health data, and in certification of education - the process of obtaining degrees (in that order). The least interest was shown in the establishment of online enterprises, and for the recognition of Slovenian public administration certificates in European Union member states (and vice versa). However, the interest for e-services in the realm of public administration is quite high. This interest in public administration services is connected to age (younger respondents show less interest) and employment status (students and the retired show less interest than do the employed and unemployed). The interest for public administration e-services is therefore linked to specific life situations. Accordingly, it is not surprising that interest is higher among those who most frequently travel to other EU countries. As for the use of public administration services in other EU countries, it is not very frequent – less than a tenth of respondents used it, more than half of them online. The countries where respondents most frequently use these services are Germany, Italy, and Austria. Considering the frequency of use, the order is reversed: Austria is in first place, then Italy and Germany, which shows that Austria has achieved the highest level of development of public administration e-services. In comparison to similar research undertaken by Cap Gemini worldwide, our survey showed a higher level of interest for electronic managing health insurance, recognition of education or other qualifications, and recognition of marriage and birth certificates. Among the respondents who lived abroad a month or longer, the interest for e-public administration domains in general is higher than for the respondents in the Cap Gemini survey. An exception is in the tax field, in which our respondents are less interested than the Cap Gemini respondents.

Keywords: Pan-European services, eGovernment, eHealth

1. Introduction

With the increasing mobility of European citizens it is increasingly important that access to essential services does not depend on "local knowledge". Presently, most eGovernment services are provided at the national or sub-national (regional or local) level. There are several ways to add a cross-border dimension; these ways range from the relatively simple (such as making a service available in another language than that of the European Union [EU] member state in which the service is being accessed), to more complex ways (such as information sharing between public administrations of different EU member states), or even through provision of a service at a "pan-European" level in which parts of the public administrations of all EU member states participate as a "back office" to this service. The term "pan-European eGovernment services" (PEGS) may seem to imply that only the latter example (service provision at the European level) would qualify for the name. However, it would be not useful to understand PEGS in such a limited way. PEGS are important because they add a European dimension to eGovernment services, and it is this European dimension and the progress towards it that matters. PEGS come in different forms, are developed by different actors, and in different areas, and have different development trajectories (Weehuizen and van Oranje, 2007).

In the report Innovative and Adaptive PEGS for Citizens in 2010 and Beyond (Glott and Haaland, 2007), which was a part of the EUREGOV project of the same name that was prepared for the Directorate general - DG Information Society & Media of the European Commission, PEGS were defined as having the following characteristics:

- Provided by or on behalf of European public sector entities,
- At local, regional, national, or supra-national level,
- By means of interoperable trans-European telematics networks (e.g. the Internet),
- In order to perform public administration tasks, including provision and exchange of information and provision of participation opportunities for citizens,
That meet a demand of other public entities and particularly demand of other citizens at any geographic level,

For “material” services as well as for the generation of civic attitudes that address pan-European tasks or improve citizens' identification with the EU,

With the potential to be extended towards a majority of EU member states (instead of, for instance, only in countries with the same language, like UK and Ireland or Germany and Austria),

By either being designed to expand or by containing elements (of, for instance, service integration, interoperability, or e-Inclusion) that could feed in the design of future eGovernment services on pan-European level.

By IDABC (Interoperable Delivery of European eGovernment Services to public Administrations, Businesses and Citizens; http://ec.europa.eu/idabc/) definition, the horizontal pan-European eGovernment services are "measures undertaken to initiate, enable and manage the provision of horizontal pan-European eGovernment services, including organizational and coordination aspects" (De Vriendt, 2005).

For the research purpose of this project there were two data gathering methodologies used in the process. First we performed a series of qualitative expert interviews with key local, regional, national, and European PEGS experts. Then in December 2009, a telephone survey was conducted on a sample of about 600 persons aged from 18 to 75 years. The Cap Gemini survey was also used to compare our results. As well during the study process some relevant EU documents and studies were used to frame the research focus, such as:

- eGovernment for all (eGovernment Action plan 2011-2015) commits the EU member states to rely on information and communications technology (ICT) solutions to develop and promote improved ways for business and citizen participation in public policy consultations, debates, and policy-making processes. The Action Plan focuses on five main priorities. Foremost among these is the aim of making eGovernment inclusive, so that "no citizen is left behind". The Action Plan aims to make high-impact services for citizens and businesses more widely available, including electronic procurement services for businesses, services for mobile citizens (including improved ability to search for jobs across the European Union), or social security services (for example, pension records and electronic benefit applications).

- A Digital Agenda for Europe (Digital Agenda for Europe 2010-2020) for maximising the social and economic potential of ICT, most notably the Internet, a vital medium of economic and societal activity: for doing business, working, playing, communicating, and expressing ourselves freely. European governments are committed to making user-centric, personalised, multiplatform eGovernment services.

- The Vision Study (SMART 2006/0064) stimulated the debate on the key transformations and challenges ahead for the renewal of the European eGovernment agenda beyond 2010.

- The Guidelines on Sustainable Business Models for Inclusive Public Service Delivery (SMART 2007/0052) study analyses the state of the art of the multichannel delivery of public services throughout Europe, and the progress made towards achieving the goal to ensure that "no citizen is left behind". It provides useful recommendations and identifies further actions that will be needed over the next few years.

- The Progress Study (SMART 2008/0042) is a qualitative progress evaluation of the i2010 eGovernment Action Plan, 2006-2010. The objectives of the study were to qualitatively analyse the progress towards achieving the goals of the Action Plan, and to evaluate its stimulus effect across the member states.

- Study on eGovernment scenarios for 2020 and the preparation of the 2015 Action Plan (SMART 2009/0069) provided concrete input to the eGovernment 2015 Action Plan in terms of assessing objectives and validated priorities, delivering innovative ideas, and proposing a range of policy actions in support of these priorities.

To better understand the PEGS in Slovenia, a small country where not all of the topics mentioned above may be equally relevant, two data gathering tools were used. First, qualitative interviews were performed to frame key priority areas and address essential problems. Second a telephone survey was conducted among active Internet users. Active Internet user was defined as “anyone who used the Internet in the last three months”.

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2. Analysis of expert interviews

As detailed previously (Vintar et al, 2010), we performed a series of qualitative expert interviews with key local, regional, national, and European PEGS experts in order to effectively analyse the state of affairs, strategies, and priorities in the domain of PEGS, and to identify key services that should be implemented in future. In total, 14 interviews were performed: 10 with experts in e-administration, 3 in eHealth and 1 in the e-business domain. The main objective was to determine the key PEGS to be implemented in the future to ensure interoperability and mobility of Slovenia in the wider European market.

Experts believe PEGS to be very important in general, but with regard to specific services their views differ, especially with respect to the order in which PEGS should be introduced. A quite wide range of domains was studied and examined with an eye toward what would be needed to enact workable pan-European PEGS: interviews/canvassing of companies employing foreign workers in Slovenia, population databases and their linkage, horizontal linkage, interoperability of services, and from the so-called “E-procurement” domain (public commissions, pan-European health cards, and so forth). The experts’ opinions focused on the different elements that would be required to enact services in the pan-European space as well as on services themselves. To provide examples, administration of taxes demand an obligatory and unified pan-European taxation number; the linking of population registers would be needed for car registration abroad, and for extending the validity of drivers’ licences to include a greater number of member states. In the research process, some good practices from the EU were uncovered, for example Smart Cities (for connecting different European cities and enterprises within them). One expert pointed out that connecting on the mezzo level is a more reasonable start than aiming to connect whole countries. The enterprise viewpoint was exposed frequently, for example with the idea of pay circulation and the concept of SEPA (Single Euro Payment Area). However, connecting on the regional level is currently left to local initiatives.

The key actors in the implementation of PEGS are the European Commission, in the role of connector, the Ministry of Public Administration, and the informatics professional in the role of the carrier of changes. Moreover, the European Commission thinks that politicians should be instructed on the importance of changes related to PEGS, but not until the different schools of thought in the field unify with respect to what initiatives should be undertaken. According to one of the interviewed experts, informatics could be withdrawn from the Ministry of Public Administration and made independent again (as it was before); this might allow for this department to be an independent actor that could step forth from the conflicting interests of others in the subfields that are collaborating to implement PEGS.

An important pan-European service that still lives in practice is, according to one expert, the European driving licence. Another expert exposed the historical background of differences in European population registers; specifically, member states in Eastern Europe (which once had different political systems) are more inclined toward centralisation of that sort of activity, and therefore have better-regulated civil population databases than do member states in Western Europe. The differences are based on different philosophies. In Slovenia, registers were introduced with the reforms of Habsburg Maria Theresa Walburga (1717 – 1780), while the collection of civilian data in Germany (due to the experience of the Second World War) is strictly unwanted and triggers social protests. Thus, cultural differences matter—in Slovenia we tend to control a priori, while in Britain control is only imposed when something goes wrong (to use an illustrative comparison).

One of the experts interviewed noted that technical background is the least problematic aspect of such pan-European projects. Interestingly, experts are not uniform in their opinions concerning legal regulation. Some experts strongly value legal regulation, but one expert expressed the problematic nature of legal regulation when it comes to personal data security. In his opinion, despite the adjustment of legislation in various EU member countries to correspond with legislation for the overall European Union, huge differences remain. For example, the RISER project (Registry Information Service on European Residents), in which also the Ministry for Public Administration is included and concerns searching for debtors abroad. The project is very successful in Germany, and eight countries participate in it. However, in Slovenia it is not feasible as our administration will not give data on debtors from Slovenia to foreign enterprises.
One other expert also provided an interesting opinion—using an e-administration system, Slovenians can manage all procedures from abroad, but e-administration does not assure pan-European services. He defined pan-European services as those that enable you to manage things in a foreign country that has no data about you, but can retrieve it from a common register. In particular, another challenge with PEGS implementation in Slovenia is our legislation stating that all collected data must at the disposal of other public administration institutions. This is in tandem with the regulation that data already demanded by one institution cannot then be asked about a second time by another institution. In fact, according to another expert in terms of interoperability the most difficult aspects of PEGS are legislative, political, and organisational (that is, not related to ICT-related issues).

2.1 eHealth domain

The eHealth domain is less developed and accessible and has been exposed as the most problematic by several experts. Therefore it deserves more detailed examination.

Slovenia has participated in the NETC@RDS project (http://netcards-project.com/web/frontpage) since 2003. This project aims to introduce an electronic European health card that would hold health insurance data. Currently, the blue EU health card is in force. This health care card is not electronic but rather includes health insurance data that is physically written down; the card is only valid for one year. It is valid for urgent medical help abroad.

The first phase of the NETC@RDS project was research; the second, pilot; and the last, at the end of 2010, implementation. Interestingly, procedures have not changed after introduction of the electronic card; insurance companies continue to send invoices as usual. The pilot phase of the study is showing that Slovenians who work abroad and have two doctors (one abroad and one at home) are strongly inclined to use the card. The card has therefore found its widest adoption in border regions. There are 16 countries participating in the NETC@RDS project (see http://netcards-project.com/web/partners). As an observer, Slovenia participates also in the Calliope project (http://www.calliope-network.eu/), which is a thematic network aimed at supporting, promoting, and disseminating products of a bigger project, European Patients Smart Open Services (epSOS) (http://www.epsos.eu/).

According to experts, not long ago Slovenia was advanced in the eHealth domain; it now lags behind, except for one insurance company for obligatory health insurance. The health card substantially facilitates procedures, as there is no need to uniformly address first at the national level. Germany, for example, has been trying to introduce the health card for five years, but has been unable to do so successfully due to the many competing interests in the country’s economy (regarding the content of the card, the interests of insurance companies, producers, and so forth).

To initiate a higher level of interoperability in the eHealth domain, it is pivotal to introduce the electronic health record (or a summary in electronic format), which is used in the Slovenian eHealth project. Our experts had the following to say about it:

- The eHealth project runs within the health ministry, therefore our experts could not speak to the details of it except for the action plan, which is partially funded by European funds.
- In 2010, the eHealth project set up a model of an electronic health record, an agreement for keeping data securely stored in an electronic format.
- Individual doctors and institutions at home and worldwide are already exchanging data in electronic format; however, for now everything is still only local. In Slovenia, some hospital and diagnostic centers are exchanging radiologic images; therefore, having on-duty radiologists is not necessary. Britain, for example, is sending their images to India, probably due to lower costs. Some doctors have their electronic health records, but they work only for themselves.

3. eAdministration domain

According to expert interviews there were some remarks about the FIO system (the phonetic index of persons, Schengen information system), in which foreign workers are authenticated, and it is determined whether they have any restrictions against being able to work and why, and about the new system (RISK) which is less clear and more difficult to use for data searches than its predecessor. It was often stated that Slovenia is well-developed in the eAdministration domain.
On the other hand, it is not known how much these services are used among citizens. Experts stress that Slovenia collaborates in different pan-European projects, including STORK (Secure identity across borders linked; designed for assuring general European identifications) and IMI (Internal Market Information System; which should enable verification of educational or other certificates, and could be useful also for other services), and PCI (Projects of Common Interests), which merges more sector projects, etc.

### 3.1 eBusiness domain

Experts provided some critical opinions on the e-VEM system (the Slovenia One Stop Shop project); these criticisms mainly centred on the idea that it is too open, and misuse is possible (for example, multiple enterprises registered at a single address). On the other hand, some experts considered e-VEM to be a world pearl, as Slovenia received the United Nations Public Service prize for it in 2009.

Tax administration was exposed as especially problematic. Every foreigner in Slovenia for employment (except for students) has to obtain a tax number. To do this, he or she needs to enter an application in the register of those liable to taxation, a copy of a personal document, and registration of their certificate of temporary residence. This can also be done for family members supported by the employment, but is mandatory only in cases where these family members also live in Slovenia.

Discrepancies between Slovenia and other countries appear also in income tax declarations, particularly in the ability to receive tax relief by claiming children as dependents. In Slovenia, children can qualify as dependents until their 18th birthdays; for most foreign countries, the age is 21 (reflecting college attendance). In Slovenian legislation concerning foreigners, family members are more broadly defined than they are in the definitions for tax administration.

### 4. Analysis of households

In December 2009, a telephone survey was conducted on a sample of about 600 persons aged from 18 to 75 years (Vintar et al., 2010). This analysis focuses only on active Internet users in this group (that is, those who used the Internet in the last 3 months; n=365).

Respondents show most interest in the eHealth domain of PEGS, specifically in electronic management of health insurance, electronic linkage of Slovenian eHealth services with similar services in other EU countries (for example, allowing doctors in other countries to access personal health data, and Slovenian doctors to access data from healthcare provided abroad). The next most interesting domain is e-business: electronic management, recognition, editing of school or education, data exchange, and employment documentation.

The least interest is shown in using PEGS for the establishment of on-line businesses and the recognition of Slovenian public administration certificates in EU countries, and vice versa. However, the interest for public administration e-services is quite high. It is connected with age (younger respondents show less interest) and with employment status (students and the retired show less interest than do the employed and unemployed). Thus, the interest in public administration e-services is linked to specific life situations, and not surprisingly is higher among those who frequently travel to other EU countries.

The use of public administration services in other EU countries by Slovenians is not frequent - less than a tenth of respondents used them, more than half of them online. The countries where the respondents most often used these services are Germany, Italy, and Austria. Austria has developed the highest level of public administration e-services as reflected by frequency of use.

In comparison to similar Capgemini worldwide Consulting research, our survey showed a higher level of interest for electronic editing of health insurance, recognition of education or other qualifications, and recognition of marriage and birth certificates. Among the respondents who lived abroad for a month or longer, the interest in e-public administration domains in general is higher than for the respondents in the Capgemini Consulting survey. An exception occurs in the tax field, where respondents from our interviews are less interested than the Capgemini Consulting respondents.

Details regarding the specific elements of the survey are provided in the upcoming sections of the article.
4.1 Interest in public administration eServices

The highest interest (expressed on scale from 1 - not interested at all to 5 - very interested) in public administration e-services was shown for the electronic management of health insurance, as described previously (4.42), followed by electronic linkage of Slovenian eHealth services with similar services in other EU countries (4.19); electronic management, recognition, and alternation of school or education (4.1); data exchange and employment documentation (4.09); electronic management of pension insurance, official electronic data transfer (4.00); electronic management of change of residence (3.85); valid electronic transfer of receipts and extracts (3.78); taxation management documentation (3.71); intra-validity and recognition of electronic signatures (3.68); electronic editing of car registration and insurance (3.64); and the least for establishing businesses (3.59) and recognition of public administration certificates in other EU countries and vice versa (3.58). The breakdown of the participants in the survey according to each level of the 5-point Likert scale is shown in Table 1 below. (Vintar et al, 2010)

Table 1: Interest in public administration eServices

<table>
<thead>
<tr>
<th>% (n)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total (n)</th>
<th>Average</th>
<th>Standard deviation</th>
<th>Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not interested at all</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Valid electronic transfer of certificates and extracts (e.g. birth, marriage, residence) from Slovenian public administration to EU country public administration.</strong></td>
<td>7 (27)</td>
<td>8 (30)</td>
<td>24 (88)</td>
<td>20 (72)</td>
<td>41 (148)</td>
<td>365</td>
<td>3.78</td>
<td>1.03</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Exchange of data and documentation for arranging employment.</strong></td>
<td>8 (28)</td>
<td>2 (9)</td>
<td>13 (48)</td>
<td>26 (96)</td>
<td>51 (184)</td>
<td>365</td>
<td>4.09</td>
<td>1.41</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Electronic management of migrations (e.g. change of the permanent residence address)</strong></td>
<td>9 (34)</td>
<td>6 (21)</td>
<td>20 (72)</td>
<td>22 (80)</td>
<td>44 (159)</td>
<td>365</td>
<td>3.85</td>
<td>1.21</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Electronic management, acknowledgement and change of school or education.</strong></td>
<td>8 (27)</td>
<td>4 (14)</td>
<td>12 (42)</td>
<td>26 (94)</td>
<td>51 (187)</td>
<td>364</td>
<td>4.1</td>
<td>1.31</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Electronic linking of Slovenian eHealth services with similar services in other EU countries (e.g. access to my health data for doctor in other EU country and vice versa).</strong></td>
<td>6 (22)</td>
<td>3 (10)</td>
<td>14 (49)</td>
<td>22 (79)</td>
<td>56 (203)</td>
<td>363</td>
<td>4.19</td>
<td>1.35</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Electronic management of health insurance.</strong></td>
<td>5 (17)</td>
<td>1 (5)</td>
<td>8 (29)</td>
<td>1 (68)</td>
<td>67 (244)</td>
<td>363</td>
<td>4.42</td>
<td>1.31</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Electronic management of insurance for pension, official electronic data transfer.</strong></td>
<td>7 (24)</td>
<td>5 (17)</td>
<td>20 (72)</td>
<td>20 (73)</td>
<td>49 (179)</td>
<td>365</td>
<td>4.00</td>
<td>1.36</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Acknowledgement of Slovenian public administration certificates in other EU countries and vice versa.</strong></td>
<td>13 (45)</td>
<td>7 (26)</td>
<td>24 (86)</td>
<td>22 (77)</td>
<td>34 (122)</td>
<td>356</td>
<td>3.58</td>
<td>1.26</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Mutual validity and acknowledgement of digital signature.</strong></td>
<td>13 (46)</td>
<td>9 (31)</td>
<td>19 (68)</td>
<td>18 (66)</td>
<td>42 (152)</td>
<td>363</td>
<td>3.68</td>
<td>1.20</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Electronic management of car registration and insurance.</strong></td>
<td>10 (36)</td>
<td>10 (35)</td>
<td>22 (81)</td>
<td>23 (83)</td>
<td>35 (128)</td>
<td>363</td>
<td>3.64</td>
<td>1.29</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Establishing enterprises.</strong></td>
<td>12 (43)</td>
<td>9 (32)</td>
<td>21 (76)</td>
<td>23 (84)</td>
<td>34 (123)</td>
<td>358</td>
<td>3.59</td>
<td>1.19</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Exchange of documentation for managing taxes.</strong></td>
<td>11 (40)</td>
<td>6 (22)</td>
<td>21 (75)</td>
<td>26 (93)</td>
<td>37 (134)</td>
<td>364</td>
<td>3.71</td>
<td>1.15</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Source: Vintar et al. (2010).
4.2 Public administration services in EU member countries

Public administration services in other EU countries have been used by less than a tenth of respondents (8%). Those who already used them were asked if they did so online; more than half (56%) responded that they did use e-services in other countries. The share of respondents that also lived in another EU country is smaller (11%). Those who lived abroad were there usually less than a year; 29% lived there only one month, 27% more than six months, 14% more than six months but less than a year, and 14% more than one year.

4.3 Slovenia in the Capgemini research

In its 2009 study, Capgemini (Colclough and Tinholt, 2009) measured the “20 basic public services” since inception. Specifically, Capgemini assessed the availability of these services and the sophistication of them as offered through 14,000 public service provider websites across Europe. Europe shows continued steady progress in terms of full online availability. The overall EU27+ measure has risen to 71% in 2009 from 59% in 2007. In terms of sophistication, Europe stands at 83%, compared with 76% in 2007. The report pointed to a coordinated approach of development of a pan-European eGovernment service design and delivery within projects in the areas of: e-Procurement, eHealth, and e-ID (collectively known as the Services Directive). These projects benefit from common building blocks for solutions, service-oriented architectures, and inter-operability across EU. The Capgemini report demonstrates that the goal of improving eGovernment services extends beyond mere provision of services. There is no point in delivering eGovernment services if they are not used, or do not deliver the expected benefits to users. The end results must reflect the outcome they deliver for citizens, businesses, and government itself. The overall sophistication of service clusters with respect to features of eGovernment services is shown for the EU27+ in Figure 1. Slovenia is in the top five countries for which sophistication, availability, and the One Stop Shop approach is considered lagging behind when accessibility and user experiences and satisfaction are measured. The research report on the other hand praises Slovenia’s portal site http://e-uprava.gov.si/euprava/ as an all-in-one gateway both to the Slovenian government and EU initiatives; and Slovenia’s One Stop Shop for companies, e-VEM, which received the United Nations Public Service Award.

Source: 8th Benchmark Measurement, Capgemini, November 2009.

**Figure 1:** Sophistication of service clusters in the EU27+
The Capgemini report states that “the Pan-EU eGovernment for most countries is a national affair. No countries have explicit targets for cross-border service development. Newer [EU member states] would appear to look more to European policy for guidance (i2010), potentially as in some of these countries the management of eGovernment and structural funds falls within the same organization. A growing and now considerable number of EU countries have elected however to participate in pan-European large scale pilots. The four major CIP ICT PSP (competitiveness and innovation program) pilots are actively supported, notably by several of the higher performing countries. Austria for example is active across all large-scale CIP pilots (pilot A). This affords the opportunity to observe, learn from, and potentially influence technology developments within Europe”.

Figure 2 shows the e-Procurement process as it has developed in Slovenia. In the Capgemini report it is described as a country that has one of the best scores for the e-notification sub-phase, but its Pre-Award Process indicator is under the EU27+ average. Its e-award and e-submission scores are among the lowest in Europe; Slovenians and foreigners can access a mandatory national e-procurement platform free of charge and without prior registration.

Source: 8th Benchmark Measurement, Capgemini, November 2009.

Figure 2: eProcurement process development in Slovenia

5. Conclusions

The development of pan-European IT service companies will bring great benefits to EU citizens; it will facilitate the settlement of their affairs with the government, especially when their affairs occur outside their home countries. To achieve this goal, we need interoperability, which plays a crucial role in the development of more efficient, quality, and overall user-friendly services. Interoperability is also critical in establishing a single European market. It is therefore not surprising that at the European Ministerial Conference in Lisbon (2007) interoperability was at the top of the four strategic objectives of eGovernment. They also point out that the European Union through the ICT Policy Support Programme (PCP) project will specifically promote the development of e-procurement and the mutual recognition of electronic identification. In addition, the EU will promote the establishment of interoperability in conjunction with the requirements of the Services Directive. We expect that the Member States will set new priority areas of development of pan-European services. In line with this orientation, the cross-border interoperability as the key to the development of pan-European services was also one of the key strategic directives of the Slovenian EU Council Presidency in the first half of 2008.
Pan-European IT services are closely connected with interoperability of services and products in the field of ICT as one of the most important conditions for successful development of an information society. The ICT market is constantly evolving, spurred by a globalised approach, competition, liberalisation of telecommunications services, convergence of ICT, and increasingly also by media technologies and services. Therefore, we can summarise the results from the telephone survey in two ways:

- Interviewers opinion was that eGovernment services are very complex and use a lot of resources during their introduction but are still needed even in cases where they are not well accepted or used by users; and
- Users’ perspective should be more accurately used in designing and in prioritising which services to be introduced.

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Predictive Analytics in the Public Sector: Using Data Mining to Assist Better Target Selection for Audit

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Abstract: Revenue, the Irish Tax and Customs Authority, has been developing the use of data mining techniques as part of a process of putting analytics at the core of its business processes. Recent data mining projects, which have been piloted successfully, have developed predictive models to assist in the better targeting of taxpayers for possible non-compliance/tax evasion, and liquidation. The models aim, for example, to predict the likelihood of a case yielding in the event of an intervention, such as an audit. Evaluation cases have been worked in the field and the hit rate was approximately 75%. In addition, all audits completed by Revenue in the year after the models had been created were assessed using the model probability to yield score, and a significant correlation exists between the expected and actual outcome of the audits. The models are now being developed further, and are in full production in 2011. Critical factors for model success include rigorous statistical analyses, good data quality, software, teamwork, timing, resources and consistent case profiling/treatments. The models are developed using SAS Enterprise Miner and SAS Enterprise Guide. This work is a good example of the applicability of tools developed for one purpose (e.g. Credit Scoring for Banking and Insurance) having multiple other potential applications. This paper shows how the application of advanced analytics can add value to the work of Tax and Customs authorities, by leveraging existing data in a robust and flexible way to reduce costs by better targeting cases for interventions. Analytics can thus greatly support the business to make better-informed decisions.

Keywords: tax; predictive analytics; data mining; public sector; Ireland

1. Introduction: Revenue and Ireland

The Irish Revenue Commissioners were established by statute in 1923. Their mission is to serve the community by fairly and efficiently collecting taxes and duties and implementing Customs controls. In broad terms Revenue’s work includes:

- Assessing, collecting and managing taxes and duties that account for over 93% of Exchequer revenue;
- Administering the Customs regime for the control of imports and exports and collection of duties and levies on behalf of the EU;
- Working in co-operation with other state agencies in the fight against drugs and in other cross departmental initiatives;
- Carrying out agency work for other departments;
- Collection of PRSI (Pay Related Social Insurance) for the Department of Social Protection;
- Provision of policy advice on taxation issues.

Net total receipts in 2009 were EUR 33bn. In 2010 receipts were ~ EUR 31.5bn.

Increasingly, Revenue is applying advanced analytics in its business processes. One of these initiatives is applying predictive analytical techniques to assist in better case selection for audit. This paper describes this approach as applied recently by Revenue.

2. Revenue’s research and analytics branch

Revenue’s Research and Analytics Branch conducts program-wide and macro-level research at a corporate level. The branch conducts analyses to transform data into information often using SAS analytical software. The branch’s work in Revenue includes large sample surveys, data mining (population profiling/customer segmentation, pattern recognition, forecasting, predictive modelling), data quality exercises, experimental design for evidence based decision support, economic research and risk analysis. The branch uses both Revenue data and data from other sources. This work enables Revenue to make better use of its data and provides an improved understanding of the taxpayer population. The results are used to better target services to customers and to improve compliance.

This paper focuses on a number of recent uses of predictive analytics in Revenue.
2.1 Business context

Revenue has a dual focus on its taxpayers. The first is on customer service, and the second is on compliance. RAB have conducted a number of exercises using analytics with a customer service focus (for example, see Clancy et al., 2010). This paper will focus the use of analytics from a compliance perspective, with the following types of targets:

- Likelihood to yield if audited
- Likely amount of yield if audited
- Likelihood to liquidate (business failure)

The aim of using analytics in Revenue is to show how analytics can assist the development of effective business strategies for Revenue, therefore optimising the use of Revenue resources. Analytics can demonstrably reduce costs, increase yields, and improve Revenue’s service to taxpayers. Revenue is one of a number of tax authorities that employ analytics to improve business processes.

3. Why use predictive analytics for target selection?

Increasingly analytics are being used in companies and entities that are seeking means of making smarter decisions and getting better results by utilising their data assets, advances in computational power and software and a new emerging class of analysts who can extract the knowledge from the vast amounts of data and information currently available. Thought leaders in this area are offering sound guidance to those who wish to improve how they go about their business and achieve their goals. Revenue is pursuing the use of analytics as it recognises the value that can be gained by such an approach. The reader is referred to a number of recent publications for a more detailed exposition of why using analytics is making increasing sense in both private and public sector (Davenport & Harris, 2007; Davis et al., 2006; Miller et al., 2006; Davenport & Harris, 2010).

3.1 Data and variables: Data integration

The primary source of data for the predictive models is Revenue’s sophisticated risk analysis programme, REAP (Risk Evaluation Analysis and Profiling), which electronically screens taxpayers’ data covering several years. It uses ~300 business rules to quantify risk for approx. 800,000 taxpayer entities, and a risk run is created at least three times annually. Predictive analytics can be used to extend from the quantification of risk in a case, to predicting, for example, likelihood of yield, if a case were to be audited, and the potential amount of yield, or likelihood to liquidate. The inputs for predictive models were therefore the outputs from the REAP system.

As with any Data Mining exercise, there is considerable effort required at the data integration stage, before modelling proper can begin. A process of ETL (Extraction, Transfer and Load) must be conducted, and RAB use SAS DI Studio (DI = Data Integration). The purpose of using this DI tool is to establish a process that would be scalable and semi-automatic. Data from the REAP system and other sources in Revenue’s Data Warehouse Environment are sourced and processed. Inherent in any data mining exercise is a review of data quality, which is not a trivial matter, and needs care and attention. The REAP system data is an opportunistic source of data, i.e. it is not designed specifically for predictive analytics. However, it is good quality in its format and completeness, which offers a solid platform for analysis. It is also readily available. Extensive work was required to understand the business context, the logic of the rules in REAP, and the underlying data that leads to those rules firing. A number of summarisations of the REAP system are produced for use in modelling, these included a table with the frequency of the rules fired in each case, and a binary indicator for rules firing/ not firing. In instances where data entailed many rows per entity, transpositions were performed, to create a flat file with one row per entity. Variables from the REAP system that summarise certain classes of rules, such as monetary risk and behaviour, are also assessed and incorporated for analysis. A target variable must be created for the training data (e.g. cases that had been audited in the previous two years). The target can be set as a binary target, e.g. where any yield over EUR 2,500 = ‘1’, and yield < EUR 2500 = ‘0’. The reason why the target should be set at EUR 2,500 is to avoid modelling for cases where the yield will be below the cost of a typical audit. If the target is the monetary amount of yield, this can be the second stage of a two stage model with the binary yield/ no yield as the first stage. In the case of liquidations, a database of known liquidations is used to train the model, using the profiles of the cases in REAP before the case liquidated. Additional data can include variables such as geography and economic sector.
This data integration process results in an ABT (Analytics Base Table) of one row per taxpayer with all of the attributes of interest as variables included for each taxpayer. These ABTs form the core inputs into the models. There will be a sub set where the target variable is populated (i.e. the data to be used to create the model). The bulk of the ABT will describe the population, which will be scored once the model is constructed. It should be noted that a lengthy exploratory analysis phase at univariate, bivariate and multivariate levels should be factored in and conducted with the raw input data and the final ABT. These univariate and bivariate analyses are performed by RAB in SAS Enterprise Guide (Ver. 4.3). Many variables are transformed to allow for better modelling, for example, to improve normality assumptions for continuous variables, or to optimally bin variables to better predict the target variable. ‘Unsupervised’ techniques (i.e. analyses without a target) are also conducted on the data, to further understand the data before predictive models are attempted. These unsupervised techniques can typically include cluster analysis and association analysis. If time allows, a full segmentation of the ABT can prove fruitful prior to modelling.

4. Data mining methodology

A predictive model by its nature has a target or interest. It can therefore be described as a ‘Supervised’ technique. Cases that have been audited (and been concluded), or cases that have gone into liquidation in the past can be used to train models. A predictive model produces a probability score for current and future cases of the likelihood of some outcome of interest occurring. This score can be deployed and used for decision support, e.g. case selection for audit. If the target is binary, both positive and negative outcomes need to be available to create a model to score unknown cases. If the target is numeric, e.g. monetary, a good range of values can be helpful.

RAB use SAS Enterprise Miner as their tool of choice for producing predictive models. Essentially the modelling process can be summarised as SEMMA: Sample, Explore, Modify, Model, & Assess. This process has been developed by SAS and it forms a solid framework for analysis. Scoring the full population completes the process. As cases are worked/ events happen, these can be used to improve the model. It is a very iterative process, with backwards and forwards movement within the SEMMA steps. Figure 1 illustrates a typical process flow.

![Figure 1: Screen grab of SAS E. Miner project, showing a SEMMA process flow](image)

4.1 Sample

The ABT having been created, this essentially reflects a snapshot of the population of interest. Revenue is in the relatively luxurious position of not needing to worry about sampling as others may...
have to, who do not have access to full population data. However, training cases, or cases with a
known outcome of interest, e.g. audit result, are often a biased sample. There are a number of ways
of addressing this bias. One is to utilise a method known as 'Reject Inference'. This is a common
method used in Banking and Insurance, wherein cases that have been accepted, for example for a
loan, form a biased sample for modelling. Reject Inference assigns an imputed outcome to cases
(based on their profile) that never had a loan, so that they can be used in further modelling. This
method has been used successfully by Revenue in instances where audit cases, which form an
analogous biased training dataset, can be augmented by cases as yet not audited.

Another means of addressing bias is to conduct random sample exercises, and record the outcome of
interest for the random cases. This has two advantages. Firstly, it gives an approximation of the true
proportions of, for example, a binary target’s two levels in the population, which may be very different
to the proportions in biased training data. These proportions can be used to adjust any model using
biased training data by telling SAS E. Miner in the Decisions Processing function the approximation
for the true population proportions. Secondly, a random sample may surface factors that lead to an
outcome of interest, that are not typically used in case selection, thus giving a better picture of the
overall population, for example the full range of taxpayer risk types. Revenue has therefore used data
from its Random Audit program as inputs to training predictive models.

Over-sampling can be used when modelling rare events, such as liquidations. This is a process
whereby when the target is binary (0,1), for example, a 100% representation of the ’1’s is included in
the sample, and a complimentary random sample of ’0’s is selected from the population, often as a
similar proportion. Thus one may have 50:50 proportioned ’1’s and ’0’s in the training data, even
though the proportion of ’1’s in the population is very low, e.g. less than 1%. The purpose of this
exercise is to avoid creating a model that is very accurate, but that classifies every case as a ’0’.

Data partition also occurs at the sampling stage. This is where the training data is divided randomly
into two or three groups. These groups are used for different aspects of the modelling process. In
SAS they are labelled ’Training’, ’Validation’, and ’Test’. The proportions of cases in each category
can vary according to the modeller’s preferences and the data available. A model will be created
using the training data, often judged by the validation data, and finally verified by the test data (which
is not used in model creation). One must maximise the data available for modelling, while allowing
enough data for validation. Typically proportions such as 60:20:20, 70:30:0 and 40:30:30 are used,
depending on the model method used and the amount of training data available.

4.2 Explore
A thorough statistical exploratory analysis must take place next, before modelling. Univariate,
bivariate and in some instances multivariate (perhaps ‘unsupervised’) analyses should be conducted.
This can surface any data quality issues, data distribution and content should be assessed, outliers
identified etc. The findings from this analysis may demand that the ABT be reconfigured, or that the
raw data is augmented, or that new derived variables be created. This process then leads to the next
stage of data modification.

4.3 Modify
Nearly always in predictive modelling, it is wise to perform some transformations of the data. Typically
this involves log (or other) transformations of highly skewed numeric variables, imputation of values
where they are missing in the data, binning of categorical variables to remove rare levels, ranking of
numeric data and creating a monotonic relationship between independent variables and the target
variable. This last method is typically achieved by RAB using SAS Credit Scoring ‘Interactive
Grouping’ node, which allows manual adjustment of the bins in each variable to maintain their
usefulness at predicting the target, but to also ensure that they do so in a logical way.

4.4 Model
Once the process flow has been developed to a sufficient point, modelling can begin.

Several model methods are available in SAS E. Miner. Typically, a regression (for binary targets use
logistic regression), a decision tree, and a neural network are chosen to prepare models. Various
parameters can be set to suit the model requirements (see Sarma, 2007). For example, with logistic
regression, a logit stepwise regression can be specified. The ranges of the options that are available in SAS E. Miner are beyond the scope of this paper, and the reader is referred to www.sas.com for details. Often, once models are produced, there is an iterative process involving returning to earlier steps in the model process flow. Issues heretofore unseen can be highlighted in the model results, and the modeller needs to adjust for problems like over-fitting. Typically many parameter changes will be made to maximise the predictive performance of the models, by for example making changes that increase the lift provided by the models, and by getting similar results for both training and validation data (i.e. making the model more robust). It should be noted however, that tweaking model parameters rarely exceeds the addition of new variables as a means of improving model performance.

**Figure 2:** Results screen from a neural network

The outputs from each model are examined and then their comparative performance is assessed. Outputs from a neural network (Figure 2) and a decision tree (Figure 3) are shown as examples here.

**Figure 3:** Results screen from a decision tree
4.5 Assessment

Assessing models can be done in a number of ways. Three main methods are:

- Within model process-flow assessment
- Sample tests of cases ranked by a model
- Back validation of model with subsequent events.

This section covers the first of these three; the next two are covered under the Results section below. SAS E. Miner offers an assessment node. There are many criteria for assessing the performance of a model. As an example, here a logistic regression with a binary target will be used. Criteria such as misclassification or average square error can be used, but often the most effective measure of the success of a model is the ROC curve (Receiver Operating Characteristic). A ROC curve shows the values of the true positive fraction and the false positive fraction at different cut-off values (Sarma, 2007). The cut-off values can be set to maximise the number of true positives in a set of cases. A set of ROC charts can be produced, that compares Training, Validation and Test data (see Figure 4), for all of the models fed into the assessment node. Essentially, the model that looks most similar across the three modelling data sets, and also has the maximum distance between the curve and the diagonal line (which represents no predictive power, i.e. an equivalent to flipping a coin), is usually the best model to use for scoring the full population/new cases.

![Figure 4: Results screen from a model comparison node](image)

5. Results and evaluation

A number of successful models have been produced by RAB. Following within modelling process validation, these have also been field tested and back validated with success.

Each model has been used to score the population of relevance. These scores have been assessed, binned into deciles and demi-deciles, and have been used to rank the case base in descending order of likelihood. Cut-offs have been set based on criteria such as misclassification rate and the amount of cases that can be worked based on resources available.

For this paper the example results to be shown are for the Yield model, i.e. the Likelihood to yield if audited model.

6. Yield prediction model

A successful pilot exercise testing a predictive model focused on yield was conducted in 2009/2010. The pilot exercise resulted in a 3:1 hit rate for the cases provided for working. Both case specific reviews and ‘Back Validation’ against all closed audits suggested that the approach was robust.
Following on from this, a new predictive model was created using similar Data Mining techniques (the pilot used Credit Scoring, the subsequent model used a Neural Network model). The model uses data from the most recent REAP Risk run available as inputs, and was trained with closed audits from prior years, as before. As noted above, the purpose of the model is to identify cases, which have a similar profile to known yielding audits, and to rank the likelihood of yield in the event of an audit of those cases. The full case base receives a probability score, and for the purposes of this model a cut-off of 80% probability to yield has been set. This cut-off, which in effect creates a binary Yes/No indicator for each case, has been provided to auditors for case selection, through the REAP system. As such, each case selector and worker can access some of the power of this predictive analytics model. Approximately 40,000 cases (5% of case base) fired the rule. As with any model, feedback is critical for evaluation and model improvement.

![Training cases, with yielding and non-yielding, by model probability score](image)

**Figure 5**: Training cases, with yielding and non-yielding, by model probability score. X axis: Probability to yield left to right, high to low, Y axis: Training cases, frequency, events= yielding cases, non events = non yielding

At the 0.8 (80%) cut-off shown by the treble red line, and above (i.e. to the left) in Figure 5, the majority of cases were yielding in training data. Thus the focus was placed on cases scoring similarly to these cases in the full risk run population.

An evaluation of the Predictive model using the latest REAP run was conducted in mid January 2011. The method used was ‘Back Validation’ of the 2010 yield prediction model, with closed audits (i.e. known results) from 2010. These audits were not used in the training of the model; hence the model can be assessed on the basis of how well it predicted events unknown to it at the time of its creation. The results were very positive, showing a strong relationship between predicted likelihood to yield and actual average yield. Each point on the graph below represents approximately 475 cases (total of 9500 cases represented in Figure 6). There is a strong positive correlation between realised yield and predicted audit outcome, i.e. as the probability to yield increases so too does the average (median) yield. This suggests that the model is robust and a good case selection tool. Cases from the uppermost probability deciles have yield on average twice that of cases from the lowermost deciles (Figure 7). Subsequent back validations continue to show that the model is performing well.

7. Conclusions

The Yield model has since been rerun a number of times (most recently the late 2011 REAP run), with modifications based on feedback, and incorporated in the nationally disseminated current REAP run in the form of an indicator rule for cases where there is a high probability to yield. In effect, the model output is available to case selectors. This qualifies the model as being in production. As cases are selected using this rule, results will be assessed and incorporated into future models. In addition, a liquidation probability model has also been made available by similar means, having been validated with events since model creation.
Figure 6: Correlation between modelled likelihood to yield and actual audit yield, probability demi-deciles and median yield per decile

Figure 7: Median yield per decile of model probability to yield

RAB is developing more models for the business (e.g. quantity of monetary yield, using a two-stage model, models for specific economic sectors, regional models etc.). RAB continues to evaluate models through field-testing, in co-operation with Revenue regions. RAB thus hopes to extract more value from the data and information Revenue already has, and is increasingly making use of the power of analytics, and is making analytics more central to how Revenue performs its work.

References
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Collaborative Network Analysis of two eGovernment Conferences: Are we Building a Community?

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Abstract: In the last two decades, eGovernment research matured into an active scientific field with a number of publication venues, many of them taking form of regular annual conferences. In this paper, we address the central question of whether the active researchers of these different venues converge towards a joint eGovernment research community. To answer this question, we perform a comparative analysis of the collaborative networks of co-authorship relationships between scholars that published papers at the two major conferences in the field: the European Conference on eGovernment, and the International Conference on eGovernment. Surprisingly, the obtained results show that each conference has built its own relatively stable community, and there are only weak ties that do not really indicate an emergence of a joint eGovernment scientific community.

Keywords: co-authorship network, scientific community, social network analysis

1. Introduction

eGovernment research (EGR) focuses on studying the use of information and communication technology in public administration and government activities. In the last two decades, the interest in EGR has dramatically grown, resulting in its evolution into an active scientific field. EGR scholars established a number of formal and informal communication channels to disseminate knowledge and research results. Among them, academic conferences comprise the exchange of information and reinstatement of discussion among the participants through the formal and informal patterns, which represent a useful feedback for the improvement of scholars’ work (Lisèe et al. 2008). In the relatively young and dynamic area of eGovernment, a number of conferences have emerged. Three of them get most of the attention from the EGR scholars: International Conference on eGovernment (EGOV), European Conference on eGovernment (ECEG), and International Conference on Digital Government Research. Two other more general conferences hold regular sections on eGovernment: Hawaii International Conference on System Sciences and the European Conference on Information Systems.

Due to the evident and intensive short-term growth, many authors have analysed the process of development and the state-of-the-art of the EGR field and its community. To perform their studies, authors have focused on the abovementioned conferences and other EGR publication venues as primary data sources. Authors have considered maturity (Grönlund 2004, Grönlund and Andersson 2006) and the development (Heeks and Bailur 2007) of EGR field, as well as the analysis of the nature of contributions and the evolution of research interests (Bannister and Connolly 2010). These studies vary both in terms of the central focus of the EGR analysis and its aims as well as analytical methodology used.

In his first study, Grönlund (2004) proposes a model for measuring the maturity of eGovernment research and following that model he analyses papers published in the proceedings of three conferences, i.e., EGOV, HICSS, and ECEG. The study categorizes each paper based on the research rigor and relevance into several categories defined by the model. The results of the categorization analysis show that the studied papers lack in theory generation and theory testing, as well as that the content of the papers frequently involve case stories and product descriptions. Thus, Grönlund finds the field immature and repeats the study in 2006 for papers published at the EGOV conference (Grönlund and Andersson 2006). The results, obtained following the same model, show increased research collaboration between various institutions as well as an increase in the publication standards in terms of number of referenced papers and research rigor. However, there is only a slight progress recognized in terms of theory forming and testing. These findings are confirmed also through the results of the analysis undertaken by Heeks and Bailur (2007), in which they study a sample of eighty-four papers published in the Information Polity and Government Information Quarterly journals, as well as the papers published in the ECEG conference proceedings. They recognize a lack of clarity, rigor, and generalization that would lead to a common eGovernment theoretical framework and identify these to be common features of most of eGovernment related papers included in the analysis.
Finally, Bannister and Connolly’s analysis (2010) which follows a similar methodology to Grönlund’s and uses it for the study of papers published in the ECEG proceedings, also confirms some of the above conclusions; the majority of conference contributions are descriptive and/or conceptual in nature. However, they also show that the trends regarding the topics addressed and research approaches used in the studied papers indicate a more analytical and investigative research.

The main analytical approach used in the above exemplary studies is content analysis (Busch et. al 2005) of articles used to identify article types, methodologies, and data used or topics and issues addressed. Although content analysis is widely used approach in the study of scientific communication, it is often limited with the number of papers we can include in the study and therefore it is also often limited to a single publication venue or a limited sample of papers from different venues. Scaling up those studies to a large number of papers and venues can be a serious challenge and mostly prohibitive.

In our previous studies (Erman and Todorovski 2009, 2010), we proposed an alternative approach based on social network analysis (Nooy et. al 2005). We focus on qualitative analysis of networks of various types of scientific communication (collaboration and citation) among researchers in the EGR field. One of the limitations of our previous studies is that they focused on the papers published at a single publication venue, the EGOV conference. In this paper, we overcome this limitation by extending our study of the EGOV collaboration networks to the ECEG conference. More specifically, we observe the networks of relations between authors publishing at the two conferences, where the relations represent co-authorships of joint papers. We build these networks using the electronic manuscripts of the papers published in the respective proceedings in the five-year period from 2005 to 2009. The main aim of this paper is then to compare the networks emerging from ECEG and EGOV to the joint network of co-authorships between all the authors from both conferences. By this comparison, we can check the validity of our central hypothesis that through the time, the scholars publishing at these two conferences converge towards a joint community of eGovernment researchers. We also use the collaborative network analysis to identify the most prolific authors in the community and identify emerging sub-communities dealing with specific eGovernment topics.

The rest of the paper is organized as follows. Section 2 introduces the notion of scientific community and collaborative co-authorship network as formalism for representing and analysing communities. In continuation, it presents the data used in this study and the resulting collaborative networks for the ECEG, EGOV and the joint community. Section 3 presents the results of the comparative analysis of the networks. Section 4 discusses and compares the results, putting them in the context of related work. Finally, Section 5 draws conclusions and outlines the directions for further research.

2. Scientific community as collaboration

Scientific community, defined as a totality of working and interacting scientists, is usually quantified through the analysis of scientific publications (Mali 1994). The most important aspect of scientific community is the communication between scientists, also known as scholarly communication. On one hand, scholarly communication has several manifestations, one of them being collaboration between scientists. Following the Bordons and Gómez’s definition (2001), scientific collaboration identifies the cooperation of two or more scientists on a joint research project, where they share different resources. On the other hand, scholarly communication mainly involves the dissemination of information and knowledge among scientists through formal and informal communication channels (Borgman 1990).

Collaboration is most frequently reflected through the joint authorship and publication of different types of scientific documents and therefore measured through the analysis of co-authorship collaboration in publications. The most commonly used methods to perform such an analysis are methods of scientometrics and bibliometrics. The use of bibliometric and scientometric analysis has several advantages compared to other methodological approaches in the study of collaboration. It enables the analysis of large amount of data leading to a higher significance of the obtained results. The results can also be verified by repeated analysis and are therefore very reliable. (Bordons and Gómez 2001, Borgman 1990).

We should note however, that there exist limitations related to the study of scientific collaboration through publications and to the bibliometric studies in general. The first is related to the practice of making colleagues or superiors “honorary co-authors” for purely social reasons. The second is
scientific collaboration does not necessarily lead to co-authored papers. However, a co-authorship network analysis is still widely used as a proxy for the study of collaboration (Bordons and Gómez 2001).

Published scientific articles and papers represent the most frequently used data source for bibliometric and scientometric studies. These studies usually analyse the papers published in scientific journals, whereas conference proceedings are often neglected. But as Glänzel and his colleagues (2006) argue, scientific conferences represent the very important communication channel, since they comprise the exchange of information and encourage the discussion among the participants. In this sense, such scientific meetings capture the informal part of scholarly communication, as well as the formal part represented by conference proceedings.

Following the dispositions presented above, in this paper, we are interested in the analysis of eGovernment conference community by studying the co-authorship collaboration of researchers in the field. More precisely, we concentrate on a community formed through publishing papers in the proceeding of two major eGovernment conferences, ECEG and EGOV in the period from 2005 to 2009. The most obvious way to represent the notion of co-authorship is the use of network, where the nodes represent individual scientists, and links among them represent co-authorship relations. Therefore, we apply social network analysis approach to study the network of co-authorships in the selected papers, which is proven to be a very useful method of bibliometric and scientometric research. In the continuation of this section, we introduce the data and corresponding co-authorship networks.

2.1 Data description

We build the data set for this study as extension of the data collected in Erman and Todorovski (2010). Hence, the bibliographic data about papers from EGOV conference is upgraded with data about papers published in the ECEG proceedings. For both conferences, we included papers published from 2005 to 2009. The extended data set includes 475 papers; 314 new papers from the ECEG proceedings and 161 papers from the EGOV proceedings. These 475 papers were co-authored by 765 different researchers.

The graphs of Figure 1 depict the dynamics of the number of papers and the number of authors through years for each conference. At a first glance, we can see that EGOV conference proceedings publish lower number of papers than ECEG conference proceedings. The same observation is true also for the number of collaborating authors. The described difference should be ascribed to the fact that the acceptance criteria for publication in EGOV conference proceedings are very strict since the review process has been improved in 2005. Papers that are not accepted for publication in the main EGOV conference proceedings are considered for publication in the second-tier (communication) proceedings, which are not included in our study.

On the other hand, the number of papers published at EGOV conference is relatively stable and ranges from 30 to 40 papers per year. In contrast, the number of papers published at the ECEG conference fluctuates between 50 and 83 papers per year. The similar pattern is observed when the number of authors is considered; the number of authors at the EGOV conference varies between 70 and 100, whereas at ECEG it varies from 100 to 180 authors per year.

2.2 From data to co-authorship network

The bibliographic data can be transformed to a co-authorship network following a simple procedure. For each paper, we collect the list of paper authors $A$. For each author in $A$, we add a corresponding node to the network, if one has not been there yet. If the list consists of a single author we proceed with the next paper, since it does not introduces any co-authorship links in the network. Otherwise, for each pair of authors from $A$, we add an undirected link (edge) connecting the corresponding network nodes. If the link has been present already, we increase its weight by one; if the link is new, we set its weight to 1. Thus, the weight assigned to an edge connecting two nodes in the network denotes the number of papers that the corresponding two researchers co-authored.
Figure 1: Number of papers published in the proceedings of the ECEG (left-hand side) and EGOV (right-hand side) conferences and number of authors thereof in the period from 2005 to 2009.

Following the outlined procedure, we generated five weighted undirected co-authorship networks for the yearly proceedings of ECEG and EGOV as well as a joint network of both proceedings for each year from 2005 to 2009. Using the single-year networks, we also constructed five “cumulative” co-authorship networks; the first network contains data from 2005 and each successive network is built by joining the next year network to the current one.
Table 1 summarizes the basic properties of the five cumulative networks for the three analyzed communities, i.e., EGOV, ECEG and the joint community. The number of nodes corresponds to the number of authors, while the number of edges corresponds to the number of co-authorships between pairs of researchers. The percentage of edges with weight larger than one represents the portion of research pairs that co-authored more than one paper, and the density represents the portion of all possible edges that are present in the observed network.

As expected, all three communities induce steadily growing networks both in terms of the number of nodes and edges. This increase in size is being strictly followed by density decrease. The ECEG community network is very sparse and has three times lower density than EGOV network in 2005. Densities of both networks, as new authors enter both communities, decline, and the more rapid decline is observed in the EGOV network. The low density of ECEG community network is reflected in the sparseness of the joint community network, where in 2009 only 0.33% of all possible edges are present. The very low density of the joint network might also indicate the lack of communication between the ECEG and EGOV community.

Table 1: Basic properties of the “cumulative” co-authorship networks for the ECEG, EGOV, and joint ECEG+EGOV community

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ECEG</td>
<td>#nodes</td>
<td>123</td>
<td>192</td>
<td>266</td>
<td>353</td>
<td>491</td>
</tr>
<tr>
<td></td>
<td>#edges</td>
<td>92</td>
<td>164</td>
<td>234</td>
<td>326</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>%edges(w&gt;1)</td>
<td>2.2</td>
<td>9.8</td>
<td>12.0</td>
<td>12.3</td>
<td>11.4</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>0.0123</td>
<td>0.0089</td>
<td>0.0065</td>
<td>0.0052</td>
<td>0.0041</td>
</tr>
<tr>
<td>EGOV</td>
<td>#nodes</td>
<td>74</td>
<td>136</td>
<td>208</td>
<td>262</td>
<td>307</td>
</tr>
<tr>
<td></td>
<td>#edges</td>
<td>91</td>
<td>170</td>
<td>295</td>
<td>395</td>
<td>467</td>
</tr>
<tr>
<td></td>
<td>%edges(w&gt;1)</td>
<td>0.0</td>
<td>1.2</td>
<td>7.5</td>
<td>7.8</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>0.0337</td>
<td>0.0185</td>
<td>0.0137</td>
<td>0.0116</td>
<td>0.0100</td>
</tr>
<tr>
<td>ECEG+EGOV</td>
<td>#nodes</td>
<td>194</td>
<td>318</td>
<td>456</td>
<td>588</td>
<td>766</td>
</tr>
<tr>
<td></td>
<td>#edges</td>
<td>183</td>
<td>328</td>
<td>516</td>
<td>706</td>
<td>950</td>
</tr>
<tr>
<td></td>
<td>%edges(w&gt;1)</td>
<td>1.1</td>
<td>7.0</td>
<td>11.1</td>
<td>10.9</td>
<td>11.2</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>0.0098</td>
<td>0.0065</td>
<td>0.0050</td>
<td>0.0041</td>
<td>0.0033</td>
</tr>
</tbody>
</table>

On the other hand, the portion of edges with weight larger than one is higher in case of ECEG community networks stabilizing at the level of 12% in the last three years, indicating the establishment of long-term collaboration between community members. The higher collaboration level in ECEG community influences the increase of collaboration activity in the joint community. The higher percentage of long-term collaboration edges might be also due to the fact that ECEG conference proceedings include more papers per year.

To further explore these initial conjectures based on the basic network properties, we will continue with deeper analysis of the structural properties and dynamics of the observed networks.

3. Structure and dynamics of the EGR community

To perform the analysis of the built cumulative co-authorship networks, we use Pajek software tool (Nooy et. al 2005). The results are presented in three subsections: in the first one, we quantify and analyze the dynamic change of the EGOV, ECEG and joint networks from 2005 to 2009; second section identifies the most active and most collaborative authors in the joint community; and in the third subsection we analyze the joint community structure in terms of subgroups of co-authoring researchers, their geographical distribution, and the thematic topics of their research. In each section, we also compare the results with the extract from our previous research (Erman and Todorovski 2010) emphasizing the aspects of interaction between the two observed conferences.

3.1 Comparative community dynamics

Table 2 summarizes the results of the analysis of the dynamics of the three observed communities. We first observe the percentage of “stable” community members, that is, “returning” scholars that published their papers in more than one proceeding. At the beginning of the observation period, in 2005, all authors are considered to be new to the community. The portion of returning authors in both communities is very high: more than half of the authors publish their papers repeatedly at the same
conference. The percentage steadily increased to more than 75% in all three communities. A notable exception is the drop to 72% in 2005-2009 ECEG community, which is due to the fact that a large number of 180 authors contributed 83 papers to the 2009 ECEG proceedings. This is in contrast with the tightly constrained EGOV publishing policy, where small number of accepted papers stabilized the community with up to 85% of returning authors. The latter situation can be considered as a sign of a stabilizing community.

The joint community shows similar stabilizing trend with 77% returning authors. However, note that the joint community is merely a “joined” community network. A surprisingly low percentage of authors (1.6) published papers at both ECEG and EGOV in 2005. The percentage steadily increases through the years, and hardly hit 4% in 2007, but still remains below 5%. This indicates that we still have to wait for the co-existence of different eGovernment scientific venues to evolve into a synergy of real joint eGovernment scientific community.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ECEG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#authors</td>
<td>123</td>
<td>192</td>
<td>266</td>
<td>353</td>
<td>491</td>
</tr>
<tr>
<td>%returning</td>
<td>0.0</td>
<td>64.1</td>
<td>72.2</td>
<td>75.4</td>
<td>71.9</td>
</tr>
<tr>
<td>#papers</td>
<td>68</td>
<td>118</td>
<td>175</td>
<td>231</td>
<td>314</td>
</tr>
<tr>
<td>%co-authored</td>
<td>54.4</td>
<td>57.6</td>
<td>60.6</td>
<td>64.1</td>
<td>66.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EGOV</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>#authors</td>
<td>74</td>
<td>136</td>
<td>208</td>
<td>262</td>
<td>307</td>
</tr>
<tr>
<td>%returning</td>
<td>0.0</td>
<td>54.4</td>
<td>65.4</td>
<td>79.4</td>
<td>85.3</td>
</tr>
<tr>
<td>#papers</td>
<td>30</td>
<td>59</td>
<td>95</td>
<td>127</td>
<td>161</td>
</tr>
<tr>
<td>%co-authored</td>
<td>66.7</td>
<td>69</td>
<td>75.8</td>
<td>78.0</td>
<td>80.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECEG+EGOV</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>#authors</td>
<td>194</td>
<td>318</td>
<td>456</td>
<td>588</td>
<td>765</td>
</tr>
<tr>
<td>%returning</td>
<td>0.0</td>
<td>61.0</td>
<td>69.7</td>
<td>77.5</td>
<td>76.9</td>
</tr>
<tr>
<td>%joint</td>
<td>1.6</td>
<td>3.1</td>
<td>4.0</td>
<td>4.6</td>
<td>4.3</td>
</tr>
<tr>
<td>#papers</td>
<td>98</td>
<td>177</td>
<td>270</td>
<td>358</td>
<td>475</td>
</tr>
<tr>
<td>%co-authored</td>
<td>58.2</td>
<td>61.6</td>
<td>65.9</td>
<td>69.0</td>
<td>71.2</td>
</tr>
</tbody>
</table>

The extent of collaboration between community members can also be measured through the percentage of co-authored papers. All three communities show stable increase in the percentage of co-authored papers, reaching the maximal value of 81% (EGOV), 66% (ECEG), and 71% (joint). In sum, there is a clear trend of growing collaboration among community members in both ECEG and EGOV. In both communities (and especially EGOV), this trend is accompanied by the process of community convergence and stabilization with researchers that regularly publish in the proceedings. On the other hand, results indicate that the ECEG and EGOV induced two separate communities, where only a very modest number of authors publish papers at both conferences.

### 3.2 Productivity and collaboration among community members

We measure the productivity of a community member by the number of his/her published papers and the number of her/his appearances in the yearly proceedings. Table 3 presents the list of the ten most productive authors in the joint community in the period from 2005 to 2009. Five or 50% of them have published their papers at only one conference, and five of them at both conferences.

The list is, however, biased towards ECEG authors, since the number of papers published at ECEG is much higher. Thus, at the top of the list, Janssen M. has published nine papers, seven of them in the ECEG conference proceedings. Further down the list, we include authors that published at least six papers at any of the conferences. The list of most prolific authors in Table 3 includes a high percentage (33%) of authors that are active in both communities relative to the percentage of joint authors in the joint community (5%). This might be an early indicator of a trend of convergence towards joint community in the future.
Table 3: The ten most productive authors in the ECEG and EGOV conference community in the period between 2005 and 2009 measured in terms of number of published papers and number of years in which authors published their papers, the names of the authors that published at both conferences are emphasized (bold)

<table>
<thead>
<tr>
<th>Author</th>
<th>#papers</th>
<th>#ECEG-papers</th>
<th>#years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janssen M.</td>
<td>9</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Fairchild A.</td>
<td>7</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Askounis D.</td>
<td>7</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>deVuyyst B., Neumann L.</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Polzonetti A., Corradini F.</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Grönlund A.</td>
<td>6</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Lubbe S.</td>
<td>6</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Becker J.</td>
<td>6</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Activity of individual members is not as important to the process of community building as the degree of collaboration of an author with others. We can observe the collaboration through the degree of connectedness among nodes within a co-authorship network. In social network analysis, the degree of connectedness is expressed through measures of centrality of individual network nodes, i.e. degree, closeness, and betweenness centralities, which differ in the way the position of individual authors within the co-authorship network is referred (Nooy et al. 2005). In co-authorship network, degree centrality equals the number of collaborators an author has, closeness centrality indicates the accessibility of the observed author to the others, and betweenness centrality indicates the number of shortest paths that pass through the observed node. Table 4 lists the most central authors with respect to each of these three measures.

Table 4: The most central authors in joint conference community in the period between 2005 and 2009 according to the degree, closeness, and betweenness centrality, emphasized (italic) names correspond to the most central authors according to three (two) centrality measures

<table>
<thead>
<tr>
<th>Degree centrality</th>
<th>Closeness centrality</th>
<th>Betweenness centrality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author</td>
<td>%</td>
<td>Author</td>
</tr>
<tr>
<td>1 Askounis D.</td>
<td>1.57</td>
<td>Askounis D.</td>
</tr>
<tr>
<td>2 Corradini F.</td>
<td>1.44</td>
<td>Corradini F.</td>
</tr>
<tr>
<td>3 Polzonetti A.</td>
<td>1.44</td>
<td>Polzonetti A.</td>
</tr>
<tr>
<td>4 Janssen M.</td>
<td>1.31</td>
<td>Charalabidis Y.</td>
</tr>
<tr>
<td>5 Charalabidis Y.</td>
<td>1.31</td>
<td>Janssen M.</td>
</tr>
<tr>
<td>6 Hahamis P.</td>
<td>1.18</td>
<td>Sourouni A.M.</td>
</tr>
<tr>
<td>7 van der Geest T.</td>
<td>1.18</td>
<td>van der Geest T.</td>
</tr>
<tr>
<td>8 Sourouni A.M.</td>
<td>1.18</td>
<td>Lampathaki F.</td>
</tr>
<tr>
<td>9 Lampathaki F.</td>
<td>1.05</td>
<td>van Dijk J.</td>
</tr>
<tr>
<td>1 Vintar M.</td>
<td>1.05</td>
<td>Hahamis P.</td>
</tr>
</tbody>
</table>

The lists presented in Table 4 contain 14 authors, most of them not being among the most prolific ones in Table 3. Five of them are among top 10 according to all three centrality measures: Askounis D., Corradini F., Polzonetti A., Janssen M. and van der Geest T. Further six authors are central according to two of the observed centrality measures. Most of these eleven authors come from the ECEG community, which is due the fact that ECEG authors and collaborations prevail the joint network in both number of nodes and edges (see Table 1). EGOV authors correspond mostly to the network nodes with high betweenness centrality.

3.3 Community structure

In this final part of the analysis, we shift our focus from the quantitative network properties to the network structure. We search for clusters of highly inter-connected nodes that might correspond to emerging eGovernment sub-communities. To this end, we apply methods for identifying components and cores in social networks. The search for components in co-authorship network enables to identify possible sub-groups of authors which collaborate frequently and, presumably, share common research topic(s). On the other hand, the search for cores makes possible to identify such sub-groups
of authors in which the authors are mutually linked. Hence, such core-sub-groups actually represent sets of paper(s) in which all core members collaborated (Nooy et al. 2005).

Our co-authorship joint network for the 2005-2009 period has 263 components. Out of these, 80 components contain only one author; 80 authors are isolated since they never in the observed period co-authored a paper with others. On the other hand, we identified the largest component consisting of 16 tightly interconnected authors. Note however, that here we can perceive the impact of papers with significantly higher number of authors compared to other papers: namely, in such a situation a single paper co-authored by many authors would induce a (non-)representative component. To overcome this problem, we augment each component with the list of corresponding papers and consider only those components that are induced by at least four joint publications. In addition, we also filter out all the components with less than five researchers.

Table 5 presents the results of the component analysis by enlisting all eleven components that satisfy the four-joint-papers criterion explained above. Each community subgroup is described with the leading researcher that is a co-author of majority of the papers in the component, the geographical distribution of authors’ affiliations, and the list of thematic topics of the papers in the component.

Table 5: The analysis of eleven largest components of the joint co-authorship network, we only considered components that correspond to at least four papers

<table>
<thead>
<tr>
<th>#authors/ #papers</th>
<th>Representative</th>
<th>Geographical distribution</th>
<th>Thematic topics</th>
<th>Conferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>9</td>
<td>Van Dijk J. Netherlands</td>
<td>citizen-centric e-services; user profiling; delivery channels; e-services adoption and usage</td>
<td>EGOV (9)</td>
</tr>
<tr>
<td>15</td>
<td>9</td>
<td>Andersen K.N. Tan Y.H.</td>
<td>Denmark, Norway, Netherlands</td>
<td>project evaluation; benefits of IT usage; e-customs; super-national e-services</td>
</tr>
<tr>
<td>14</td>
<td>8</td>
<td>Charalabidis Y. Greece</td>
<td>interoperability; meta-data and (semantic) annotation of e-services</td>
<td>EGOV (5) ECEG(3)</td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td>Janssen M. Netherlands</td>
<td>service-delivery, eGovernment stage models</td>
<td>EGOV (3) ECEG (7)</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
<td>Vintar M. Slovenia, Greece</td>
<td>indicators of eGovernment development; e-services adoption and usage; life events and integration of e-services</td>
<td>EGOV (7) ECEG (1)</td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>Corradini F. Sabucedo L.A.</td>
<td>Italy, Spain</td>
<td>semantic-driven integration of e-services</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>Grönlund Å. Sweden, Norway</td>
<td>eGovernment research analysis; misc</td>
<td>EGOV (7) ECEG (1)</td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>Ayo C. Nigeria</td>
<td>e-voting, eGovernment progress, eGovernment and public administration reforms</td>
<td>ECEG (6)</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>Becker J. Germany</td>
<td>Misc</td>
<td>EGOV (7)</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>Ferro E. Italy, USA</td>
<td>digital divide and IT literacy</td>
<td>EGOV (6)</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>Mentzas G. Greece</td>
<td>evaluating quality of e-services</td>
<td>EGOV (4)</td>
</tr>
</tbody>
</table>

The results show that most of the components representatives (all but the representatives of the eighth and last components) were already identified as most productive or most central ones. Furthermore, most of the identified sub-groups have narrow geographical distribution: ten out of eleven components are entirely from Europe, six are even tighter, including single region or country, or, in some cases, a single institution. International or trans-Atlantic collaboration is relatively rare. Finally, there is a great variety of thematic topics addressed by the researchers in different groups. Note also, that the identified sub-communities are orthogonal in the topics they deal with; each of them develops its own (relatively narrow) expertise area that is different from the others. Most of these groups are mainly affiliated with EGOV conference. This is in line with our previous results that show the greater cohesiveness of the EGOV community. In this part of the analysis, this fact is reflected in a greater ability to stir groups of researchers with a common research interests.

When identifying the cores of the network, we applied the same four-joint-papers criterion. Figure 2 depicts the six cores of the joint co-authorship network that follow this criterion. They confirm the findings of the component analysis: each of the six cores corresponds to one of the identified components from Table 5. Another fact can be derived from the result depicted in Figure 2: only these 15 authors (out of 765; 2%) have been involved in more than three joint collaboration ventures. This is
another piece of evidence that the long-term collaboration within the joint conference community is relatively rare.

Figure 2: Six cores of the joint (ECEG+EGOV) community co-authorship network

In sum, the structural analysis shows that a number of sub-communities have emerged, each of them dealing with topics that are orthogonal to the thematic topics of the other. Virtually almost all the sub-communities have a representative researcher that is ranked among top active or collaborative community members. Most of the sub-communities have narrow geographical distribution including a single region, country or even institution. The community members are mostly affiliated at institutions in European countries, and large-scale international collaborations are very rare. The findings virtually resemble the ones for the EGOV conference.

4. Discussion

The results of our study provide several insights into the activity and collaborative cooperation of authors in eGovernment field. First, when comparing the number of authors publishing in the EGOV and the ECEG conference proceedings, we find that in both communities the portion of returning authors is very high; more than a half of authors publish their papers repeatedly at the same conference, and the portion increases from year to year (exception is a notable drop in 2005-2009 ECEG community). However, the EGOV community tends to be slightly more stabilized as compared to the ECEG community, since more than 85% of authors repeatedly publish their papers in conference proceedings. Second, three out of ten most productive authors are active in both communities and a portion of authors publishing their work in both proceedings increased from 1.6% to a good 4% in 2005 to 2009 period. Although the numbers are very low, this can be an early indicator of a trend towards the establishment of a joint community in the future. Third, note that the findings of community structure analysis indicate greater cohesiveness of the EGOV community, which is reflected in a greater ability to stir groups of researchers with a common research interest (despite the bias towards ECEG papers and authors, since the number of papers published in ECEG proceedings is much higher).

There are number of studies that analyze the state-of-the-art and the dynamics of the development of the eGovernment research (EGR) field mentioned in the introduction. There are four studies by Grönlund (2004), Grönlund and Andersson (2006), Heeks and Bailur (2007), and Bannister and
Connolly (2010) that our paper strongly relates to. All the above mentioned studies use content analysis as a main methodological framework. Grönlund (2004, 2006) proposes a model for measuring the maturity of the field focusing on the phases through which the research fields typically pass in the process of becoming mature. He observes an increase in the authors' efforts to comply with the research publication standards, increase in the number of references, which indicates better involvement with previous research, and increase in the collaboration of authors from various institutions. Heeks and Bailur (2007) study a sample of eighty-four journal and conference papers dealing with eGovernment per se. They characterize papers according to methodological issues related to and conclude that the change over time seems limited. Therefore, they also propose some recommendations for further research in eGovernment field. Last but not least, Bannister and Connolly (2010) use a methodological framework similar to Grönlund's, where they investigate the nature of contributions and the evolution of research interests in papers published in one conference publication venue. They show a large diversity in topics addressed in the studied papers, while the research approach evolves from conceptual to investigative in nature. Authors also note the absence of novel theoretical contributions and propose that the authors in the future direct their work in this direction.

There are several important properties in which our study differs from the related ones. First, the mentioned studies mainly use content analysis, whereas our paper relies on a standard scientometric method widely used to analyze other research fields. The advantage of the latter is particularly that it is not limited with the number of papers or publications we want to analyze. The use of such common analytical framework also enables to further develop the study scope and simply compare the results of these studies. In this sense, the present paper continues our previous studies (Erman and Todorovski 2009, 2010), where we have dealt with the analysis of citation and co-authorship networks induced from the papers published in the EGOV conference proceedings. Here, we extend the scope of those studies to the ECEG conference. Second, we collect the empirical data systematically from all the papers published in the proceedings of the ECEG and EGOV conference in the five years period between 2005 and 2009. Most other studies perform analysis of a sample of data about articles and papers from various publication venues. Although this decision makes the definition and the scope of the scientific community clear, which can be often subjected to various, not very strict definitions in other studies of the eGovernment research community (Scholl 2009). Finally, as opposed to the focus on methodological approaches in the other studies, we identify here the most productive and collaborative authors as well as the geographical distribution of authors and thematic topics addressed by the core clusters of co-authors.

5. Conclusion

Scientific community is a conglomerate of scientists who spread and diffuse their knowledge mainly through the publication of their theories and studies. The core of every analysis of such communities is the study of communication patterns among scientists on the basis of citation, co-citation, or co-authorship network analysis. In the present paper, we focused on the study of two eGovernment conference publications, i.e. ECEG and EGOV conference proceedings, where we addressed a very important question: Do the active researchers of these two different publication venues converge towards a joint eGovernment research community? The answer to this research question is clearly: No. The two publication venues considered in this study do not converge towards a joint eGovernment scientific community. Only few authors (less than 5%) publish papers at both conferences. However, both communities do show maturity, in terms of large number of members publishing regularly, increasing collaboration between community members, and emergence of clearly profiled sub-communities. In this sense, EGOV community seems to be ahead of ECEG; the profiling and stability of the community being more evident. The high share of authors publishing at both conferences among the most prolific authors in the communities might be an early indicator of the emergence of the eGovernment community.

The (non-) existence of eGovernment research community has to be further tested with extending the scope of this study. We cannot disregard the fact that the data used to perform the analysis is far from being exhaustive. We have to include eGovernment papers from other publication venues, both conference proceedings (such as International Conference on Digital Government Research, Hawaii International Conference on System Sciences, European Conference on Information Systems) and journals (such as Government Information Quarterly, Information Polity, European Journal on eGovernment) in our data set. There also exist other possible data sources to be included in our future work. We can use different reference libraries as well as online journal databases, or data
gathered by means of Google Scholar tool. The analysis of listed data expansions will enable us to significantly widen the current scope of our study.

Note also that in the present paper we focused on the co-authorship network, whereas a study of the citation network of ECEG papers can be another line of further work. Other types of networks that capture informal communication among researchers in the field can be considered as well, e.g., a network of joint conference participation, which can be derived from the lists of participants of every year conferences. Finally, one can also look into other types of networks analysis of the citation networks that has publication venues where the referenced papers come from in the nodes. Such analysis would reveal the most influential “neighbouring” scientific fields and publication venues with highest impact on the development and shape of the eGovernment research field. Ultimately, there is a challengeable issue of integrating the results of analysing different networks of relations among scientists and/or publication venues into a unified map of the EGR field.

Acknowledgments

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Abstract: This paper proposes an interpretative framework which aims to provide a systemic perspective and an instrument to elicit the links between Information and Communication Technologies (ICTs) and governance, outlining the various challenges that this poses. In particular, it discusses the multiple dimensions of governance and identifies the public value drivers underpinning the conceptual and measurement framework proposed. In doing so the paper focuses on the ‘openness’ of governance mechanisms through its interoperability dimension. It considers state-of-the-art contributions at both academic and practitioner level and it also looks at how the proposed framework can be applied to the evaluation of two case studies at cross-border, and national-city level in Europe. Interoperability in fact is predominantly seen as an instrument for enabling cross-border collaboration between public administrations within and between different Member States. Many initiatives and projects have been promoted and carried out during the last decade resulting in a growing number of potentially reusable best practices and benchmarks. Nevertheless, the complexity and volume of resulting project outcomes represent a challenge for effective exploitation of the results in other initiatives and intervention contexts. Moreover, despite the recognition of interoperability as a multi-faceted concept (i.e. technological, organizational, and semantic), it seems to be mainly the technological aspects of interoperability that emerge from the available project results. The paper concludes outlining indications for future research and in particular on interoperability as a key driver for ICT-enabled governance. Interoperability is found to play a strategic role in the delivery of e-Government services to local and national communities within the EU. Moreover, its significance is expected to increase over the next few years, especially in terms of how it supports emerging city governance models and acts as the backbone of communications at a pan-European, national and local level.

Keywords: interoperability, eGovernance, information systems, Europe, policy, value

1. Introduction

The interpretative framework for ICT-enabled governance proposed in this paper resulted from exploratory research conducted by the Information Society Unit of the Institute for Prospective Technological Studies (IPTS) of the European Commission’s Joint Research Centre, on emerging ICT-enabled governance models in EU cities (EXPGOV) (Misuraca 2010a).

This research aimed to better understand the interplay between ICTs and governance processes at city level and formulate a multi-dimensional framework to assess the various dynamics emerging from the application of ICT-enabled service innovations in European cities.

In this research governance is defined as the process of decision-making and the process by which decisions are implemented, monitored and evaluated. These changes in decision-making are strongly conditioned by historical transformations in society’s underlying values and organisational models and can be analysed from several research perspectives (Misuraca 2010b). In particular, ICTs are important tools to support the transformation of governance processes through eGovernance, where eGovernance is defined by Misuraca as the field of activity where policy design, decision-making, coordination, arbitration, networking and regulation, with ICTs, but also of ICTs, take place (Misuraca 2010b). eGovernance can therefore be considered as a broad framework to capture the co-evolution of ICTs’ various stakeholders with the political institutions, at local, national and global level. eGovernance can also be regarded as a multidimensional construct that encompasses ICT research, at the intersections with social, economic, political, and organizational science research, and
addresses the investigation of the missions of government in relation to the interests of society (Misuraca 2010a).

The proposed framework aims to provide a systemic perspective and an instrument to elicit the links between interoperability and governance, outlining the various challenges that this poses, especially from a European perspective, in order to link local to pan-European perspectives. It is feasible to say that local authorities should be considered a fundamental part in this multi-level or – as it is often called in official documents – “pan-European” governance, which consists of increasing networking between local and national administrations across the European Union and of the emergence of a new and more integrated “European public space”. European strategy related to the harmonization of policy-making in the field of e-Government among the Member States is not a “law-making system”. On the contrary, it is based, as Criado states, on “soft” institutional mechanisms of coordination, which consist of spreading best practices, benchmarking, defining common policy objectives and common technological, semantic and organizational standards. While vertical mechanisms are based on adaptive pressure and coercion, horizontal mechanisms indicate policy framing, mutual adjustment and policy learning” (Criado 2009, p. 301). In this sense, local e-Government initiatives and experiences play an important role in this process of “soft Europeanization”.

This paper thus looks at the state of the art in e-Government, discussing the multiple dimensions of ICT-enabled governance within the EU, the value drivers underpinning the conceptual and measurement framework proposed, and how this could be applied to the evaluation of ICT-enabled governance systems in two case studies at cross-border and national-city level in Europe. The paper concludes by presenting the main findings of this exploratory analysis, and outlining indications for future research on interoperability as a key driver for ICT-enabled governance.

2. A multi-level network approach to analyse ICT-enabled governance

Research on organizational networks can be broadly characterized by two basic approaches: the 'network analytical' approach and the 'network as a form of governance' approach, both of which are limited when it comes to analyzing multi-level networks functioning and governance.

Network analytical approaches focus mainly on micro-level, egocentric aspects of networks, building largely on work done by sociologists studying networks of individuals. This perspective has had a long history (since Moreno 1934). Scholars have contributed especially to the description and explanation of network structural characteristics using such concepts as density, centrality, and structural holes (see e.g. Burt 1992; Wasserman and Faust 1994). The units of observation are a set of objects called nodes, positions, or actors, and a set of present or absent relations among these objects referred to as edges, ties, or links (Knoke 1990). In network analytical approaches, the main objective can be either to describe, explain, or compare relational configurations or to use these configurations to explain certain outcomes (Provan et al, 2007).

The functioning of organizational networks can be partially addressed using this approach, since functioning is defined as the process by which certain network conditions lead to network outcomes. The problem, however, is that for the most part, what gets analyzed and explained is not the network itself, but the ‘nodes’ and ‘relations’ that comprise the network (cf. Graddy and Chen 2006; O’Toole and Meier 2006). Apart from some notable exceptions (e.g., Owen-Smith and Powell 2004; Powell et al. 2005; Provan and Milward 1995; van Raaij 2006), the unit of analysis (i.e., the phenomenon to be investigated) in this literature is not the complete network but a node (ego) or a dyad. In these studies, findings are related to questions of whether or not the way an actor is embedded in a network has an effect on the outcomes of the actor (such as level of innovation, performance, and learning) (Ahuja 2000) or on describing and explaining the birth, death, effectiveness, etc. of dyadic relationships (cf. Larson 1992; Van de Ven 1994; Uzzi 1997). Consequently, this literature tells us little about the functioning of networks, because networks are seldom treated as the unit of analysis.

The network as a form of governance approach, in contrast, does treat networks as the unit of analysis. Network is viewed as a mechanism of coordination, or what has often been referred to as network governance. Starting with Williamson’s (1975) Markets and Hierarchies, a rich literature has developed on different forms of governance over the last three decades. As seen from an economic perspective, this literature challenged the conventional wisdom that the market is the only efficient system of non-hierarchical coordination. From an organization and administrative science perspective, the most innovative aspect of this literature is that it made clear that organizations cannot
be taken as something for granted (see Perrow 1986) and that other forms of coordination, such as networks, can equally achieve goals. Consequently, a discussion unfolded as to whether networks are simply a combination of elements of market and hierarchy, and could, therefore, be placed on a continuum between market and hierarchy, or whether they would be better understood as unique forms of governance in their own right (see Powell 1990).

This literature moved toward treating networks as discrete forms of governance, characterizing them as having unique structural characteristics, modes of conflict resolution, bases of legitimacy, etc. (cf. Jones et al. 1998; Raab 2004). Although the governance approach considers networks as the unit of analysis, the tradition has been for networks to be treated as undifferentiated forms, as if they all be characterized in the same general way (e.g., Jones, Hesterly, and Borgatti 1997; Powell 1990). This may be due to the fact that for the most part, networks were seen as a ‘new’ and ‘positive’ mode of coordination that needed to be distinguished from markets and hierarchies.

A functionalist argument dominated, claiming that networks are a response to failures of markets, failures of hierarchical coordination, and to societal and technological developments. The implication was, and continues to be, that despite problems, networks in general can produce positive outcomes that would not be possible in a market or a hierarchy.

What we propose in our approach (see Misuraca et al., 2011), instead, is to combine the network analytical and ‘governance’ perspectives, and focusing specifically on the enabling networking role played by ICTs in support of the functioning of the governance system, intended as a network (networked governance as ICT-enabled governance model).

The governance perspective is valuable in that the network itself is considered to be the unit of analysis. Networks are forms of social organization, which are more than the sum of the actors and their links and which deserve to be studied in their own right (O’Toole 1997). The network analytical perspective contributes another central idea to our work -that networks are a set of actors or nodes, with relationships between these nodes as being either present or absent. Thus, networks are considered to vary with regard to their structural patterns of relations and according to the use of ICTs for governance to enable network effects.

Consistent with this logic, we view networks enabled by ICTs as a variable, examining different networked governance configurations and the conditions for the effectiveness of each form (i.e. ICT-enabled governance models) we aim at demonstrating that ICT-enabled governance networks with different configurations have different network-level effects. This can be considered also our main research hypothesis and the basis for establishing a rationale for developing multi-level network theories in the area of ICT-enabled governance and the further development of a measurement framework.

3. The interoperability dimension of Governance Openness

Interoperability plays a strategic role in the delivery of e-Government services to local and national communities within the EU. In terms of technical definition, an interoperability platform is a solution that enables two or more software applications to exchange data and achieve a common objective, even if the two applications were not originally intended to cooperate. However, interoperability can take place at different governance levels; i.e. from the exchange of simple data items, to structured documents (e.g., a purchase order), to business process cooperation where different organizations are enabled by interoperable software applications to achieve a common objective (Gottschalk 2009). According to the European Interoperability Framework (EIF) and the UNDP e-Government Interoperability Study Group (UNDP 2007), there are three *layered stands* for interoperability:

- **Technological interoperability**: This includes both hardware and software issues. The former mainly concerns connectivity and protocols (e.g., TCP/IP), while the latter concerns a common syntax (e.g. XML) for data, but also standards for messaging (e.g. SOAP and WSDL). A technological interoperability platform allows two organizations to reliably exchange messages, but the actual understanding of message content remains outside of its scope.

- **Semantic interoperability**: This implies that, despite divergences in the structure, organization and content of the exchanged data, the intended meaning is correctly conveyed, the information is correctly acquired and the expected actions are understood and undertaken.
Organizational interoperability: For an effective and far-reaching cooperation between two (or more) organizations, organizational interoperability also needs to be addressed. The latter means that the two (or more) cooperating organizations are able to effectively perform a cooperative task, exchanging information and services. Furthermore, this layer also includes the progressive adoption of best practices, necessary to ease an effective interoperability. Organizational interoperability is generally supported by adopting an appropriate framework, such as ebXML, TOGAF, or e-GIF.

These three layers are interdependent. For instance, the user interface and interaction methods (for civil servants and end users) require solutions that cut across the three layers. They also have an inherent progression, in terms of the achievable interoperability scope.

Two further conceptual elements help scholars and practitioners to assess the interplay between these three levels: interoperability maturity models and interoperability scope. The maturity level concerns the organizational capacity to achieve interoperability. Interoperability initiatives should consider the actual administrative needs and available resources according to the defined objectives. When complex organizations start a process aimed at integrating its different databases and application systems, they should clearly define the progressive levels of interoperability they want to achieve. To help in this direction, administrations should adopt a layered maturity model for interoperability (Interoperability Maturity Model, or IMM). In order to achieve advanced and effective interoperability solutions, to consistently model the organizations involved in the interoperability process is a crucial precondition. The IMM (already adopted by many governments around the world, such as the Australian Government for example) closely follows the Capability Maturity Model Initiative (CMMI) framework, which consists of the following five maturity levels: Initial; Managed; Defined; Measured; and Optimised.

Interoperability maturity models aim to define different stages across a continuum of networking capability of organizations. These stages are described not only in technological terms. On the contrary they are a mix of policy, management and technological elements. In general these models expand their perspectives beyond a technology development perspective (i.e., software development or implementation) and focus on the required mix of policy, management, as well as technology capabilities to achieve the broader goal of improved delivery of government services and programs (Pardo and Brian Burke, 2008). Thus it is feasible to say that Interoperability has no value per se; its value depends on the context of cooperation among organizational units and the benefits produced in terms of the public value they contribute to produce (Misuraca and Zambrano 2009).

Finally, the concept of maturity level of interoperability is tightly related to the kinds of object that are managed via the interoperability platform: i.e the concept of interoperability scope. The interoperability scope is determined by the elements that are considered and managed by the interoperability platform, namely: simple data items, structured documents, services, processes, organization models and strategies. Interoperability initiatives should be undertaken considering the actual administrative needs and resources according to the defined objectives.

4. An interpretative framework for assessing the public value of ICT-enabled governance

With specific regard to the evaluation of the impact of ICTs on governance, despite considerable resources have been invested in supporting innovation in public administration through ICTs, a consensus about how to evaluate the results of the investments in e-Government projects to transform governance systems is still lacking.

On the one hand this is due to the fact that not all the results of the ICT-enabled innovation processes, which have been put into action, are visible yet. On the other hand, the complexity itself of the concept of eGovernance makes it difficult to define an evaluation system that can be applied to all the areas covered by this multi-dimensional construct (e-Administration, e-Services, e-Inclusion, e-Participation, etc.).

Adopting a broad definition of e-Government, such as the one suggested by the Organisation for Economic Cooperation and Development (OECD, 2003), where e-Government can be considered as the process of innovation of Public Administration in order to achieve innovative forms of government
and governance through the use of ICTs, the evaluation of an e-Government system must be referred to its capacity of improving on the whole the performance of the organisation adopting it.

In this perspective, the concept of public value can provide an interesting support for the evaluation of ICT-enabled governance. Public value refers to the value created by government through services, law regulations and other actions (Moore 1995). The close relationship between the concept of public value and e-Government was first noted by Kearns (2004). From this perspective, the use of ICTs to improve government and governance is also a means to improve the production of public value. Thus, an e-Government system resulting from a process of technological and organisational innovation can be indirectly evaluated by considering the possible increase of public value deriving from the adoption of that system. In general, a public value-based evaluation must be performed by considering the value that citizens perceive in their interactions with Public Administration (Alford 2002; Bannister 2002). Since the interactions between stakeholders and Public Administration can concern both stakeholders as users (mostly citizens) and stakeholders as operators of Public Administration (mostly private organizations and suppliers), public value can be measured both from an external point of view (stakeholders as users) and from an internal point of view (stakeholders as operators). In the first case, the policies for e-Government can be evaluated with respect to the quality of the services delivered. In the latter case, they can be evaluated with respect to their ability to improve the system of local government (Castelnovo and Simonetta, 2008). All these results can be achieved only by means of a governance framework that considers the various relations and effects (not only from a technical perspective) in a ‘dynamic’ manner, and maintains the aggregations (for example, at city or community level) stable in time.

Within this context, we make reference to recent work in the area of social studies, public policies and ICTs (see e.g. Viscusi et al. 2010), and more specifically to the research conducted by the Information Society Unit of the Institute for Perspective Technological Studies (IPTS) of the European Commission’s Joint Research Centre, namely the Exploratory Research on emerging ICT-enabled governance models in EU cities (EXPGOV) which developed a theoretical model and a proposal of framework for assessing ICT-enabled governance. The EXPGOV theoretical model argues for the adoption of a wide definition of e-Government as a system of ICT-enabled innovation policies for public administration and related governmental functions. From this point of view, ICT-enabled projects can be considered high-level, context-sensitive interventions that aim to introduce and facilitate gradual changes.

In this connection the EXPGOV project has identified three main value drivers that constitute the basis of a measurement framework for ICT-enabled governance:

- **Performance**: effectiveness and efficiency (enabling optimal use of resources for citizens and taxpayers in the service delivery); and also, indirectly, responsiveness (serving all citizens in a consistent and predictable way).

- **Openness**: access to information as a proxy for participation (enabling the empowerment of citizens so that they can legally control service delivery to their advantage) and transparency (bringing visibility to citizens of the service workflow by means of automated service delivery); and accountability (creating standards against which the individuals providing a service and the service delivery can be held accountable), that also serves the goal of ensuring consensus orientation (following democratic practices).

- **Inclusion**: equity and inclusiveness (referring to citizens receiving a service on an equal basis and providing services to disadvantaged and minority groups), which implicitly ensures respect for the rule of law (ensuring that laws and regulations governing the service are applied impartially).

These value drivers represent the principles and the expected outcomes of ICT-enabled initiatives, experiments and pilot projects taking place at different governance levels.

More specifically, the Openness value driver also includes as a fundamental component, the interoperability dimension, both in terms of Technological interoperability (i.e. diffusion of standards and technological infrastructures and systems for interoperability) that in terms of shared data and services (i.e. the ability of administrations to access data by means of the inter-administration back office, and the possibility for external users to access administrative data via ICTs).
In this regard, though it has been recognized that interoperability plays a key role in ICT-enabled
governance, there has been little research into the non-technical dimensions of this phenomenon, or
into the relation between interoperability and governance processes. Furthermore, there are few
instruments which allow the systemic perspective needed by scholars and public administration
managers to face up to the challenges of these multiple facets of interoperability. At the moment, a
silo representation of interoperability tends to prevail. For this reason in this paper we discuss a
conceptual model built on the analysis of state-of-the-art research and literature on ICT-enabled
governance, and also the authors’ previous experiences in the implementation of concrete projects.

The conceptual model represented in Figure 1 aims to support the elicitation of different
configurations of Interoperable governance systems on the basis of the relationships between the
following factors:

- Governance model characteristics (i.e. cultural administrative tradition and socio-economic
  characteristics of the intervention context)
- Value drivers (i.e. performance, openness, inclusion).

![Figure 1: The conceptual model](image)

This conceptual model aims to provide an interpretative instrument to deal with the multiple facets and
layers of ICT-enabled interoperability and governance. In particular, the role played by interoperability
and its impact on the value drivers, in turn influenced by governance model characteristics and
related dimensions (see Figure 1), can be evaluated in terms of quality dimensions associated with
the considered value drivers. Thus, for each driver we provide a set of quality dimensions, which
enable a better interpretation of the type of contribution offered by interoperability initiatives. The
relevance of a systemic perspective on quality assessment to support the strategic planning of e-
Government initiatives has been discussed in Viscusi, G. et al. (2010), who also propose a quality
framework. This framework has been applied to eGovernance issues in Misuraca, G and Viscusi G.

In this paper, we apply some of the dimensions of this framework to the elicitation of interoperability
targets and goals for each considered value driver (see Table 1).

In the following section, we apply the conceptual framework to two European case studies at different
governance levels: one is a cross-border pan-European project and the other, a city government
initiative.
5. A pan-European case study: STORK

STORK (Secure idenTity acrOss boRders linKed) is a large-scale project involving 17 EU countries, with backing from the European Commission. The STORK project deals with the use of electronic identities in a cross-border context and it has established a number of pilot projects to test the mutual recognition of eIDs by public authorities in different European Union member states (Tauber, A. and Rössler, T., 2010). STORK is working on an EU-wide interoperable solution to provide mutual recognition of eID and eID-based services such as authentication, which will enable citizens and businesses to use their national eIDs in any Member State involved in the project.

Table 1: Drivers, quality dimensions and related levels of application

<table>
<thead>
<tr>
<th>Value driver</th>
<th>Dimension</th>
<th>Quality level</th>
</tr>
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<tbody>
<tr>
<td>Performance</td>
<td>Efficiency</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td>Effectiveness</td>
<td>Organization</td>
</tr>
<tr>
<td>Openness</td>
<td>Transparency</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organization</td>
</tr>
<tr>
<td></td>
<td>Accountability</td>
<td>Organization</td>
</tr>
<tr>
<td></td>
<td>Accessibility</td>
<td>Legal</td>
</tr>
<tr>
<td></td>
<td>Accessible</td>
<td>Organization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Information</td>
</tr>
<tr>
<td>Inclusion</td>
<td>Accessibility</td>
<td>Service</td>
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<tr>
<td></td>
<td></td>
<td>Technology</td>
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<tr>
<td></td>
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<td>Information</td>
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</tbody>
</table>

The six STORK pilots (described in Table 2 with related goals, value drivers, and involved countries) are testing common eID specifications for several applications that have a substantial impact on e-Government across Europe. In particular, the technologies and services developed and tested by the STORK project are expected to be key enablers of interoperable electronic identification management (eIDM) for access to e-Government services across Europe. The STORK electronic identity project has gone live with a first pilot initiative, which demonstrates how European Union citizens can use their national eIDs to receive electronic documents securely from eDelivery portals of any participating EU Member State. As an example, the cross-border eDelivery pilot demonstrates how citizens of Slovenia, for example, can register at Austria’s eDelivery portal. Using their existing national eID cards, citizens are able to receive and pick up electronic documents by accessing the Austrian eDelivery portal. In addition, citizens may also receive eDeliveries from senders in other Member States through the Austrian portal. Currently, Austria, Estonia, Finland, Luxembourg and Slovenia are participating in the cross-border eDelivery pilot.

The STORK project is expected to be a best practice or benchmark for further cross-border initiatives dealing with the exchange of sensitive information and documents. Indeed, the main outputs of projects like STORK are expected to be functional documents for ICT-applications integrated in a
cross-border platform. As a confirmation of the 'best practice' nature and aims of STORK, the project on 15 November 2011, is set to receive a Best Practice Certificate at the European Public Sector Award (EPSA) 2011 to be held in Maastricht, the Netherlands (furthermore, STORK is among the 58 projects were submitted by 18 European countries). 

**Table 2: STORK Pilots goals, value drivers, and participants** (source: [https://www.eid-stork.eu/pilots/index.htm](https://www.eid-stork.eu/pilots/index.htm))

<table>
<thead>
<tr>
<th>Pilot number</th>
<th>Pilot name</th>
<th>Pilot goals</th>
<th>Value driver</th>
<th>Participants</th>
</tr>
</thead>
</table>
| 1            | Cross border authentication for electronic services | • Deliver technical interoperability between the electronic services in one Member State with the eID infrastructures in other Member States via the interoperability layer provided by STORK.  
• Demonstrate the flexibility and scalability of STORK common specifications for the EU interoperability layer to accommodate a range of national services.  
• Test and implement the trust framework by operating services requiring different authentication levels.  
• Test the use by citizens of a variety of credentials to access cross border services.  
• Assess ease of use and take-up of cross-border e-ID services. | Openness | Austria  
Belgium  
Estonia  
Finland  
Germany  
Iceland  
Italy  
Portugal |
| 2            | Safer Chat | • Enable students and teachers to use their secure national electronic identities in the Member States.  
• Test secure and easy-to-use eID solutions for students and teachers at both national and European levels.  
• Interact with other EU initiatives to maximise the usefulness of eID services and the long term sustainability of the SaferChat application.  
• Provide a scalable solution with open source specifications for possible take-up throughout the EU and for sustainability of the solution in the long term. | Openness | Austria  
Iceland |
| 3            | Student Mobility | • Use the STORK infrastructure for developing cross-border electronic services in the academic environment.  
• Evaluate the viability of extending the application to provide, for example, interoperability between administrative offices from different universities. | Openness | Austria  
Estonia  
Italy  
Portugal  
Spain |
| 4            | Electronic Delivery | • Demonstrate how the STORK protocol elements, can be used to create a cross-border eDelivery solution.  
• Create a rudimentary cross-border eDelivery protocol.  
• Deploy the STORK authentication components in the national eDelivery portals of the participating partners for authentication purposes. | Openness | Austria  
Estonia  
Finland  
Luxembourg  
Slovenia |
| 5            | Change of address | • Develop a set of common specifications for the implementation of | Openness | Estonia  
Finland |

a pan-European Change of Address service.

- Achieve interoperability for the Change of Address service without changing internal processes currently in place in the Member States.
- Identify potential problems and pitfalls preventing wide-scale adoption of such a model.
- Provide a working technical solution independent of the legal constraints in each Member State.
- Develop a pilot service that allows citizens to change their legal addresses to a new location in any participating Member State, through the use of the STORK interoperability layer.

Portugal

Slovenia

Spain

Sweden

Nevertheless, even though interoperability is declared to be a multi-faceted concept, the final outcomes of projects like STORK tend to focus mainly on the technological aspects of interoperability. Therefore, the main challenge would be to elicit the multiple dimensions of interoperability for the value drivers that underpin ICT-enabled governance systems. As to STORK, Table 2 points out openness as the main value driver emerging from the comparison of the different pilots related goals. Indeed, as discussed in Section 4 openness concerns access to information as a proxy for participation/accessibility (Pilots 2, 3, 5, 6), transparency (Pilots 1, 4), and accountability (Pilots 1, 5, 6). Taking these issues into account, in Table 3 here below we apply the interpretative model proposed to the STORK project.

Table 3: Governance value drivers, quality dimensions, and type of interoperability

<table>
<thead>
<tr>
<th>Value driver</th>
<th>Quality dimension/level</th>
<th>Type of interoperability (enabling layer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>Accountability/Legal</td>
<td>Organizational</td>
</tr>
<tr>
<td></td>
<td>Accountability/Organization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transparency/Organization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accessibility/Service</td>
<td>Semantic</td>
</tr>
<tr>
<td></td>
<td>Accessibility/Legal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accessibility/Technological</td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 3, the main challenge for cross-border initiatives (such as STORK is) dealing with the exchange of sensitive information and documents is related to the fitness or alignment of the openness value driver (as the strategic and political guiding principle) and the different cultural administrative traditions at operational and procedural level. In the STORK project, the alignment has been reached by dealing first with the legal and organizational issues, and then with the service and related technological issues.

In terms of quality elicitation, the implementation of the openness value driver focused first on accountability at legal (who is the by law owner? who is the guarantor of information flow? how can rules and laws from different legal frameworks be aligned?) and organizational level (how can the administrative process be coordinated in order to make transparent the service provision and the local responsibilities?). As a consequence, accessibility was also a relevant quality dimension which could improve the above mentioned accountability and transparency levels: e.g. accessibility to citizens of
services (in terms of language and appropriateness for the e-readiness level of constituencies); accessibility at legal level to public administration employees and managers (in terms of understanding laws and rules from foreign legal frameworks); accessibility at technological level (in terms of cooperative information system architectures, allowing multichannel provision of services at front-office level).

Thus, the application of the interpretative model discussed in Section 4 shows that organizational and semantic interoperability are the main focus for projects like STORK and should be addressed in parallel to technological interoperability issues. Furthermore, the model allows us to elicit the critical quality dimensions to be considered and the level at which they have an impact. This again highlights the need for a multi-level analysis when conceptualizing and implementing such a broad and ambitious interoperability initiative at pan-European level.

6. A city case study: VENIS

VENIS (Venezia Informatica Sistemi S.p.A.) is an ICT company owned by the local authorities and the public utilities of the City of Venice. It has a wide spectrum of objectives concerning the design, implementation, management and maintenance of the information systems, the software, the technological infrastructures and the telecommunication networks used by the majority of the local authorities and the public utilities of Venice. Venis states on its internet page that the ‘innovation of the City’ is the mission it has been given by the local authorities.

The local government is the biggest shareholder in Venis (75.1%), followed by ACTV S.p.A – a local transport company (14.9%), the municipal Casinò of Venice and Veritas S.p.A a local public utility (5% each). Moreover in the future shares will be issued to other important institutions of the City of Venice, such as, for example, the “Fondazione Musei Civici” – the municipal cultural foundation that manages and promotes the museum system of Venice. This broad sharing of ownership of VENIS amongst Venetian public institutions aims to secure wide product diversification, with economies of scales. Furthermore, it contributes to fostering interoperability between the information systems of local authorities - the backbone for enabling an ICT-enabled governance system for the City of Venice.

Although it is owned by local institutions, VENIS has considerable managerial autonomy in the industrial, commercial, and financial operations covered by its statutory purpose. It is fair to say that the projects managed by VENIS are not focused on the technological needs of a given institution but on the urban systems as a whole. In 2009 and 2010, two of the main projects VENIS dealt with were the construction of an urban fibre-optic network and the design of “Venice Connected”, the official city website for tourism that aims to develop a sustainable tourist flow into Venice. The fibre-optic network provides a high transmission capacity (10 Gigabits) and connects not only municipal offices but also the whole University system of the City (University of Venice Ca’ Foscari, IUAV). Moreover, the urban fibre-optic network constitutes the backbone for 120 free WiFi hotspots that provide high-speed access to the Internet in the whole urban area to citizens and tourists.

The website “Venice Connected” is defined as an “interoperable platform” (Figure 2) for the online booking and sales of the City’s tourist services (transport, museums, etc.). It helps visitors to reserve the services they are interested in and, at the same time, it helps the City to organize services according to the actual number of visitors expected. Venice Connected allows the purchase with a single payment transaction of various tourist services from different providers. Tourists get a single booking number which they can use to access all the most important services in Venice (from transport to museums).

The website aims to encourage tourists to reserve services before they arrive in the city through a differentiated pricing policy. The lowest prices are applied if you book online and the website explains the different prices, depending on the season. It thus contributes to guiding the flow of tourists and limiting the number of unsustainable peaks of too many tourists in the City. Using Venice Connected site tourists can receive discounts by booking tickets from museums fees to parking spaces and “water taxis”. The site provide a colour-coded calendar so tourist can choose between high season - the most expensive time to visit - versus more economically feasible times of the year. Therefore tourists are incentivized to choose the less crowded time of the year to visit Venice.

The aim is to make a step toward a more sustainable tourists flow for the whole city of Venice. In fact the peculiarity of the city of Venice makes sustainable tourism an issue of public concern. For
inhabitants and institutions’ opinion the city of Venice can host only a determined amount of tourists in a given moment of the year without negative consequences for the monuments and the population itself. In fact 16 millions of yearly visitors have a strong impact on a city population of only 80 thousand inhabitants that is also constantly decreasing also because of these impacts, such as for example the price of residential housing and other primary public services. Venice Connected site, then, attempts to manage the arrivals into the city with the aim of combining a positive effect for the inhabitants and quality experiences for tourists.

Figure 2: The interoperable system of Venice Connected (www.venis.it)
As shown in Figure 2, the technological infrastructure shared amongst different Venetian local authorities and public utilities fosters the development of interoperability projects for the urban system.

Another important project in this sense is the “imob” smart-card that, in the near future, will contain all the information and the codes for access to mobility services in the city (e.g. public transport, parking spaces, car-sharing, bike-sharing, and others). Imob system also collects and provides information about passenger’s flows that could be analysed in order to improve the city’s public transport. In this regard, the high-speed network and interoperability between the information systems of local institutions and public utilities are important enablers for technological and organizational innovation in the City’s public services.

In summary, the case of VENIS is interesting as it highlights how far the aforementioned technological, semantic and organizational levels of interoperability can be connected and interdependent. The development of interoperable systems amongst public authorities in this case is conditioned by an institutional and organizational structure that is peculiar to Venice. This structure enables city policies and city governance models that are strictly dependent on the technological infrastructure and the interoperable systems – as seen in the example of tourism policies and coordination between tourism services in the city (Venice connected). In this sense, it can be argued that the ICT-enabled governance system of Venice is characterized by the presence of a single organization, which is owned by the local authorities, and is focused on the technological development of the urban area. In Table 3, we apply the conceptual model proposed in this paper in order to understand the specificity of the interoperability system in this city.

Indeed, the aforementioned interoperable applications and projects are interconnected with a significant change in policy strategies, in stakeholder relationships and in organizational structures.
In this case, Performance and Inclusion (see Table 4) are the two main value drivers as the improvement of the urban system via ICT and interoperability infrastructures and policies both set out to improve public services and provide wide and ubiquitous accessibility.

Table 4: Governance value drivers, quality dimensions, and type of interoperability

<table>
<thead>
<tr>
<th>Value driver</th>
<th>Quality dimension/level</th>
<th>Type of interoperability (enabling layer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Efficiency/Service</td>
<td>Technical /Semantic</td>
</tr>
<tr>
<td></td>
<td>Effectiveness/Organization</td>
<td></td>
</tr>
<tr>
<td>Inclusion</td>
<td>Accessibility/Service</td>
<td>Technical</td>
</tr>
<tr>
<td></td>
<td>Accessibility/Legal</td>
<td></td>
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<tr>
<td></td>
<td>Accessibility/Technological</td>
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</tbody>
</table>

Thus, the application of the interpretative model shows that technical and semantic interoperability are the main concerns in the Venice case; whereas, organizational and semantic interoperability were more relevant in the cross-border pan-European case described in Section 5.

7. Conclusions and future work

The paper has proposed and discussed an interpretative framework for assessing ICT-enabled governance with a specific focus on analyzing government openness. This framework aims to provide a systemic perspective and an instrument to elicit the links between ICTs and governance, outlining the various challenges that this poses. In this connection, the paper has discussed the multiple dimensions of governance and the value drivers underpinning the conceptual framework proposed together with its application in evaluating more specifically the interoperability dimension in two case studies at cross-border and city level in Europe. The application of the framework showed how at both cross-border and city level different cultural administrative traditions and objectives influence the critical governance value drivers and characteristics of interoperability systems deployed. Different governance levels of focus and objectives influence different value drivers at cross-border (openness) and city level (performance/inclusion) enabled by different types of interoperability, i.e. organizational/semantic at cross-border level and technical/semantic at city level. It is worth noting how semantic interoperability is relevant for service layer at both levels of investigation: accessibility/service (cross-border level) and efficiency/service (city level).

The results of this preliminary analysis of the application of the interpretative framework provide insights for further analysis and research on how the design and reuse of interoperability initiatives should be implemented. As shown in the two examples analysed, technical interoperability seems to be more appropriate for local initiatives focused on elementary services (such as payments, booking services, etc.), whereas organizational interoperability is a critical factor in cross-border initiatives, where the alignment of legal framework constraints and administrative requirements are the key to an effective (and reusable) outcome of the initiative.

In both case, however, semantic interoperability plays an intermediate role as a representational tool which enables both the correct translation of organizational and legal requirements (at cross-border level) and the efficiency of the technical infrastructure (at city level).

However the sample of application of the framework does not yet allow more than a classification of the initiatives and the elicitation of the relevant type of interoperability to be considered by policy makers when planning interoperability initiatives. In future work, we aim to further refine and apply the quality dimensions of the conceptual framework proposed to categorize and possibly benchmark the type of barriers to interoperability initiatives underlying ICT-enabled governance and particularly its openness component. This should allow us to reach higher granularity in the analysis of the application of the interpretative framework. Finally, we will extend the analyses in order to have a wider set of case studies for comparison of experiences at the same and different levels of policy design and implementation.

Acknowledgments

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work for the Information Society Unit of the Institute for Prospective Technological Studies (IPTS) of the European Commission's Joint Research Centre, in collaboration with EUROCITIES. (See http://is.jrc.es/pages/EAP/EXPGOV.html). A previous version of the paper has been presented at ECEG-2011 in Slovenia.

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

References


Determinants of eGovernment Maturity in the Transition Economies of Central and Eastern Europe

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Abstract: Our research focuses on the possible determinants of eGovernment (E-gov) maturity in the Transition Economies of Central and Eastern Europe (TEECE). E-gov maturity, in this research, refers to the growth levels in a country's online services and its citizens' online participation in governance. Our study of the extant literature indicated that few have discussed the determinants of E-gov maturity in TEECE. Studies from differing parts of the world are needed for theory development. Building on a prior framework, we used the contingency theory and the resource-based view perspective to guide our discourse. In particular, we examined the relationships between macro-environmental factors such as national wealth, technological infrastructure, rule of law, and so forth on E-gov maturity. A 5-year panel data of 16 TEECE selected from two main groupings was used for analysis in conjunction with structural equation modeling technique; the data consisted of 80 observations or data points. The data analysis underscored the relevance of such factors as technological infrastructure, rule of law, and human capital development as possible determinants of E-gov maturity in TEECE. National wealth was found to be an enabler in the research conceptualization. The implications of our study's findings for research and policy making are discussed.

Keywords: Transition Economies of Central and Eastern Europe (TECEE), eGovernment (E-gov), eGov maturity, contingency theory, resource-based view, structural equation modeling

1. Introduction

The United Nations and the World Bank describe eGovernment (E-gov) as the utilization of the Internet and the World Wide Web for delivering government information and services to citizens and other stakeholders in a country (InfoDev, 2004; UN Public Administration Programme, 2010). E-gov allows government’s services to be more effective and accessible to citizens (Fountain, 2001; Moon, 2002; West, 2004). Empirical data from international agencies, consulting organizations, and academic research shows that E-gov has become a global phenomenon with nearly all governments around the world adopting it to promote citizen engagement and empowerment (Accenture 2001; West, 2007; UN Public Administration Programme, 2010; Karunasena et al., 2011).

Despite the popularity of E-gov around the world, empirical evidence from both academic research (West, 2007; Siau & Long, 2006; Singh et al., 2007; Gupta et al., 2008; Azad et al., 2010) and international agencies’ reports (InfoDev, 2004; UN Public Administration Programme, 2010) indicated that transition economies and developing countries around the world lag behind advanced countries with respect to the deployment and use of E-gov facilities. That is, more economically endowed countries often occupy the upper echelons of innovators or adopters of advanced E-gov initiatives and schemes (West, 2007; Azad et al., 2010). In part, this fact has influenced our research conceptualization. Notably, we worked with a research model indicating that economic considerations or imperatives directly or indirectly influence the advancement of E-gov schemes in emerging parts of the world.

Norris (2001) asserted that the emerging digital divide (in this case, E-gov divide) has three distinct aspects: the social digital divide, the democratic digital divide, and the global digital divide. Gascó (2005) noted that the regional digital divide is a variation of the global digital divide in the sense that it signifies the differences that exist in E-gov initiatives between countries from the same geographical region. With respect to the region of focus in this article, it can be seen that the E-gov index (i.e. an indicator of a country’s electronic government adoption) for Eastern European countries averaged 0.5449 in 2010. At the same time, the scores for two countries in the region i.e. Hungary and Belarus were 0.6315 and 0.4900, respectively (UN Public Administration Programme, 2010) to indicate the existence of regional differences. In this regard, we argue that more attention needs to be paid to understanding E-gov issues at the regional level to enrich insight.
To address E-gov issues in Eastern Europe, professionals from that part of the world and elsewhere have gathered every year since 2003 on designated Eastern European E-gov days to discuss issues related to the advancement of E-gov in Central and Eastern Europe (Eastern European e-Gov Days, 2011). Knowledge transfer in the area of E-gov between advanced Western European countries and their counterparts from Central and Eastern Europe is actively encouraged. This paper adds to the growing body of knowledge in this area of interest. More precisely, more needs to be done regarding enriching the academic discourse related to the determinants of E-gov maturity in Transition Economies of Central and Eastern Europe (TECEE).

Our study’s focus on TECEE is informed by two considerations. First, researchers such as Roztocki and Weistroffer (2008), Ifinedo & Davidrajuh (2005), and Ifinedo and Ifinedo (2011) have indicated that there is a lack of adequate research related to information systems and technologies (IS/IT) issues in TECEE; they called on researchers to focus on such issues in that part of Europe. Indeed, the academic literature focusing on trans-national E-gov issues in TECEE is sparse, perhaps due to the relative novelty of the subject (Katchanovski & La Porte, 2005). Moreover, research in this area of study tends to employ global E-gov data (Azad et al., 2010; Kovačić, 2005; Katchanovski & La Porte, 2005; Singh et al., 2007; Siau & Long, 2006; Moon et al., 2005) that included some TECEE rather than focus on countries from that region specifically as is the case in our own study. By not focusing on specific regions of the world, it is possible that a deeper understanding of the factors or determinants of E-gov maturity in differing parts of the world is underreported.

Second, TECEE share a common political and cultural history as most countries in the region only recently metamorphosed from centrally planned systems to free market democracies (Ifinedo & Davidrajuh, 2005; Ifinedo & Ifinedo, 2011). Thus, it is pertinent to continue to monitor progress in TECEE especially with regard to IS/IT use for development and governance (Levada, 2004; Alexander, 2004; EU Regional Policy, 2009). Put differently, as E-gov initiatives are implemented to reform administrative services and enhance citizen empowerment, research such as this current one could provide a useful lens through which advancement and positive changes emanating from the use of such technological innovations in governance across TECEE can be assessed or viewed. Moreover, theory development in the area is engendered by views from elsewhere other than the easily available perspectives from the developed Western countries.

With respect to the discourse of E-gov maturity around the world, our research complements the study by Singh et al. (2007) that investigated a similar theme globally by including the effects of political, economic, social, and technological factors on E-gov maturity. Nonetheless, our research differs from Singh et al.’s work in three ways: a) this current study focuses on solely on TECEE for reasons already espoused; b) it underscores the relevance of factors such as rule of law and transparency levels, which were not considered in Singh et al.’s work, c) this study seeks to contribute to the growing body of knowledge regarding the overriding impact of economic imperatives on E-gov maturity and the possible mediating influences of the others factors under focus. That is, this research does more than examining the direct impacts of selected factors on the dependent variable as is usually the case in some previous research (e.g. Kovačić, 2005; Moon et al., 2005).

Further, the focus of some prior E-gov studies in TECEE (e.g. McHenry & Borisov, 2006) was on a single country wherein the quantitative research method was favored. To some degree, comparative analyses of issues across countries can be negatively impacted through the use of such approaches. In our study, published data from reliable sources such as the United Nations (UN) and the World Bank for 16 TECEE over a 5-year period was used for analysis. Very few (e.g. Wong & Welch, 2004) have used longitudinal or time-series data to capture the development of E-gov around the world. We assert that more information could emerge when E-gov progression, over the years, in TECEE are considered and discussed with reliable data. Specifically, our research is designed to provide an answer to the following question: Over time, what are the possible determinants of E-gov maturity in TECEE? The resource-based view (RBV) and the contingent theory (CT) will be employed to provide the necessary conceptual underpinning for our study.

The remainder of the paper is organized as follows: First, information related to the study’s underpinning theoretical frameworks and key concepts are provided. Second, the study’s research model and the hypotheses are presented. Third, the research methodology and other relevant information are presented. The paper concludes by discussing its findings, implications, limitations, and avenues for further research.
2. Background information

2.1 Theoretical underpinnings

The resource-based view (RBV) is a management tool that has been used by researchers (e.g., Srivastava & Teo, 2007; 2008) to discuss E-gov issues against the background of that concept being seen as a national resource. The RBV posits that the basis for a competitive advantage of a firm lies in the application of the bundle of valuable resources at the firm's disposal (Wernerfelt, 1984; Barney, 1991). Some researchers including Mathews (2002) have extended the RBV to a “resource economy” to include the resources produced and exchanged by firms within a country. According to Srivastava & Teo (2007, p. 76), “in a resource economy, the objects of interest are not the resources existing within a particular firm, but the unique configuration of resources within the economy.” In that regard, the distinctive resource configurations within an economy or state and its capability to use such resource will serve to enhance its national competitiveness. The availability of wealth or economic factors for national development has since been fundamentally recognized in the relevant literature (McClelland, 1967; Goldthorpe et al., 1968; Friedman 2005). Factors such as human resource development and other facilitating conditions such as the availability of IT resource within an economy makes it more competitive than counterparts lacking such resource (Friedman 2005; WEF, 2010). It would suffice to note that economies with requisite capabilities and endowments to effectively institute E-gov as a national resource might have benefited from the availability of such endowments (Norris, 2001; West, 2004; 2007; Srivastava & Teo, 2007).

The second relevant theoretical framework considered in this research is the contingency theory (CT), which was developed by Lawrence and Lorsch (1967). The CT has often been used at the organizational level, but it can also be extended to the national level. The CT posits that a set of independent or contingent variables are assumed to influence the dependent variable such that higher favorable outcomes result from the direct impact of the independent variables. To some degree, the CT compliments the direct measure approach (Bonoma & Johnson, 1979), which can be used to assess the direct impact of contingent variables (e.g. political rights and/or GDP per capita) on E-gov maturity. Several researchers (e.g. Moon et al., 2005; Kovačić, 2005; Katchanovski & La Porte, 2005; Singh et al., 2007; Azad et al., 2010) have framed their studies in the context of the CT. Others (e.g. Kubicek & Westholm, 2005) have built upon the CT to propose a “contingency model of E-democracy” that examines the impact of relevant socio-economic, political, and technological factors on E-gov development.

2.2 Transition economies: Definition and categorizations

In general, the term transition economy (TE) refers to an economy that is changing from a centrally planned economy to a market economy (IMF, 2000; Samoilenko & Osei-Bryson, 2008). The characteristics of TEs include rapid economic liberalization, legal and institutional reforms, restructuring and privatization, and macroeconomic stabilization (IMF, 2000). Two groups of TECEE can be found in Europe. The group of eight countries that joined the EU on 1 May 2004 (i.e. Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia) is in fact considered as having completed the transition process. The second group comprises such countries as Romania, Russia, Moldova, Croatia, Bulgaria, Belarus, Ukraine, and Georgia that are still transiting. The latter eight were selected from the list of TECEE in IMF (2000) for illustration purposes. It is suggested that the former and latter groups can be categorized Leaders and Followers, respectively (Samoilenko & Osei-Bryson, 2008; EU Legislation, 2010; World Bank, 2010). The inclusion of the groupings is done to ensure a fair representation of countries in this paper.

2.3 eGovernment maturity

The concept of “maturity” signifies a stage of growth from lower to higher stages or phases in a process (Galliers & Sutherland, 1991; Andersen & Henriksen, 2006). In this research, E-gov maturity refers to the actual level of progress made by a country with respect to the sophistication of the features present on its government websites (Chen, 2002; Andersen & Henriksen, 2006; West, 2007; UN Public Administration Programme, 2010). Accordingly, governments’ websites or web presence that have incorporated advanced functionality and features capable of providing more efficient services to their citizens are generally considered to occupy higher stages in the growth model (West, 2007). It is worth pointing out that the focus of our research is on the aspect of E-gov measures related to the extent to which each country in TECEE has advanced in that regard. It does not
address “E-gov readiness” which describes how ready or able a country might be with respect to using technologies in governance (UN Public Administration Programme, 2010). E-gov readiness measures include the telecommunication infrastructure and human capital-indices, which are prerequisites for E-gov engagements; however, these measures do not show how well a country has progressed with regard to its E-gov efforts. Therefore this particular item has not been considered in this research.

Prior E-gov maturity models and measures (e.g. Layne & Lee, 2001; UN Public Administration Programme, 2010) guide the discourse related to the development of E-gov applications and initiatives in a stage-wise manner – from immature (one-way communication) to the mature (digital democracy) stage (Andersen & Henriksen, 2006). By using a stage-wise approach it affords governments and international agencies the opportunity to assess accomplishments over time. Several of the E-gov maturity models tend to have between three to six growth phases. For example, Howard (2001) used a model comprising of three stages i.e. Publish, Interact, and Transact. Layne and Lee’s (2001) model consists of four stages i.e. Cataloguing, Transaction, Vertical integration, and Horizontal integration. Chen (2002) proposes a model with the Information–Communication–Transaction continuum. The UN’s E-gov maturity model (UN Public Administration Programme, 2010) is a four-stage growth model (Figure 1).

Although there are several E-gov maturity models, our research uses the UN’s E-gov maturity model (see Table 1 for its phases and their descriptions) as it provides a global, comparative data on the Web measure/online service index measures for countries around the world. The other E-gov models were not considered as they do not have such data. In brief, the UN’s E-gov maturity model indicates that countries that have advanced to higher growth levels on their E-gov projects are the ones with relatively high Web measure/online service index scores.

![Figure 1: The UN's four stages of online services growth](image)

**Table 1: Some of the E-gov maturity models in the literature**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Source/proponent(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1: Cataloguing Phase 2: Transaction Phase 3: Vertical integration Phase 4: Horizontal integration</td>
<td>1. Creating web sites and making government information and services available online. 2. Supporting online transactions between governments and citizens. 3. Focusing on the integration of different systems and functionalities. 4. Focusing on the integration of government services for different functions horizontally; real one-stop center for citizens.</td>
<td>Layne &amp; Lee (2001)</td>
</tr>
<tr>
<td>Phase 1: Information Phase 2: Communication Phase 3: Transaction Phase 4: Transformation</td>
<td>1. Government “information” is created, categorized, and indexed and delivered to its citizens through the Internet. 2. E-gov services support two-way “communication,” with citizens communicating requests through web forms, email, or other Internet media. 3. “Transaction” services between citizens and governments are supported. Government branches also use the Internet.</td>
<td>Chen (2002)</td>
</tr>
</tbody>
</table>
for transactions among themselves.
4. An opportunity for the “transformation” of
government’s practices and services is
exploited. Application such as e-voting and e-
politics that may alter the democratic and
political processes are instituted.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Source/proponent(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1: Information</td>
<td>1. Government services are delivered online. One-way communication between government and citizens is put in place. 2. Simple interaction between citizens and governments are supported. 3. Services enabling transactions between citizens and government are supported. 4. Integration of services across the agencies and departments of government are put in place.</td>
<td>Chandler &amp; Emanuel (2002)</td>
</tr>
<tr>
<td>Stage 2: Interaction</td>
<td></td>
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<tr>
<td>Stage 3: Transaction</td>
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<tr>
<td>Stage 4: Integration</td>
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</tr>
<tr>
<td>Phase 1: Publish</td>
<td>1. Information about government’s activities is available online. 2. Enables citizens to have simple interactions through emails with their governments. 3. Provides citizens with full transactions benefits over the internet with services such as purchasing licenses and permits.</td>
<td>Howard (2001)</td>
</tr>
<tr>
<td>Phase 2: Interact</td>
<td></td>
<td></td>
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<tr>
<td>Phase 3: Transact</td>
<td></td>
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</tr>
<tr>
<td>Phase 1: Cultivation</td>
<td>1. Horizontal and vertical integration within government, front-end systems use, and the adoption of intranet. 2. Extensive use of intranet, personalized web interface for customer processes. 3. Abandoning of intranet, accountability and transparent processes, personalized web interface for customer processes. 4. Data mobility across organizations, application mobility across vendors, ownership of data transferred to customers.</td>
<td>Andersen &amp; Henriksen (2006)</td>
</tr>
<tr>
<td>Phase 2: Extension</td>
<td></td>
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<tr>
<td>Phase 3: Maturity</td>
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<tr>
<td>Phase 4: Revolution</td>
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<tr>
<td>Phase 1: Billboard</td>
<td>1. Government’s websites (usually static at this stage) are used for information display. 2. Government’s websites have more capabilities and functionalities to include sorting and searching of information. 3. One-stop centre is created with full integrated online services. 4. Government website develops into a system-wide political transformation with executable and integrated on-line services. Customized information service is available.</td>
<td>West (2004)</td>
</tr>
<tr>
<td>Phase 2: Partial service delivery</td>
<td></td>
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<tr>
<td>Phase 3: Full integrated service delivery</td>
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<td></td>
</tr>
<tr>
<td>Phase 4: Interactive democracy with public outreach and accountability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1: Web presence</td>
<td>1. Government uses the web to provide basic information. 2. Government provides a website equipped with search engines, documents downloading capability and emails. 3. Citizens can carry out enhanced online transactions. 4. All government services and processes are integrated, unified and personalized.</td>
<td>Gartner’s group model in Baum &amp; Maio (2000)</td>
</tr>
<tr>
<td>Phase 2: Interaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 3: Transaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 4: Transformation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1: Information publishing</td>
<td>1. Government creates websites (static) to provide information to its citizens. 2. Enables customers to have electronic interaction with government services such as television licenses renewal. 3. Enables customers to obtain government services and information from a single point. 4. Government provides customers and its agencies with opportunities to customize portals according to their needs.</td>
<td>Deloitte &amp; Touche (2001)</td>
</tr>
<tr>
<td>Phase 2: Official two-way transactions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 3: Multi-purpose portals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 4: Portal personalization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 5: Clustering of common services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 6: Full integration and enterprise transformation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
All government services and processes are clustered so as to provide unified and seamless services to citizens.
6. Government changes its structure to enable the provision of more sophisticated, integrated and personalized services to its citizens.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Source/proponent(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1: Emerging</td>
<td>1. Government provides information and basic services on its web site.</td>
<td>UN Public Administration Programme (2010)</td>
</tr>
<tr>
<td>Phase 2: Enhanced</td>
<td>2. Government websites deliver enhanced one-way or simple two-way communication between government and citizens through the use of downloadable forms.</td>
<td></td>
</tr>
<tr>
<td>Phase 3: Transactional</td>
<td>3. Government websites uses advanced two-way communication between government and its citizens. The websites process transactions such as e-voting, filling of taxes, and licenses and certificates applications.</td>
<td></td>
</tr>
<tr>
<td>Phase 4: Connected</td>
<td>4. Government websites changes the way it communicates with citizens; they are proactive in requesting opinions and information from their citizens; they create and &quot;empowered&quot; citizens with more voice in decision making.</td>
<td></td>
</tr>
</tbody>
</table>

3. Hypotheses formulation

The pertinence of economic imperatives (i.e. national wealth) as a possible foundation for the advancement of E-gov maturity across nations, including TECCE has been succinctly noted above. Consistent with the tenets espoused in the RBV and the CT, the research model in Figure 2 is designed to highlight the relationships between relevant factors or issues and the dependent variable i.e. E-gov maturity. The mediating influences of the other factors are also delineated in the research conceptualization. Discussions on each of the hypothesized paths are presented below.

![Figure 2: The research model (and highlighted hypotheses)](image)

Evidence shows that wealthier nations tend to have higher levels of human capital resource (Kiiski & Pohjola, 2002; UN Public Administration Programme, 2010; World Bank, 2011). According to the RBV, such economically endowed countries are more likely to be advantaged in providing needed resources for human capital development in their contexts (Goldthorpe et al., 1968; Barker, 2005). It is reasonable to expect that economic endowments in TEECE – as would be expected for parts of the world - will be positively related to its human capital development. We predict that:

H1: In the context of TECCE, national wealth will be positively related to human capital development
Empirical data suggests the existence of a positive relationship between the availability of economic endowments and the perceptions of transparency levels across countries (Transparency International, 2010; WEF, 2011). The findings from past studies by Wong and Welch (2004), Torres et al. (2005), and Tolbert et al. (2008) affirm this viewpoint, to some extent. Likewise, prior research has shown that the diffusion of innovative technologies is significantly influenced by the availability of wealth (Caselli & Coleman, 2001; Norris, 2001; Moon et al., 2005; Singh et al., 2007; WEF, 2011). More affluent countries with better financial resources than counterparts lacking in such often make more progress regarding the types and scope of quality features and services provided or seen on their government websites (Singh et al., 2007; West, 2007). We predict that:

H2: In the context of TECEE, national wealth will be positively related to transparency levels

H3: In the context of TECEE, national wealth will be positively related to E-gov maturity

Global data suggests that wealthier countries are far more likely to be advantaged in committing resources to enhancing their technological infrastructure than relatively poorer nations (Torres et al., 2005; WEF, 2011). McClelland (1967) and Goldthorpe et al. (1968) also observed the existence of a positive association between national affluence and the capability to use of technological innovations to engender social change and progress across nations. We predict that:

H4: In the context of TECEE, national wealth will be positively related to the availability of technological infrastructure

There is an association between the economic well-being of nations and their attitudes toward the national institutional variables such as government efficiency (InfoDev, 2004; Accenture, 2001; Kiiski & Pohjola, 2002; North, 1999; West, 2007; Singh et al., 2007). Such findings have implied that the efficiency of governance in countries with superior financial capability tend to be higher in comparison to those lacking in such resource (Wong & Welch, 2004; Srivastava & Teo, 2008). This is because the efficient management of governance structures, at all levels, requires substantial investments in manpower development and infrastructure acquisition (Caselli & Coleman, 2001; Kiiski & Pohjola, 2002; Norris, 2001; Singh et al., 2007; Torres et al., 2005). We predict that:

H5: In the context of TECEE, wealth will be positively related to government efficiency

Along the same line of reasoning as the preceding hypothesis, academic researchers and international agencies have also shown the existence of a positive relationship between the economic well-being of nations and the national governance variable of rule of law (InfoDev, 2004; Accenture, 2001; North, 1999; West, 2007). That is, the wealthier a country is, the more likely it is for its rule of law to be conducive for governance and business (Norris, 2001; Shih et al., 2005). We predict that:

H6: In the context of TECEE, wealth will be positively related to favorable rule of law climate

Researchers such as Norris (2001), Barker (2005), Caselli and Coleman (2001), Karunasena et al. (2011), and the WEF (2011) found that low level of educational attainment and illiteracy negatively impacts social change and the growth of an information society. The UN human capital index, which encompasses average years of schooling (across the three main levels) in populations, as well as literacy rates, captures this social measure across countries. Moon et al. (2005) and Singh et al. (2007) found the human capital index to be positively related to E-gov maturity across countries. The findings in their studies are suggesting that the capability to utilize innovation such as E-gov for development purposes is relatively high for countries with quality human capital resource. That is, top-end features on government websites may be appreciated, demanded, and supported by individuals in countries with a pool of quality human capital compared to where such are lacking. We predict that:

H7: In the context of TECEE, human capital development will be positively related to E-gov maturity

The Transparency International (2010) publishes the Corruption Perceptions Index (CPI) of countries around the world by comparing the degree “to which corruption is perceived to exist among public officials and politicians.” Corruption and a lack of transparency denote abuses related to a lack of openness and abuse of entrusted power. In general, more open societies with a more enlightened public sector governance structure affording more transparency to government operations would
appreciate a need to take their E-gov schemes to levels where citizen participation, engagement and empowerment are encouraged (Kovačić, 2005; Islam, 2008). Previous studies have shown that corruption/transparency perceptions are significantly associated with E-gov progress and diffusion across nations (Azad et al., 2010; Bertort et al., 2005; Cho & Choi, 2004; Kovačić, 2005; Islam, 2008).

We predict that:

H8: In the context of TECEE, transparency levels (i.e. low corruption perceptions) will be positively related to E-gov maturity

Prior researchers such as Singh et al. (2007), Norris (2001), Moon et al. (2005), and Azad et al. (2010) showed that innovative technologies spread where enabling technological infrastructure are present. In the context of the diffusion of E-gov globally, Moon et al. (2005) found that the more technologically advanced (i.e. a higher level of technological infrastructure) a country is, the more likely it is for the country to advance its E-gov projects and agenda. Likewise others, Singh et al. (2007) and Azad et al. (2010) found that the availability of technological infrastructure positively influences E-gov maturity across nations. We predict that:

H9: In the context of TECEE, the availability of technological infrastructure will be positively related to E-gov maturity

When governments adopt E-gov, they tend to do so to improve public administration efficiency (Fountain, 2001; UN Public Administration Programme, 2010; West, 2004; Wong & Welch, 2004; Srivastava & Teo, 2008). The availability of fully connected, integrated services between governments and their citizens enhance government operations as well as engender citizens’ satisfaction (Fountain, 2001; Moon, 2002; UN Public Administration Programme, 2010). Srivastava and Teo (2008) and Singh et al. (2007) revealed that there is a significant association between government efficiency and E-gov development and maturity. These researchers found that efficient governments easily appreciate the need to use advanced E-gov features to improve governance in their contexts. We predict that:

H10: In the context of TECEE, government efficiency will be positively related to E-gov maturity

Rule of law refers to the sound political institutions, impartial systems, and legal protection of property rights in a country (Shih et al., 2005). Prior studies have shown that it impacts the diffusion of e-commerce and E-gov (Oxley & Yeung, 2001; Welch & Wong, 2004; Katchanovski & La Porte, 2005). It has been suggested that countries from emerging parts of the world lag behind advanced countries in technological innovations such as E-gov because of weak and or non-existent national governance institution factors such as rule of law (Azad et al., 2010). It is reasonable to expect that where favorable rule of law exists, there will be little or no problems in instituting advanced features that facilitate citizen participation and empowerment in governance. Conversely, where a serious rule of law issues exist, such progress may be curtailed; discussions on this issue have been presented in the context of some TECEE (please see for example, Alexander, 2004; Levada, 2004; Katchanovski & La Porte, 2005; McHenry & Borisov, 2006). Welch and Wong (2004) and Kovačić (2005) indicated that the authorities of countries with poorer “rule of law” may have little or no interest in providing advanced features on their websites that would encourage citizen engagement and empowerment as such enhancement may be deemed to engender dissent. We predict that:

H11: In the context of TECEE, rule of law will be positively related to E-gov maturity

4. Research method

4.1 Data sources and measures

We used data sourced from reputable world organizations such as the United Nations and the World Bank. Previous comparable research that has used data from such sources include Azad et al. (2007), Katchanovski & La Porte (2005), Kovačić (2005), Singh et al. (2007), and Siu & Long (2006). The human capital index that was obtained from the UN Public Administration Programme (2010) is derived from measures related to the educational attainment and literacy levels across the selected countries. The rule of law and government efficiency variables were obtained from Kauffman et al. (2009) who composed their data from both qualitative and quantitative sources. The rule of law and government efficiency scores ranged from +2.5 and -2.5 with higher scores indicating better
values. The data for the transparency levels variable came from the Transparency International (2010) for which the scores ranged from 0 to 10 with higher numbers indicating less corruption and more transparency societies.

The GDP per capita was obtained from the World Bank’s Development Index (World Bank, 2010). The GDP per capita variable was transformed and normalized with a logarithmic function. Each country’s technological infrastructure level was assessed using a weighted index comprised of Internet users/1000 persons, PCs/1000 persons, telephone lines/1000 persons, online populations, mobile phones/100 persons, and TVs/1000 persons (UN Public Administration Programme, 2010). Each country’s technological infrastructure level was assessed using a weighted index comprised of Internet users/1000 persons, PCs/1000 persons, telephone lines/1000 persons, online populations, mobile phones/100 persons, and TVs/1000 persons (UN Public Administration Programme, 2010). The description of the variables is provided in the Appendix.

For the dependent variable, we used two variables i.e. the Web/online services and E-participation indices from the UN Public Administration Programme (2010). We did not aggregate the aforementioned indices in operationalizing the E-gov maturity variable as was the case in Singh et al. (2007). Our use of the structural equation modeling technique is capable of handling both indices as latent constructs, in our research model. In order to have a fair representation of countries from TECEE, E-gov scores at all levels i.e. above and below scores for the region’s average as well as scores close to the average were considered from the UN Public Administration Programme’s data source. The selected TECEE in the research and some of the indicators used in the research are shown in Table 2.

Table 2: Selected TECEE and some of the indicators used in the study

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech Republic</td>
<td>$15,300</td>
<td>$24,900</td>
<td>0.349</td>
<td>0.454</td>
</tr>
<tr>
<td>Estonia</td>
<td>$10,900</td>
<td>$18,500</td>
<td>0.642</td>
<td>0.502</td>
</tr>
<tr>
<td>Hungary</td>
<td>$13,300</td>
<td>$18,800</td>
<td>0.312</td>
<td>0.505</td>
</tr>
<tr>
<td>Latvia</td>
<td>$8,300</td>
<td>$14,400</td>
<td>0.266</td>
<td>0.416</td>
</tr>
<tr>
<td>Lithuania</td>
<td>$8,400</td>
<td>$15,500</td>
<td>0.524</td>
<td>0.483</td>
</tr>
<tr>
<td>Poland</td>
<td>$9,500</td>
<td>$17,900</td>
<td>0.541</td>
<td>0.387</td>
</tr>
<tr>
<td>Slovakia</td>
<td>$12,200</td>
<td>$21,100</td>
<td>0.380</td>
<td>0.346</td>
</tr>
<tr>
<td>Slovenia</td>
<td>$18,000</td>
<td>$27,700</td>
<td>0.441</td>
<td>0.400</td>
</tr>
<tr>
<td>Mean</td>
<td>$11,987.50</td>
<td>$19,850</td>
<td>0.432</td>
<td>0.437</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>3437.79</td>
<td>19850.00</td>
<td>0.129</td>
<td>0.058</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>$6,600</td>
<td>$12,500</td>
<td>0.537</td>
<td>0.410</td>
</tr>
<tr>
<td>Romanian</td>
<td>$7,400</td>
<td>$11,500</td>
<td>0.419</td>
<td>0.416</td>
</tr>
<tr>
<td>Russian Fed.</td>
<td>$9,300</td>
<td>$15,100</td>
<td>0.223</td>
<td>0.330</td>
</tr>
<tr>
<td>Ukraine</td>
<td>$4,500</td>
<td>$6,300</td>
<td>0.349</td>
<td>0.346</td>
</tr>
<tr>
<td>Belarus</td>
<td>$8,200</td>
<td>$12,500</td>
<td>0.122</td>
<td>0.302</td>
</tr>
<tr>
<td>Croatia</td>
<td>$8,800</td>
<td>$17,500</td>
<td>0.424</td>
<td>0.422</td>
</tr>
<tr>
<td>Rep. of Moldova</td>
<td>$2,500</td>
<td>$2,300</td>
<td>0.070</td>
<td>0.295</td>
</tr>
<tr>
<td>Georgia</td>
<td>$3,100</td>
<td>$4,400</td>
<td>0.048</td>
<td>0.248</td>
</tr>
<tr>
<td>Mean</td>
<td>$6,300</td>
<td>$10,263</td>
<td>0.274</td>
<td>0.346</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2630.00</td>
<td>5355.89</td>
<td>0.184</td>
<td>0.065</td>
</tr>
</tbody>
</table>

4.2 Procedure and the estimation model

Our data was composed of items collected over a 5-year data period (2003-5, 2008, and 2010) in a span of 7 years. Accordingly, the data used for analysis is a panel data (also known as longitudinal or cross-sectional time-series data). This procedure is appropriate in capturing the development of E-gov maturity in the selected countries over time. The advantage in using a panel data lies in the fact that it accommodates variations regarding changes in used variables; a single year study (cross-sectional...
analysis) may not reflect such changes. For the data set of 16 countries, 80 points or observations were obtained, which is adequate for a study such as this one.

Additionally, a panel data takes the fixed-effects (FE) into consideration (Hedges & Vevea, 1998). With FE, it is assumed that each independent variable has its own individual characteristics that may or may not influence the dependent variable. Importantly, the FE removes the effect of those time-invariant characteristics from the predictor variables so that the predictors’ net effect can be assessed. Thus, the pooled time series data enables precise estimates and test statistics with more power in the regression to be obtained. Having said that, this study's analysis will use the structural equation modeling technique, which is similar to the ordinary regression model (Chin, 1998). The main advantage of this technique is that it allows latent constructs to be used, and it enables the results of paths to be assessed simultaneously.

4.3 Analysis and results

The Partial Least Squares (PLS) approach of structural equation modeling technique, which utilizes a principle component-based for estimation, was used for analysis. The approach is suitable for validating predictive models (Chin, 1998). The PLS assesses the psychometric properties of the measurement model, and estimates the parameters of the structural model. The specific tool used was SmartPLS 2.0 (Ringle et al., 2005). The requisite information related to measurement model i.e. the average variance extracted (AVE) and composite reliability were not provided as the study’s variables have items that were mainly operationalized by single-item variables). However, the item loadings for the two items used to represents the dependent variable were 0.907 (Web/online services) and 0.892 (E-participation) to underscore their reliability. The descriptive statistics and inter-correlations among the variables from the PLS analysis is presented in Table 3.

Table 3: Descriptive statistics and the inter-construct correlations (N = 80)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: EGovernment maturity i.e. Web measures index &amp; E-participation index</td>
<td>0.34</td>
<td>0.15</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Human capital development</td>
<td>0.93</td>
<td>0.03</td>
<td>0.51</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: Technological infrastructure</td>
<td>0.30</td>
<td>0.13</td>
<td>0.61</td>
<td>0.53</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: Govt. efficiency</td>
<td>0.25</td>
<td>0.68</td>
<td>0.56</td>
<td>0.32</td>
<td>0.80</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: Rule of law</td>
<td>0.05</td>
<td>0.71</td>
<td>0.57</td>
<td>0.33</td>
<td>0.79</td>
<td>0.95</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6: Transparency levels</td>
<td>3.95</td>
<td>1.25</td>
<td>0.56</td>
<td>0.41</td>
<td>0.78</td>
<td>0.81</td>
<td>0.82</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7: Wealth (GDP per capita $USD)</td>
<td>12310</td>
<td>6081.27</td>
<td>0.56</td>
<td>0.60</td>
<td>0.61</td>
<td>0.74</td>
<td>0.71</td>
<td>0.67</td>
<td>1</td>
</tr>
</tbody>
</table>

S.D. = Standard deviations

The structural model presents information related to path coefficients (β) and the squared R (R²). The strength of the relationship is indicated by the β, which can be interpreted exactly like standardized regression coefficients. The R² shows the percentage of variance in the model to give an indication of its predictive power. The SmartPLS 2.0 results for the βs and the R² are shown in Figure 3. The path significance levels (t-values) are estimated by the bootstrapping method (Chin, 1998).

The data provided significant support for hypothesis H1, which predicted that in the context of TEECE, national wealth would be positively related to human capital development (β = 0.60). Hypothesis H2 that suggested that the national wealth of TEECE would be positively related to their transparency levels was affirmed by the data (β = 0.67). Hypothesis H3 indicating that the national wealth of TEECE would be positively related to E-gov maturity was however unsupported by the data (β = 0.01). The data showed that TEECE with higher levels of economic wealth tends to have higher technological infrastructure (β = 0.82) to support hypothesis H4. The data analysis provided support for hypothesis H5, which suggested that in the context of TEECE, national wealth would be positively related to government efficiency (β = 0.74). Hypothesis H6 was strongly supported as well to affirm the view indicating that in TEECE, national wealth was positively related to favorable rule of law climate (β = 0.71).
In the context of TECEE, human capital development will be positively related to E-gov maturity (H7), the hypothesis was confirmed by the data (β = 0.30). For TEECE, their transparency levels would be positively related to their E-gov maturity levels (H8) was unconfirmed by the path significance (β = 0.09). Support was provided for the prediction made in hypothesis H9 suggesting that in the context of TEECE, the availability of technological infrastructure would be positively related to E-gov maturity (β = 0.19). Hypothesis H10 that was formulated to ascertain the nature of the relationship between the variables of government efficiency and E-gov maturity was unsupported by the data (β = -0.01). The data provided significant support for hypothesis H11, which predicted that in the context of TECEE, rule of law would be positively related to E-gov maturity (β = 0.26). The summary of the results is presented in Table 4.

Table 4: Summary of results

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>path coefficient (β)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>National wealth → Human capital development (H1)</td>
<td>0.60</td>
<td>Supported</td>
</tr>
<tr>
<td>National wealth → Transparency levels (H2)</td>
<td>0.67</td>
<td>Supported</td>
</tr>
<tr>
<td>National wealth → E-gov maturity (H3)</td>
<td>0.01</td>
<td>Not supported</td>
</tr>
<tr>
<td>National wealth → Technological infrastructure (H4)</td>
<td>0.82</td>
<td>Supported</td>
</tr>
<tr>
<td>National wealth → Government efficiency (H5)</td>
<td>0.74</td>
<td>Supported</td>
</tr>
<tr>
<td>National wealth → Rule of law (H6)</td>
<td>0.71</td>
<td>Supported</td>
</tr>
<tr>
<td>Human capital development → E-gov maturity (H7)</td>
<td>0.30</td>
<td>Supported</td>
</tr>
<tr>
<td>Transparency levels → E-gov maturity (H8)</td>
<td>0.09</td>
<td>Not supported</td>
</tr>
<tr>
<td>Technological infrastructure → E-gov maturity (H9)</td>
<td>0.19</td>
<td>Supported</td>
</tr>
<tr>
<td>Government efficiency → E-gov maturity (H10)</td>
<td>-0.01</td>
<td>Not supported</td>
</tr>
<tr>
<td>Rule of law → E-gov maturity (H11)</td>
<td>0.26</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Information related to the variances explained by the study’s constructs is presented in Figure 2. It is worth noting that all the research’ constructs explained 46% of the variation in the research model to indicate that the theorized conceptualization has relevance. Specifically, Chin (1998) noted that R² values of 0.67, 0.33, and 0.19 for the percentage of variance in a model are substantial, moderate and weak, respectively. Thus, the obtained R² in this study with a value of 0.46 suggests that the percentage of variance in the research model is above moderate levels.

5. Discussions

Research findings presented above present information related to the determinants of E-gov maturity in TECEE. While IS, public administration researchers, and practitioners around the world have provided relevant information related to the possible impacts of a variety of macro-environmental factors on the diffusion and adoption of E-gov initiatives globally, the review of the extant literature...
showed that studies discussing the determinants of E-gov maturity in TEECE are not well represented. This current research is primarily designed to fill this gap in the literature. Discussions on unconfirmed hypotheses are presented first followed by the ones that were supported. It is also important to assert that our discussions will be made in the context of the results obtained from our study. We accept that due to the limitations imposed on this study, realities across the countries in Central and Eastern Europe with regard to E-gov maturity may differ somewhat from what is being presented herein.

Our research model did not provide evidence in support of the positive, direct associations between national wealth and E-gov maturity, in the context of TEECE. Also, the transparency levels and government efficiency variables were not found to be positively related to E-gov maturity in our study. These unconfirmed hypotheses do not, in any way, affirm that such factors have no bearings on E-gov maturity issues in TEECE and elsewhere. For instance, the lack of support for the relationships between rule of law and E-gov maturity are counterintuitive propositions, which need further investigation. One plausible reason for the unconfirmed predictions in our research may be due to incomplete and missing data of some of the measures used in the research. Another explanation could be that socio-political factors of government efficiency and transparency levels may actually have little or no impact on the concept of E-gov maturity across countries complying with findings in Singh et al. (2007). It could also be possible that the variable of transparency levels may not be conceptually related to E-gov maturity (Azad et al., 2010; Kovačić, 2005; Singh et al., 2007). However, more studies are needed to debunk or reify insights on the relevance of the foregoing construct on E-gov issues.

Contrary to widely held beliefs among some E-gov experts suggesting that notable progress in E-gov development, diffusion, and maturity appear to have taken place in relatively richer societies (e.g. Norris, 2001; Moon et al., 2005; West, 2007; Azad et al., 2010), the analysis with data from TEECE - with two distinct groupings being used - seem to indicate that the availability of national wealth per se, may not be sufficient a factor to occasion growth with respect to E-gov maturity in the region. To some degree, our result is congruent with new insights noting that remarkable progress have in fact been recorded in relatively poorer countries around the world (Accenture, 2001; InfoDev, 2004; InfoDev, 2004; UN Public Administration Programme, 2010). The data analysis seems to uphold the notion indicating that some of the determinants considered in our study mediate the relationships between national wealth and E-gov maturity.

With respect to the supported hypotheses, we offer the following comments: our research's conceptualization does not imply causation in the model. Where national economic wealth is sufficiently available, the human capital development of such societies tends to be relatively higher as the data analysis has shown. This result is consistent with the RBV. Our data confirmed that higher levels of national wealth are positively related to the pervading transparency levels in TEECE. The data confirmed the notion indicating that economic resources are likely to be vitally important to governments and their citizens in their bids to acquire requisite technological products (e.g. hardware and software) to further enhance E-gov initiatives. We found that higher levels of national wealth have positive relationships with both government efficiency and rule of law. Consistent with the CT and the RBV, higher levels of national wealth in TEECE suggest that such countries are more likely to have the capacity to develop their human capital resource, have an enabling technological infrastructure, and a favorable rule of climate in their contexts. With such foregoing resources, it is easy to argue that a platform for engendering social change and progress through E-gov advancement can be instituted.

The data showed that higher pools of quality human capital resource have positive effects on E-gov maturity. In that regard, our result in this aspect implies that quality human resource in TEECE seems to augur well for the deployment and use of advanced E-gov features in their contexts. Greater capabilities and knowledge can permit a better understanding and appreciation of advanced technological products like those present in websites with higher-end features. Prior research has shown that human capital development boded well for E-gov expansion (Norris, 2011; Wong & Welch, 2004; West, 2007). The data strongly confirmed that the selected TEECE with more technological amenities were the ones that had more favorable E-gov maturity scores. It is reasonable to believe that citizen engagement and empowerment through sophisticated technology-enhanced platforms can only thrive where the necessary, enabling infrastructure is available (Norris, 2001; Azad et al., 2010; Moon et al., 2005; West, 2007). As well, where favorable rule of law climate exists, the political institutions in such TEECE may have a belief that citizen engagement and empowerment through
sophisticated technology-enhanced governance augurs well for their society (Katchanovski & La Porte, 2005; Azad et al., 2010; Kovačić, 2005; Wong & Welch, 2004).

5.1 Implications for research and practice

Our research presents some useful implications for both research and practice. With regard to research, we have attempted to answer the call for researchers to focus on E-gov development issues in emerging economies of the world, including TEECE to deepen our understanding of the phenomenon. Our paper has contributed to the theories of CT and RBV by extending their applications to E-gov maturity. Future research in the area could draw from and expand on the foregoing theoretical underpinnings and concepts in discussing comparable issues. Our findings provide support to espoused views and observations indicating the significance of factors such as national wealth, human capital, technological infrastructure, rule of law, and transparency levels on E-gov diffusion, development, and maturity in the literature (e.g. Azad et al., 2010, West, 2007, Moon, 2002; Moon et al., 2007; Singh et al., 2007; Wong & Welch, 2004; Kovačić, 2005; Katchanovski & La Porte, 2005).

We also deepen insight related to the impact of national wealth in stimulating growth in E-gov initiatives across countries. Likewise, we provided empirical analysis highlighting the roles of transparency levels and government efficiency on E-gov maturity, at least in the context of TEECE. In general, our research efforts benefit the accumulation of knowledge in this area of study. It is worth noting that previous research on E-gov issues in TEECE has used a single nation or a few countries in their analysis. By using a panel data of 16 TEECE, our effort provides a richer and robust insight into E-gov issues. Other researchers may be enticed to follow our approach in this regard, which is not entirely novel. By not focusing attention solely on the direct relationships between the independent and dependent variables in our study, we have avoided one of the commonly known mistakes in the use of CT for research studies (Ifinedo, 2007). Our work adds to Singh et al.’s (2007) model.

With regard to practice, our study also offers implications for policy makers, international agencies, and public administrators. Governments of TEECE are alerted to the salient factors that could serve as possible determinants of E-gov progress in their contexts. Accordingly, more attention may be placed on such noted factors to enhance E-gov maturity in their settings. The attention of international agencies and public administrators are drawn to the fact that national economic considerations and imperatives may not be a direct driver of E-gov maturity. Rather, such a factor constitutes an enabler in the background. In other words, if public administrators are able to properly marshal economic resources available to them in improving the quality of their human resource as well as procuring required technological infrastructural facilities; it is likely that positive outcomes on the E-gov development front will ensue. To that end, financial support from relevant sources may be called upon to accelerate investments in infrastructural acquisitions that relatively poorer nations in the region may be lacking in order to improve their E-gov capabilities.

Regarding the impacts arising from selected socio-political influences, policy makers need to know that while favorable rule of law climate may be conducive to E-gov maturity and advancement, an efficiently run government does not necessarily guarantee progress with regard to how it fares in incorporating advanced E-gov features aimed at improving citizen engagement and empowerment. Adequate focus and well-defined national IS/IT policy as well as benchmarking progress in comparable countries could be beneficial in pointing the way for policy makers (Accenture, 2001; InfoDev, 2004; UN Public Administration Programme, 2010; Eastern European e-Gov Days, 2011). Likewise, E-gov maturity does not hinge on how transparent or corrupt a country is. In fact, results in the E-gov survey of UN Public Administration Programme (2010) showed that E-gov maturity were higher in some corrupt societies than more transparent ones, which exists in TEECE as well. Policy makers and governments in comparable regions of the world such as South East Asia and elsewhere may benefit from this information.

5.2 Limitations and directions for future study

Our research has its limitations. Our research relied on secondary data sources; as such, it is difficult to ascertain with certainty the reliability and validity of items used in composing the various measures. Our dependant variable i.e. the E-gov maturity indicator largely used the assessment of efforts on governments’ websites; the views of citizens are not represented. Thus, this might be limiting given that citizens’ perceptions and expectations of E-gov initiatives may be dissimilar from those of their...
governments’. The lack of an internationally recognized ‘E-gov maturity’ indicator may have its drawbacks. Some of the items we used had missing entries for some of the countries and some data were not up-to-date; these might have negatively impacted the data analysis. In selecting the countries for this research we used the UN Public Administration Programme's (2010) E-gov scores to guide the selection. Notwithstanding, selection bias cannot be ruled out in our research. In fact, we caution against the generalization of our findings to all countries in Central and Eastern Europe.

The amount variation explained in our dependent variable i.e. 46% suggests that other relevant factors such as cultural norms and values, political actors’ actions, citizen awareness and resistance not included in our study could be relevant. Future studies should endeavor to work with a more comprehensive framework that includes such factors. Our study was limited to a five-year observation period; it is advised that as more data become available, a much longer observation period should be considered to enhance insight. Other researchers could replicate this study in other comparable contexts such as the Middle East, South Asia, Sub-Saharan Africa, and Latin America. Accumulated body of knowledge on the possible determinants or drivers E-gov maturity across the regions of the world is welcoming to theory development. Case studies in TEECE and elsewhere could also be considered to deepen our understanding in the area.

6. Conclusion

We used the contingency theory and the resource-based view to guide our discourse of the determinants of E-gov maturity in TEECE. We employed a panel data of 16 countries in the region to provide insight. Our data analysis showed that resources (e.g. national wealth, human capital development, technological infrastructure, and rule of law) matter in accelerating a country's ability and willingness to advance its E-gov initiatives with features that promote citizens’ participation and engagement. The confirmed hypotheses are congruent with similar prior studies and serves to enhance our understanding of the factors that could be perpetuating the progress of E-gov in selected TEECE. The unconfirmed predictions open up an opportunity for further investigations. The attention of policy makers in the region is drawn to factors or issues deserving of further attention as progress is being made in the area. The replication of this study in other emerging and developing parts of the world will be useful to improve knowledge related to the factors impacting E-gov maturity (or lack thereof) in such contexts.

7. Appendix: The research’s data sources

<table>
<thead>
<tr>
<th>Variable</th>
<th>Assessment/definition</th>
<th>Source</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-gov maturity</td>
<td>The Web measures and online services index provides scores for the online services available in each country's web pages. The E-participation index assesses the extent to which ICT-supported participation in processes of governance is enabled.</td>
<td>UN Public Administration Programme (2010)</td>
<td>The Web measures/online services index was added to the E-participation index. The data analyses with the two variables’ average produced an analogous result to the one discussed herein.</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>The value of all goods/services produced within a country in a given year divided by the country’s population for the same year.</td>
<td>World Bank (2010)</td>
<td>Each country’s data is expressed in the US dollar ($)</td>
</tr>
<tr>
<td>Technological infrastructure level</td>
<td>Assessed by a weighted index comprised of Internet users/1000 persons, PCs/1000 persons, telephone lines/1000 persons, online populations, mobile phones/100 persons, and TVs/1000 persons</td>
<td>UN Public Administration Programme (2010)</td>
<td></td>
</tr>
<tr>
<td>The human capital development index</td>
<td>Derived from measures related to the educational attainment and literacy levels across countries</td>
<td>World Bank (2010)</td>
<td></td>
</tr>
<tr>
<td>Rule of law</td>
<td>The extent to which sound political institutions as well as</td>
<td>Kauffman et al. (2009)</td>
<td>Composed by data from more than 20</td>
</tr>
<tr>
<td>Government efficiency</td>
<td>The extent to which governments use available mechanisms and to promote and support their functions.</td>
<td>Kauffman et al. (2009)</td>
<td>The scores for each country ranged from +2.5 and -2.5 with higher scores indicating better values.</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Corruption/transparency perceptions</td>
<td>The degree to which corruption is perceived to exist among public officials and politicians of a country.</td>
<td>Transparency International (2010)</td>
<td>The scores ranged from 0 to 10 with 10 indicating less corruption and more transparency.</td>
</tr>
</tbody>
</table>

**References**


Lawrence, P.R. & Lorsch, J.W. (1967). Organization and Environment, Division of Research, Graduate School of Business Administration, Harvard University, Boston, MA.


The Challenges of Accelerating Connected Government and Beyond: Thailand Perspectives

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**Abstract:** Key issues to make Thailand more dynamic, competitive and prepared for ASEAN economic integration are the implementation of Internal Smart with eGovernment, International Smart with intergovernmental processes and overcoming language barriers. As a first step towards internal smart or being a smart society, eGovernment has been implementing since 2000 in order to improve government services, transactions and interactions with citizens and business. Since 2007, the Ministry of Information and Communication Technology has been developing the Thailand eGovernment Interoperability Framework (TH e-GIF) as guidelines for transformation to connected government. However, the transformation has been slow for six main reasons: lack of national data standards and standard governance body, lack of clear understanding about common processes across all involved stakeholders, lack of best practices and knowledge sharing in implementation, lack of data quality and data collection resources, lack of laws and regulations in data sharing and absence of a proactive mindset. The challenges are how to accelerate connected government and push forward to the connected ASEAN. This work focuses on three main activities: analyzing the gaps and prioritizing the need of information exchange, providing systematic approach for data standardization as well as developing a roadmap for moving towards a smart government with smart health, smart education, smart agriculture, smart tourism, smart trade and smart energy by 2015. Using best practices and the road map, the creation of connected government and connection to ASEAN can be pursued in a strategic and rapid manner. Moreover, secure e-transactions with supportive laws, science, technologies and innovation are also key factors for economic growth sustainability and community well-being enhancement.

**Keywords:** data standardization, TH e-GIF, connected government, connected ASEAN, data landscape, information logistic, ontology based information exchange, connected government roadmap

1. Introduction

ASEAN leaders agreed to establish the ASEAN collaboration by 2015 consisting of three pillars: the ASEAN Economic Community (AEC), the ASEAN Political-Security Community (APC) and the ASEAN Socio-Cultural Community (ASC). Thailand is facing both internal and external pressures. Internally, the performance of government services is increasingly being measured by the benefits they can create for citizens, communities and the business sector. These government customers demand greater efficiency, accountability, public trust and better services. Examples are faster payment of promised compensation to flood-effected households, reducing waiting time and cost of referring patients from one hospital to another as well as providing one-stop service to enable searching and viewing all data pertinent to an individual citizen. In order to decrease this internal pressure, connected government is required.

External pressure comes from the need for Thailand to be more dynamic, competitive and ready to participate in the ASEAN community collaboration. To reduce external pressure, intergovernmental processes for connecting ASEAN with secure e-transactions for AEC, with supporting poverty alleviation and promoting sustained peace and stability in the region for APC as well as with lifting the quality of life and its' people for ASC are recommended. In addition, better language competency for ASEAN and international communication is also necessary. The challenges are how to accelerate the implementation of internal smart with eGovernment and international smart with e-ASEAN.
As a first step towards internal improvement, eGovernment has been implemented since 2000 to improve government services, transactions as well as interactions with citizens and businesses. In Thailand, almost all government agencies are actively grooming their organization to incorporate eGovernment to provide better services. However, processes have been individually designed and developed by data owners or by software developers, which has resulted in a wide variety of non-standard data formats and data collection procedures. Beginning in 2007, the Ministry of Information and Communication Technology (MICT) developed Thailand's eGovernment Interoperability Framework (TH e-GIF) as guidelines for transformation to connected government. Two main phases, TH e-GIF 1.1 and TH e-GIF 2.0, are put forth as recommendations and guidelines for eGovernment interoperability implementation (Ministry of Information and Communication Technology, 2009; Ministry of Information and Communication Technology, 2010). The recommendations relate to data harmonization, data interoperability standards, technical interoperability standards, eGovernment project development, etc. Some pilot projects have been implemented. TH e-GIF 2.0 extension (phase 4) develops a data standardization manual for government interoperability (Ministry of Information and Communication Technology, 2011a) as well as develops a roadmap for national data standardization (Kawtrakul et al., 2011a). Currently, TH e-GIF extension (phase 5) follows the roadmap by developing a data standardization registry system, establishing a data standardization committee and implementing an information exchange system as a best practice. However, the transformation to connected government has been slow for six main reasons: lack of national data standards and standard governance body, lack of clear understanding of common processes across all involved stakeholders, lack of best practices and knowledge sharing in implementation, lack of data quality and data collection resources, lack of laws and regulations in data sharing and absence of a proactive mindset. The challenges are how to move proactively from an inefficient current state to a desired future state and prepare for the ASEAN collaboration in the dimensions of economic and social sustainability. The preparation includes infrastructure development such as logistics and next generation network, trust development such as enhancing information security, supportive regulations and laws as well as high-touch and high-tech development with science, technology and services innovation.

The path from the current situation to the desired situation starts by analyzing the gaps, defining a strategy, roadmap and implementation. As stated in (Dada, 2006), some key challenges which should be also addressed are the ability of government organizations to interchange and integrate information using common data standards, creating success cases for sharing and reusing best practices as well as strategies and policies to support transformation to connected government and connected ASEAN. This work focuses on three main activities: analyzing the gaps and prioritizing the need of information exchange, providing systematic approach for working as well as developing a roadmap for moving to a smart government with smart health, smart education, smart agriculture, smart tourism, smart trade and smart energy by 2015. Based on the best practices and road map, the creation of connected government followed by connection to ASEAN can be pursued in a strategic and rapid manner. Moreover, secure e-Transactions with supportive science, technologies and innovation are also key factors for enhancing economic growth, sustainability and community well-being.

In section 2, the background of TH e-GIF is given; analyzing gaps and the need of information exchange are described in section 3. The systematic approach to accelerate connected government is explained in sections 4. A roadmap is described in sections 5. The final section presents observations, lesson-learned and recommendations for future work.

2. Background of TH e-GIF development

In order to achieve the targets of one-stop service: providing seamless data integration as well as quality and cost effective service delivery, the Thailand eGovernment Interoperability Framework (TH e-GIF) was developed under the auspices of the MICT. TH e-GIF 1.1 and TH e-GIF 2.0 are put forth as recommendations and guidelines for eGovernment interoperability implementation.

TH e-GIF version 1.1 (Ministry of Information and Communication Technology, 2009) provides six recommended guidelines for eGovernment interoperability implementation as follows:

- Policies and guidelines for government data integration
- eGovernment interoperability benchmarking
- Business process modeling
- Business information modeling with XML Naming and Design Rules
- Interoperability technical standards that allow data, IT systems, business processes and delivery channels to interoperate such that services can be properly integrated
- TH e-GIF change management and compliance.

Many public agencies have been implementing e-Document for back office functions and some integrated service applications, such as e-Tax and e-Procurement, under TH e-GIF 1.1 guidelines.

TH e-GIF 2.0 provides more details for how to develop interoperability projects with pilot projects and indicates success criteria with evaluation methods. A one-stop driver licensing service and flood-effected-households compensation have been implemented as proof-of-concept. TH e-GIF 2.0 extension (phase 4) develops a data standardization manual for government interoperability with three case studies (Ministry of Information and Communication Technology, 2011a) as well as develops a roadmap for national data standardization (Kawtrakul et al., 2011a). Currently, TH e-GIF 2.0 extension (phase 5) follows the roadmap by developing a data standardization registry system, establishing a standardization committee and implementing an information exchange system as a best practice. However, acknowledgement of government agencies in order to raise their awareness and make them collaborate in building domain specific and common data standards has not been accomplished yet. In addition, national data standards have not been developed. Data standards can provide not only common syntactic but also semantic understanding of data among government agencies. Without national data standards, government agencies are unable to share information in a timely and effectively manner.

According to NIEM (2007), data standards establishment for TH e-GIF are, also, classified into three categories: universal core data, common core data, domain specific core data (see Figure 1).

- Universal data standard is defined for data that is commonly shared and understood among all domains, e.g., person, address.
- Domain-specific data standards are defined for each specific domain.
- Common core data standard is defined for use in two or more domains.

![Figure 1: Domain data core concept (NIEM, 2007)](image-url)
There are three main types of data that should be standardized for information sharing are:

- A data component, describing a concept by giving its name and details (attribute names). For example, a person is a data component describing an individual person by attributes such as the person's name, date of birth, gender, race and ethnicity.

- A code list, a list of codes and descriptions representing objects in the same set such as currency codes (ISO-4217) and country codes (ISO-3166-1) defined by ISO (in Charalabidis et al. 2008:42).

- An electronic document for interchange among government agencies composes of data extracted from their internal databases. It is essential that the data contained in each document conform to existing data standards. A commonly used document can be registered as a standardized document for reuse or restructuring to create new related documents.

To become a universal data standard, consensus by all domains is needed on the semantics and structure of the data (NIEM, 2007). An example of a universal address component defined by UK e-GIF (2010) is shown in Table 1.

**Table 1: UK e-GIF universal address (UK-eGIF, 2010)**

<table>
<thead>
<tr>
<th>BS7666 Address Component</th>
<th>Cardinality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic land and Property Unit</td>
<td>0-1</td>
</tr>
<tr>
<td>Primary Addressable Object Name</td>
<td>1</td>
</tr>
<tr>
<td>Secondary Addressable Object Name</td>
<td>0-1</td>
</tr>
<tr>
<td>Unique Property Reference Number</td>
<td>0-1</td>
</tr>
<tr>
<td>Street Descriptive Identifier Structure</td>
<td>0-1</td>
</tr>
<tr>
<td>Unique Street Reference Number</td>
<td>0-1</td>
</tr>
<tr>
<td>Postcode</td>
<td>0-1</td>
</tr>
</tbody>
</table>

Note: details of each component are given on the UK e-GIF website (UK-eGIF, 2010)

Figure 2 shows the relationships between each type of data standard where the innermost, universal core set, is necessarily defined first as core data standard for reuse in defining domain specific or common core sets. For example, a person data component could be reused to create new kinds of people components such as student, farmer and patient (see Figure 3). Compliance with the universal data standard enables person data in all domains to be effectively interoperable. Based on data standards, electronic documents can be designed for exchange among government agencies.

![Basic data modeling concepts and their relations](https://www.ejeg.com)
Figure 3: Reuse of universal core data schema (NIEM, 2007)

TH e-GIF 2.0 recommends using the Core Component Technical Specification developed by UN/CEFACT (United Nations Centre for Trade Facilitation and Electronic Business) for electronic document data modeling, XML Naming and Design Rules (UN/CEFACT) and existing international data standards. However, there are many different international data standards which make it difficult for public organizations to follow this guideline. Moreover, the international standards may not be applicable in every case, for example, the address component of each country has both schematic and semantic differences. In Thailand, there exist data standards, mostly of code list types, used in some government agencies, but they have not been declared national data standards yet. In addition, there is some redundancy in data standards developed by different government agencies with different semantics and schemas.

In conclusion, moving proactively to connected government, national data standards, especially universal core set, practical footprints for starting information exchange projects, supporting tools and best practices are essential.

3. Analyzing gaps and the need of information exchange

In order to arrive at the desire future state, i.e., connected government and beyond as well as achieve measurable results, analyzing the root causes of the current problems is necessary. Also, studying multi-sectoral information exchange requirements and their strategic priorities are needed. From our previous work (Kawtrakul et al., 2011a) on the TH e-GIF project (phase 4) hosted by the MICT of Thailand, we conduct many activities to gather information about the barriers of information exchange among Thai government agencies and information exchange requirements as follows:

- Conducting e-survey of governmental information systems to find out what data exist and where they are stored in government agencies as well as to find out the problems of input data collection and information dissemination. (30% response rate or 250 departments responded)
- e-Survey one day training for the selected government agencies(250 persons) to input the survey data through the web.
- Conducting three-day workshops 3 times for operational officials from several government agencies to prepare the data standardization manual aligned with the three selected scenarios.
- Conducting two-day seminars twice for executive officials(100 persons) from several government agencies to raise awareness in data standardization among top management.
- Organizing the “eGovernment day”, a one day conference for raising awareness in data standardization and sharing best practices.

3.1 Barriers of information exchange among Thai Government Agencies

From the analysis of information exchange among government agencies, we come up with the barriers of information exchange both on the data collection as well as the information production and
dissemination. Government agencies had four types of problems in data collection for their database systems as shown in Figure 4. The largest problem was lacking resources for supporting data collections, accounting for 65% of all respondent organization problems. For data standard, there was only 7% of problems reported, which may due to the low rate of information exchange among government agencies during the period of conducting survey.

![Data collection problems](image)

**Figure 4:** Problems of data collection

Figure 5 illustrates the problems of data production and dissemination in government agencies surveyed by our previous work. It shows that almost 50% of the problems come from lacking resources for producing information. It corresponds to the largest problem of data collection.

![Data production and dissemination problems](image)

**Figure 5:** Problems of data production and dissemination
From e-survey, interviewing and discussions during our various activities mentioned above, the barriers of information exchange among government agencies can be summarized as followed:

- Information Management
  - Lack of national data standards
  - Absence of standardization guideline
  - Lack of data quality: completeness, accuracy, timeliness
  - Lack of data standard governance
  - Lack of best practices and knowledge sharing in eGovernment implementation

- People
  - Insufficient IT personnel
  - Data ownership and data sharing mindset problems
  - Lack of awareness about the necessity of data integration
  - Lack of clear understanding about data standardization processes

- Policy and Laws
  - Frequent change of political agenda affecting eGovernment projects
  - No clear rules about hosting for cross-ministry projects
  - Lack of laws and regulations in data sharing

- Technologies
  - Lack of data mapping and conversion tools
  - Lack of research innovation for eGovernment services
  - Lack of enterprise service architecture

Comparing to the barriers of eGovernment integration identified by Lam(2005), there are similarities between barriers in both studies, especially in the areas of governance, data standards, guidelines, agency readiness, funding issues, data ownership and privacy issues.

3.2 Information exchange requirements for G2G

From the analysis of information exchange requirements for government to government (G2G) gathered during both executive and operational level workshops (Kawtrakul et al.,2011a), information exchange models were created. Information exchange models with horizontal integration means integrating information across domains/organizations and vertical integration means integrating within the same domain but in different levels such as referred data of the patients between a primary care unit and a provincial hospital (see Table 2). These models are future extra requirements which have not been implemented yet. Three of them were selected based on prioritization factors for study in detail to be case examples in data standardization guideline establishment. Those are data integration for tracking educational records, data interchange for patient referral and data integration for traceability of agricultural products.
### Table 2: Information exchange models derived from workshops

<table>
<thead>
<tr>
<th>Information Exchange Model</th>
<th>Domain</th>
<th>Integration Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data integration for tracking educational records</td>
<td>Education</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Research data integration</td>
<td>Education</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data exchange for checking vaccine receipts of students</td>
<td>Healthcare</td>
<td>Vertical</td>
</tr>
<tr>
<td>Data interchange for patient referral</td>
<td>Healthcare</td>
<td>Vertical</td>
</tr>
<tr>
<td>Data integration for preventing the spread of diseases</td>
<td>Healthcare</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data integration for finding causalities of traffic accidents</td>
<td>Healthcare/Security</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data exchange for preventing illness from environmental problems</td>
<td>Healthcare/Environment</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data integration for traceability of agricultural products</td>
<td>Agriculture</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Individual and juristic person data exchange for ship registration</td>
<td>Agriculture</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data exchange for natural disaster assistance for farmers</td>
<td>Agriculture</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data exchange for rubber exporter subsidiary</td>
<td>Agriculture</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data exchange for criminal background checks</td>
<td>Security</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data integration for elderly monthly payment service</td>
<td>Security</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data integration for job finding assistance for disabled people</td>
<td>Security</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data integration for pollution control</td>
<td>Environment</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data integration for checking juristic tax fraud from water usage amount</td>
<td>Justice</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Data exchange for facilitating application for factory building in settlement industrial zones</td>
<td>Economic</td>
<td>Horizontal</td>
</tr>
</tbody>
</table>

The projects were prioritized using six criteria: readiness of technology infrastructure, data quality, budget for implementation (compared to cost), personnel readiness, impact on the nation and collaboration among related organizations. However, prioritizing projects based on their impact is difficult, since the impact is not always quantifiable and comparable. Accordingly, prioritization can be done by brainstorming by people who are affected by each project (McGilvray, 2008).

From these information exchange models, we can specify the healthcare information exchange domain which consists of four engaged ministries: public health, agriculture, internal and education as depicted in Figure 6. These four ministries need to exchange or integrate data concerning patients, vaccine receipt records of students, accidents, planting areas, human and animal disease spreading and patient referral. It is crucial to have both universal data standards (e.g., person, address) and domain specific standards (e.g., disease, vaccines, crops) to support data integration and service interoperability among these ministries.

![Figure 6: The healthcare information exchange domain](image_url)
3.3 From internal smart to external smart

As mentioned above, G2G is the first step of internal smart to provide interoperability and service integration in eGovernment and there are many barriers as mentioned in section 3.1. However, after conducting three workshops and implementing at least three pilot case studies, we found that the transformation of eGovernment was slow due to lack of national data standards and standard governance body, lack of clear understanding about common processes across all involved stakeholders, lack of data quality and data collection resources as well as lack of laws and regulations in data sharing and absence of a proactive mindset.

Besides internal pressures, there is also external pressure since Thailand is a member of ASEAN Economic Community (AEC) which formed by 10 Southeast Asia countries: Indonesia, Malaysia, Philippines, Singapore, Vietnam, Brunei, Myanmar, Cambodia, Laos and Thailand. AEC objective is to transform ASEAN into a region with free movement of goods, services, investment, skilled labor and free flow of capital by 2015 (Association of Southeast Asian Nations, 2007). To be a single community, the intergovernmental processes in ASEAN, academic and policy-relevant activities, especially, economic integration are required. To achieve those goals and ensure timely implementation by 2015, eGovernment and e-transactions consisting of e-commerce, e-business, e-document and e-payment are being developed by the government sectors. Preparation is on-going not only to be ready for the ASEAN Economic Community (AEC) but also the ASEAN Political-Security Community (APC) and the ASEAN Socio-Cultural Community (ASC).

The challenges are how to move proactively from an inefficient current state to a desired future state and be ready for ASEAN community collaboration. This move includes infrastructure development such as logistics and next generation network, the trust development such as enhancing information security and establishing information sharing regulations and laws as well as the high-touch and high-tech development with science, technology and service innovation. Some key challenges are to enable government organizations to interchange and integrate information using common data standards, to create best practices for sharing and reusing as well as to set strategies and policies for supporting transformation to connected government and connected ASEAN.

To be fully integrated into global community, MICT and Electronic Transactions Development Agency (public organization) are the leaders and main actors to set out the key strategies and action plans to transform eGovernment to be connected government and transform traditional transactions to be full-electronic transactions. Moreover, in order to sustain economic growth, enhance community well-being and promote ASEAN integration, science, technology and innovation are to be considered as the key factors. Accordingly, in parallel, National Electronic and Computer Technology Center (NECTEC), sets up the technology roadmaps and a series of action plans for electronics, computer, telecommunication, information and services innovation to support the ASEAN blueprint, e.g., smart health, smart agriculture (National Electronic and Computer Technology Center, 2011; Kawtrakul et al., 2011b).

To push forward to implement the concrete and productive actions mentioned above, Thailand has to move up the infrastructure of the eGovernment Interoperability, especially building national data standards complying with international data standards to ensure data interoperability among ASEAN collaborations (AEC, APC and ASC) in the activities of eGovernment, e-commerce, e-business, e-document and e-payment. In addition, Thailand needs to focus on smart society building in order to be internal smart before being external smart. The current selected domains for transforming to be connected government are agriculture, health, education, logistics, security, economic, environment and energy.

4. A systematic approach to accelerate connected government

As stated in section 2 and section 3, data standards are crucial to eGovernment integration and service interoperability. To achieve both vertical integration (between tiers of public administration) and horizontal integration (across boundaries of functions, organizations, or nations) (United Nations, 2008), every domain must define its domain specific core set; and related domains collaborate to define common core data sets. To accelerate this process, it is important to develop automated tools and guidelines consisting of data landscape, information logistic for supporting data sharing and standardization as well as web-based language translation for data and information accessibility in order to support ASEAN collaboration activities and intergovernmental processes.
4.1 Developing tools for supporting data sharing and standardization

To be able to share data, a government agency needs to know where and what data exist in other government agencies. The landscape of government data is also useful for discovery of interrelated data and semantically matched data stored in various different names in government agencies. The flow of data shared among government agencies, data logistics, is useful for data standardization, especially in the process of building common core data and universal core data.

Data landscapes and information logistics can be developed by conducting an e-survey to collect data about governmental information production and dissemination from government agencies with the following details.

- **Government agency (at department or division level of all ministries)**
- **name of respondent, department name, ministry and contact information**
- **Information systems of the government agency, data of each system consist of**
  - **Information system**
  - name
  - type of database system
  - **Input data**
  - main entities stored in each database
  - sources of data
  - data collection problems
  - **Information production**
  - names of information or reports produced by the system
  - channel of information disseminations
  - information users (organizations or groups of people)
  - Internal problems of information production such as too many information requests to handle, lack of IS personnel
  - **Referenced data standards**
  - **Services provided/ operational functions**
  - **Additional data exchange requirement (status: future or on-going project)**

Figure 7 shows the structure of the e-survey database. In addition, the collected information can be used to study state of the art of information production and data sharing among government agencies.

4.1.1 Developing data landscapes

**Data Landscapes** (Chisholm, 2008) are information about all data and information stored or produced by government agencies. Table 3 shows an example of the *crops and farmers* data landscape. Data landscapes can be used for searching eGovernment data.
By analyzing data collected by the e-survey, data landscape can be produced for any level of an organization, or across organizations. Furthermore, related specific data entities entered by government agencies can be categorized into generic common terms, e.g., weather, forest, student, or soil, before illustrating the data landscape. Then, government agencies that produce or store that information are interrelated as shown in Table 3 above. As a result, information users can find government agencies that own related information.
4.1.2 Developing information logistics

It is essential to know current information exchange across departments or ministries to support data standardization. This work introduces the concept of information logistics to model data flows among government agencies. Information logistics is a directed graph \( IL \) as follows;

- \( IL = (V, E) \)
- \( V = \text{set of nodes representing organizations} \)
- \( E = \text{set of ordered pairs of nodes \((n1, n2)\), called directed edges, where each directed edge represents a flow of data from organization \(n1\) to organization \(n2)\).} \)
- \( \text{Each edge is labeled with a data element name that organization } n1 \text{ sends to } n2. \text{ In addition, each edge can be categorized by data dissemination methods: paper based, electronic, or online exchange. Figure 8 shows a sample of information logistics obtained from our survey data.} \)

![Figure 8: An example of information logistics. Note: Data labels on edges are omitted due space limitation, each node represents an organization.](image)

Circles delineate an information exchange model outlined from information logistics.

Combining data sources and data dissemination from the e-survey, data landscapes of all ministries can be integrated to establish the governmental information logistics, illustrating flows of data among government agencies. Using graphical tools to display the logistic, the density of traffic can easily be detected and the status of data exchanging methods explored. Moreover, by using the ontology and graphical reduction techniques, we can explore more specific information logistics.

The information logistic can be reduced to specific information logistic by indicating the data concept of interest. The ontology can support this reduction process by eliminating edges that do not relate to a specified data concept. Then, nodes without any out-going edges are eliminated resulting in smaller specific information logistic. In addition, edges from \( x \) to \( y \) can be combined if they are labeled with a data element in the same specified concept.

4.1.3 Ontology based information exchange domain identification

An ontology is defined as “An explicit specification of a conceptualization.” (Gruders, 1993) It is a set of concepts and relations describing domain knowledge. Ontologies can be used in various
applications such as data integration, knowledge management, natural language processing (Blomqvist and Öhgren, 2007; Dahap et al., 2008; Janssen et al., 2009.) Since information exchange or integration among government agencies requires consistency in data interpretations; ontologies could also support automated semantic matching of different data elements as well as categorizing data elements into specific topics or domains. By using a specific ontology such as governmental organization ontology, object and task-oriented ontologies in agriculture, health or justice domains, identifying information exchange domains for data standardization can be done automatically. An example of instances of organizational and domain specific ontologies is shown in Figure 9.

Figure 9: An example of instances of organizational and domain specific ontologies

Organizational and domain specific ontologies can be used to support identifying information exchange domains (see example in Figures 10 and 11) which are important keys to initiate national data standardization. Each domain indicates what data is needed for interchange and who the stakeholders are.

Figure 10: An example of Information logistics before reduction

Note: see Table 3 for the full organization names of each node
4.1.4 Finding common data interchanged among organizations

Besides using ontologies to identify information exchange domains, we can also apply ontologies to find common data that are exchanged between two or more organizations. This can be done by analyzing information logistics and data landscapes to determine data element that each organization uses or creates. Data that are common between organization A and B are data that are either used or created by both A and B. The method of finding common data interchanged among organizations is explained as follows.

Let $D_X = \{\text{data} \mid \text{used or created by organization } X\}$, where data element names are from data landscapes or information logistics.

Define $D_A \cap D_B$ as a set of common data interchanged between organization A and B

To find $D_A \cap D_B$, the following two steps need to be performed.

Find $D_A \cap D_B$ where
Consider all members of $D_A \times D_B$ and

$$D_A \times D_B = \{(a_i, b_j) \mid a_i \in D_A \text{ and } b_j \in D_B\}$$

add $a_i$ into $D_A \cap D_B$ if $a_i = b_j$,

add generalized term of $a_i$ and $b_j$ into $D_A \cap D_B$ if $a_i \neq b_j$ and $a_i$ relates with $b_j$ such that they are synonyms, generalization or specification of one another, or they have the same root concept.

For example, if

$a_i = \text{rice grower registry}$ and

$b_j = \text{fisherman registry}$

then the generalized term of $a_i$ and $b_j$ is $\text{farmer registry}$.

Hence, we can conclude that organization A and B have a common data named ‘farmer registry’ since when looking up in the agricultural ontology, we’ll find that rice grower and fisherman are both farmers. Both of them can inherit a common core data from ‘farmer’ data standard as shown in Figure 13.

![Figure 13: Example of Inheriting common core data from ‘Person’ and ‘Farmer’ data standards](image)

NLP techniques along with ontologies are needed to determine the generalized term of $a_i$ and $b_j$ as described above. By using this method, we can find common data interchanges among any number of organizations. As a result, we can also find universal core data sets.

### 4.2 Data standardization framework

To establish national data standardization, it is important to consider the re-engineering of processes, tools and technologies, skills and the mindsets of public officials within a holistic framework. In order to accelerate connected government transformation, a framework for data standardization has been recommended. This framework consists of three main parts: data standards, processes and data standard governance.

#### Universal core set

Before any organization attempts to develop a domain specific data standard or common data standards among domains, a universal data standard set should be developed. The universal data standard set is defined for data that are commonly shared and understood among all domains such as person, address, document, vehicle, organization, activity, or project.

#### Data standardization processes

To help government agencies understand how to initiate data standardization in their organization, it is essential to have a data standardization guideline as shown in Figure 14. This guideline starts with
an introduction to data standard concepts following by how to prepare teamwork for data standardization project that may involve many organizations. Then, a four step cycle is suggested.

The cycle starts by creating business scenarios of information exchange such as earthquake scenario or flood scenario. Using methods described in section 4.1, many scenarios of information exchange can be identified. Second, analysis of information exchange required in each scenario is performed. Third, data standardization is done by analyzing both syntax and semantics of information exchanged among agencies and applying the national standards (if existing) or creating a new data standard which should conform to related international standards. Forth, the newly created data standard needs to be validated and published by an authorized national body. Finally, cost-benefit analysis of data exchange projects is presented along with project prioritization methods which will be useful for organizations that have many projects to implement.

For better results, this data standardization guideline should include best practices from both vertical and horizontal information exchange projects.

**Figure 14: The data standardization processes (modified from NIEM, 2007)**

Hence, government needs to support the development of a data standard registry system and a guideline for data standardization processes. The data standard registry system should provide these functions: searching, validating and publishing data standards. In addition, mapping tools to convert data into standards should be also developed for various data mapping. For example, Sahavechaphan et al. (2011) have developed a data mapping tools for supporting an efficient environmental management system.

**Data standard governance**

Data standard governance is important to ensure the success of data standardization and data standard application. There must be a national data standard body that is responsible for developing, supporting data standardization as well as promoting, controlling and certifying national data standards.

**4.3 Overcoming language barriers for connected ASEAN**

In parallel to the standardization framework, many activities are needed to prepare for integration into the AEC, APC and AEC. Both human-human interaction and computer-computer interaction will be needed, especially for smart trade and smart tourism. To address human language issues, we propose web based language translation to support data or information accessibility.

**5. Road map for moving a smart government with Smart X**

The survey, workshops and seminars, along with a study of national strategic plans, including the IT Master Plan 2020 (Ministry of Information and Communication Technology, 2011b), Secure e-Transactions by Electronic Transactions Development Agency, Smart-X flagship projects by National Electronic and Computer Technology Center (2011), enabled us to come up with a roadmap that
consists of four main activities for supporting connected government and connected ASEAN. The four main activities are data management, research and development, human resource preparation as well as policy and plan establishment. Based on the best practices and road map, the creation of connected government and ASEAN integration can be pursued in a strategic, rapid manner. Moreover, secure e-transactions with supportive science, technology and innovation is also a key for economic growth, sustainability and community well-being enhancement.

Two executive seminars were conducted in 2010 where 100 executives were invited from various government agencies. The seminar participants brainstormed for ideas on the success factors of information exchange among government agencies, resulting in identification of four success factors: human resources, budget, policy and measurement which details are presented in Table 4.

Table 4: Success factors in connected Government implementation

<table>
<thead>
<tr>
<th>Success Factors</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Resources</td>
<td>Continuous training and education for operational, management and executive personnel. The topics are data exchanging model, data standardization process and data quality management.</td>
</tr>
<tr>
<td>Budget</td>
<td>Sufficient budget for connected government implementation, e.g., data standardization, information exchange projects, data quality improvement programs and Plan-Do-Check-Act for road map implementation</td>
</tr>
<tr>
<td>Policy and Plan</td>
<td>Establishing National policy and regulations for public information sharing Building connected government road map Promoting connected government as strategic driving</td>
</tr>
<tr>
<td>Measurement</td>
<td>Need good measurement for both quantitative and qualitative in government interoperability and services to citizen, community and business sectors</td>
</tr>
</tbody>
</table>

Raising awareness, building capacity and obtaining collaboration from all government agencies are essential for the success of connected government. To accomplish those goals, skills, culture, politics and mindsets of public officials with a holistic framework should be considered (Archmann and Kudlacek, 2008; Gottschalk and Solli-Saether, 2009). This section proposes a roadmap that highlights four categories of tasks: data standardization and data quality management, government personnel preparation in order to tackle data interchange challenges as early as possible, policy and laws for information sharing as well as research and development for connected government and connected ASEAN implementation. Figure 15 shows the 10-year roadmap for 2011-2020 with short term (1-2 years), mid-term (3-5 years) and long term (5-10 years) goals.

6. Discussion and future work

There are three main lessons learned from our work in creation of information exchange model, development of a data landscape and information logistics and knowledge transfer.

- Creation of information exchange models: from workshops and creating information exchange models, we learned that:
  - Representatives of each government agency joining the seminar should come from both business and IT departments since most IT people do not know the usage and usefulness of their organizational data.
  - The more organizations involved in the workshops, the more useful business scenarios can be created.

- Data landscapes and information logistics:
  - The response rate from our e-survey was 30% (250 agencies); most are representatives from invited organizations at the department level that we trained how to use the e-survey system. Hence, to obtain all information from all ministries, we need to train representatives from lower level organizations that are divisions which are sub organizations of departments since some divisions manage their own information systems.

- Knowledge transfer:
Most representatives do not know the concepts of data standards and standardization. In addition, many of them do not realize its importance. Therefore, all government agencies should educate and train their personnel in all levels about these concepts.

Knowledge of best practices should be managed and shared.

Technical training for government IT personnel is needed.

Initiative projects are necessary for action learning and creating best practices in implementation (Kawtrakul et al., 2011b; Sahavechaphan et al., 2011).

<table>
<thead>
<tr>
<th>Data Management</th>
<th>Short Term</th>
<th>Medium-Term</th>
<th>Long Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>National data standard committee appointment</td>
<td>Revision</td>
<td>Revision</td>
<td></td>
</tr>
<tr>
<td>Universal data core set development</td>
<td>Revision and usage promotion</td>
<td>Revision and usage promotion</td>
<td></td>
</tr>
<tr>
<td>Establishment of communities of interest for all domains</td>
<td>Extension to all domains</td>
<td>Extension to all domains</td>
<td></td>
</tr>
<tr>
<td>Development of domain-specific and common core sets</td>
<td>Revision and extension to all domains</td>
<td>Revision and extension to all domains</td>
<td></td>
</tr>
<tr>
<td>Developing data standard benchmark and evaluation system</td>
<td>Monitoring and auditing</td>
<td>Monitoring and auditing</td>
<td></td>
</tr>
<tr>
<td>Data quality improvement program implementation</td>
<td>Implementation and evaluation</td>
<td>Implementation and evaluation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy &amp; Plan</th>
<th>Short Term</th>
<th>Medium-Term</th>
<th>Long Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing IT personnel workforces and capacity improvement</td>
<td>Continuing</td>
<td>Continuing</td>
<td></td>
</tr>
<tr>
<td>Raising awareness and building capacity in data standardization and Information exchanging for all government agencies</td>
<td>Knowledge management and sharing</td>
<td>Knowledge management and sharing</td>
<td></td>
</tr>
<tr>
<td>Studying national policy and regulations for public information sharing</td>
<td>Establishing</td>
<td>Revision</td>
<td></td>
</tr>
<tr>
<td>Establishment of policy for data standard deployment</td>
<td>Implementing</td>
<td>Revision</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>R&amp;D</th>
<th>Short Term</th>
<th>Medium-Term</th>
<th>Long Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>National data standard registry development</td>
<td>Maintenance</td>
<td>Maintenance</td>
<td></td>
</tr>
<tr>
<td>Implementing information exchange projects as best practices</td>
<td>Knowledge sharing</td>
<td>Knowledge sharing</td>
<td></td>
</tr>
<tr>
<td>Implementing information exchange projects aligning with national agenda</td>
<td>Continuing</td>
<td>Continuing</td>
<td></td>
</tr>
<tr>
<td>Research innovation for e-Government services</td>
<td>Continuing</td>
<td>Continuing</td>
<td></td>
</tr>
<tr>
<td>Studying and planning for next generation network</td>
<td>Next generation network implementation</td>
<td>Next generation network implementation</td>
<td></td>
</tr>
<tr>
<td>Public safety system implementation</td>
<td>Continuing</td>
<td>Continuing</td>
<td></td>
</tr>
<tr>
<td>Developing tools for supporting data exchange</td>
<td>Continuing</td>
<td>Continuing</td>
<td></td>
</tr>
<tr>
<td>Language translation for supporting e-services, e-transaction, e-laws and smart services</td>
<td>Continuing</td>
<td>Continuing</td>
<td></td>
</tr>
</tbody>
</table>

Figure 15: The 10-year roadmap for connected government

From the analysis of information exchange situation among government agencies, we found that there were problems in data management, personnel capability, policy, laws and supporting tools. Hence, to accelerating connected government, we propose systematic approach for moving fast in data standardization and propose a road map for the government to implement necessary foundations and strategic actions for tackling problems while moving towards the goals.

In order that mindsets and work systems reflect best practices, the following issues should be considered:
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- Initiate and promote events for sharing best practices in the public sector, such as an eGovernment day for sharing service innovation, service innovation exhibition, etc.
- Capture, share and reuse knowledge and best practices in data standardization
- Develop and design innovative mechanisms for driving the data standardization implementation
- Promote the benefits and importance of data standardization to all government personnel, including top management
- Establish a standardization evaluation system with
  - Key performance indices which are academic based, outcome-oriented and mission-based
  - Non-financial incentives for motivating proactive participation in data standardization
  - Rewards for success cases in developing connected government applications

For future work, ontology development, including multilingual ontology for eGovernment and e-ASEAN should be constructed to function as a key word index to support online search and as a “category list” to support navigational browsing. This ontology could support automated semantic matching. Moreover, language competency building and web-based language translation are challenges for integration with the ASEAN community. For example, when users want to find data about farmers by using the ontology, the search system could find data elements in data landscape that semantically relate to the word ‘Farmer’. In the Thai language there are many words belonging to the subcategory of ‘Farmer’, e.g., ‘(chao na) meaning rice grower and ‘(chao rai) meaning grains grower.

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References


Examining the Potential for Channel Shift in the UK Through Multiple Lenses

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Abstract: As we globally enter a period of shifting economic fortunes and austerity measures, public service bodies continue to look to make provision more effective and efficient. In this context, such organisations look at service provision, making judgements on the value, type, and location of such provision. Inevitably questions arise as to whether particular aspects of provision can operate differently or be served through different channels at lower cost (saved either through cost of service or efficiency savings from doing things better). Questions arise about whether savings are possible, and what opportunities are offered through revision of service. Citizens are also becoming more demanding over service provision, recognising government wastage and demanding service reform that best makes use of the public purse. The aim of this paper is to detail research findings from a project designed to discover the scope for channel shift (principally migrating users from mediated to self-help solutions) within local government services. The research was carried out on behalf of a group consisting of regional and local governmental public bodies including nine councils and the local area police force. The research consisted of four defined stages: identification from within the public sector bodies of scope for shifting provision; collection of case studies related to successful switches of provision; sampling of customer groups in relation to perspectives on changes to provision; and the creation of a framework to support a business case for strategic decision making regarding channel shift. In terms of project findings, within the initial stage of the project there was no shortage of ideas related to the potential for change to provision linked to a channel shift. The issue was explored through Customer Service Managers with all identifying services with clear scope for change from the automation of different elements of environmental services, through a more comprehensive linking together of benefits services, to simple customer data collection. However, one of the underlying issues is the lack of accessible management data that can easily be aggregated together to support a business case for provision reform. This initial data provided a starting point for the discovery of case studies linked to channel shift and service migration. Thirteen case studies were highlighted from the research linked to the areas identified by Customer Service Managers where reform may make a difference. This case study material provided a range of information about key benefits and issues with service reform in the identified areas. Following case study identification, customer perceptions on service reform were canvassed (n=197 customers at six locations) through the use of a detailed questionnaire. The results suggest that: there are concerns regarding access to e- service provision (brought about through either lack of technology or knowledge); that there is a demand for system reform (focused on doing things the right way for the right cost); finally, that at present the most valuable local government service offered on the web is access to local information with this sometimes being difficult to find. In the final stage of the project a business case template was designed. The business case was to better enable strategic decision making regarding channel shift. The business case is designed to enable the evaluation of requests for service channel growth with critical examination of potential success factors for the shift of government services. Research around successful case study data also identified cases wherein success had not been achieved. Development and implementation of a business case template should enable teams to develop a better understanding of the potential for success or failure and indicate clearly measures needed to best support channel shift occurring.

Keywords: eGovernment, channel shift, transformational government, citizen requirements, e-services

1. Introduction

The changing global market and rising international debt has led to a tide of public service austerity measures designed to limit national public expenditure. The UK government has announced cuts amounting to a loss of 27% of public funding to regional and local government. This translates to 7.1% of cuts on an annual basis (Her Majesty’s Government, 2010). Facing substantial funding cuts forces organisations to re-evaluate service provision and look at service value, effectiveness and efficiency. One area which the UK public service believe still offers opportunities for reform is taking more advantage of the web in the delivery of services. This is primarily because “the cost ... (is)

approximately one-tenth the cost of a contact by telephone” (Socitm Consulting, 2010). However, different channels are more appropriate for different services and the web is just one channel which may or may not prove to be an efficient method for service delivery. Therefore there are still questions
in governmental organisations about the appropriateness of channel for service delivery, and whether reduced costs from web based provision can effectively be realised.

Channel shift itself is not limited to a simple move from physical to virtual services rather it has been defined as "the design and marketing of effective and efficient channels because they are the most appropriate channel for the type of contact, customer and organisation" (Simon Pollock, Head of Customer Services at Surrey County Council, as quoted in Public Networks, 2010). Effectively this means thinking holistically about the service provision not just cutting physical costs but working out the most efficient and effective form of delivery. In some cases this may mean increasing physical costs at one point in a process such that they decrease in other areas, for example, improving the quality of applications coming into a system (through the employment of an individual responsible for quality checking) may mean that lower amounts of applications are processed, then rejected or sent back for modification thus saving time and money at later points in the cycle. This evaluation of the most appropriate channel obviously is quite complex but essentially will come down to a balance in decision making between available resource (space, time, finance), quality of service requirements, access and demand.

The contents of this paper report on findings from a short research consultancy project delivered for a partnership of nine UK councils and other public service bodies. The project focused on providing support for this partnership in exploring the potential for shifting service provision across aspects of their operation from physically based interactions (one-to-one and call centre operations) to self-help based channels. This project was designed to capture scope for channel shift within this collection of public bodies, build on this scope with the identification of related case study material from the sector and beyond, establish customer perceptions regarding shifting channels for service provision and designing a mechanism to support public sector decision making in this area. This paper contributes to a growing body of research focused on public and private sector e-services most particularly in providing a support mechanism for strategic planning in relation to switches of public modes of access to council services.

2. The project problem and literature review

In the summer of 2010, a partnership of nine UK councils funded a short investigation into the potential for the transition of a variety of eGovernment services to self-help web based channels. The project was motivated by the impending changes to council funding, the drive from within council services to improve service efficiency and the general aim to improve service offerings for the citizen. This motivation led to a wish to better understand case studies of success linked to this shift of provision and a requirement to understand the benefits/pitfalls linked to service transformation. A four stage process was designed to provide the information requested.

The first stage of the investigation would focus on ascertaining the scope for channel shift from within council services. This would provide a mechanism for employees responsible for service management and employees on the front line of council services to provide input in identifying such scope. Following this the second stage would provide a detailed review of the literature relating to successful and unsuccessful case studies of channel shift from private and public sector environments. This case study material would provide the partner organisations with an understanding as to what has been successfully translated in the past and give some examples of best practice. The third stage of the project provided a focus on the customer, understanding customer perspectives in relation to the transformation of council services, taking into account the nuances of customer reaction to service change. The final stage would take the results of each of the previous stages to establish a mechanism for evaluating the scope for changes to channel provision. The form of this evaluation mechanism was established as a business case template for service transition.

However, the work completed for this project does not sit in an area with an empty expanse of literature. Questions asked around service transformation linked to technological integration have a long history of research investigation. The World Wide Web is just one of many technologies that have been expected to make a significant impact on the ways in which citizens engage with their government. This lead some individuals to suggest that the WWW had the power to enable governments to re-invent the ways in which they engage with their local citizens (Silcock, 2001). However, there is a growing realisation that in order to truly transform there is a clear need for governmental organisations to focus not just on the provision of appropriate channels for delivery but also re-evaluation of processes to put the customer at the heart of online services (Cabinet Office,
A push to make multiple government services electronically accessible in early e-strategies for government is now replaced by more considered thinking regarding the most appropriate ways in which to engage citizens with services. This is further outlined in David Varney's 2006 book “Service Transformation – A better service for citizens and businesses, a better deal for the taxpayer” (Varney, 2006) which presents a clear case for the transformation of government services to take account of other channels of delivery.

Whilst e-Government benchmarking documentation over the past ten years demonstrates shifts in perception over ease-of-use and perceived use of channels (Accenture, 2005; Accenture, 2007; Accenture, 2008). There continues to be a reliance on the telephone as the preferred method of contacting government services. There is also clear indication in research linked to channel migration and multi-channel strategies that the web as a medium is not a golden bullet, but is another mechanism for citizen engagement, to be used as part of an established channel strategy for government-citizen engagement (van Deursen & Peterson, 2006; Ebbers et al., 2008; Ebbers et al., 2008). A substantial determinant in channel selection is the type of service that the customer is seeking interaction with (Reddick, 2005; Thomas and Streib, 2003). If the service is informational then the web may be a first choice, whilst if the issue is a service related problem then direct contact over the phone may be preferred.

There are clear examples at an International level of where web based channel provision can make a substantial difference in the delivery of service. At national levels we find web based provision making a clear impact on the filing of taxes, with examples such as the Irish (Corbett and Carroll, 2008), UK (Cabinet Office, 2010) and Dutch (Pieterson, 2009) taxation systems demonstrating substantial growth in use of online services. The identification of further best practice case examples of shifts of service provision formed part of the research conducted for this project. This is detailed within Section 3 of this paper.

One of the issues however with a multi-channel process particularly one involving web based services is thinking in relation to a whole solution, which encompasses both back end and front end elements. In relation to this Kenaghan , 2005 suggests that there are “four major categories of barriers to integrated service delivery (these) are political/legal, structural, operational/managerial and cultural ones”. He suggests that successful services are generally seamless in operation between front and back end systems, helping government leverage efficiencies and helping customers also gain advantages. However, there are clearly significant challenges in transforming service provision including changing office processes, increasing customer understanding, dealing with changes in job roles, purchasing or building systems which better enable channel integration. Without tackling service integration organisations are often left with multiple channels with multiple processes which are clearly inefficient and may lead to reduced customer satisfaction. For example, the addition of a web form for booking may, if care is not taken, lead to delayed service provision through this channel as opposed to telephone or physical interaction.

Researchers such as Pumphrey (Pumphrey, 2006) have concentrated on developing guidance for successful channel migration. For example, Pumphrey suggests in his paper “golden rules for formulating future channel strategies in consumer-facing organizations in both commercial and public sectors”. These rules are developed from Pumphrey’s experience in implementing online services for public private sector organisations and from identified best practice. Organisations such as Socitm (see http://www.socitm.gov.uk/) produce a wide range of consultancy papers focused on developing strategies for channel shift, for example Socitm Consulting (2010). In addition governmental guidance in relation to shifting of governmental services including planning for channel shift (Cabinet Office, 2010) is also available. These papers, associated events and workshops provide targeted support for government service managers to understand how channel shift can best work for them.

Consideration does not just need to be limited to the technical transformation of service but needs to consider the mechanisms through which to engage the citizen with new opportunities for interaction. Apicella and Streatfeild (2010) provide a good summary of the issues related to marketing practice of online public services. Small changes like the emphasis of a ‘web first’ focus for council service marketing can make substantial differences in the way citizens engage with the service.
3. Scope for channel shift in local government

In the first stage of the project time was taken to gain an understanding of the potential scope for channel shift within government organisations through an activity designed for customer service managers and conversations with members of staff within the service. The workshop was designed to enable the collection of qualitative perspectives on which services seemed to offer the most scope for a shift of service provision. At the outset of the workshop a short explanation of the channel shift project, and some brief case study material related to channel shift was provided. Following this, the workshop outlined some of the issues needing discussion and identified the scope for specific services to shift channels. Finally, customer service managers took time to identify those council services that they believed were appropriate for exploration, in relation to, shifting some of the present interaction between customers and the services to self-help web based channels. Concentration was placed on shifts to service provision that would result in efficiency savings for council services and shifts that had the potential to bring about real customer benefits. Services identified were:

- Benefits Services
- Dogs including Dog Fouling, Lost Dogs, Street Scene
- Leaflet Provision and online information regarding access to services
- Leisure and Tourism
- Licensing and Planning Applications
- Parking (including Parking Permits and the Blue Badge process)
- Payments
- Pro-active Council Services
- Reporting
- Resident information services e.g. Notifications of Change of Address, Electoral register etc…
- Training services
- Waste Management

Customer Service Managers took time to outline what they believed to be the expected issues and benefits from a transformation of process and the adoption of new service channels for delivery. Consideration was given to which channels were most appropriate for particular services and approaches to improving service. Attention was given to the perceived complexity of transactions, the lifecycle of customer interaction with services, and the potential impact of transformation of services.

In addition a number of visits were made to points of customer access where conversation took place with front end customer service staff around the potential for shifts in customer access. These staff were also positive about the potential for improved access to service but also were clear about issues that may arise related to service nuances.

This initial stage of the project gave a clear indication that there are many potential service areas which are worth exploration in relation to shifts in provision. The Customer Service Managers and front end service staff identified multiple areas for exploration from basic reporting linked to customers in the local area, through automation of benefits services, to online services to support waste and recycling management. Whilst individual areas where benefit could occur were identified it was also clear that data may not be easily accessible to support a case for the provision of new channels. It was also clear that there would need to be a clear understanding of service nuances and customer groups.

4. Case study examples of channel shift success

The above section provided information about the initial stage of the project which focused on analysing the scope for the potential shift of governmental services to self-help channels. Following this initial investigation the research focus shifted to the identification of case studies linked to the previously identified services. The case studies were identified through desk research identifying through available literature best practice examples (and some poor examples) of successful channel migration. Thirteen case studies were identified through the project; in the paragraphs below we outline some of the identified services and findings from related case studies.
Reporting Services

Councils provide reporting services to enable citizens to provide information about different elements of their operation which are either not working (e.g. street lighting), have been damaged (e.g. potholes in roads) or are in need of improvement (e.g. a requirement for dropped paving). Reporting services can also be used to highlight problems in neighbourhoods like anti-social behaviour and can be used to enable citizens to suggest service changes. One of the main service areas that requires reporting mechanisms is that of Waste and Environmental management. Waste and environmental services are one of the most important council services and getting more significant with the increasing trend of recycling. To better enable these services a number of councils have shifted their mechanisms for citizen reporting linked to Waste and Environmental services. For example, South Tyneside Council in 2008 (Astun Technology, 2009 and see http://my.southtyneside.info/), re-engineered their waste and recycling web pages to improve their usability and increase their prominence within the council website. Extra services were provided to better enable individuals in the local community to quickly and easily access the information they required and organise waste collection. With the introduction of the re-vamped waste and recycling pages, service improvements and marketing through a targeted email campaign, cost was reduced from £2.97 to £1.25 and the number of transactions made via the service leapt from 203 to 2873. The council gained 2000 new subscribers to this service in 2009. Subscriptions keep subscribers updated about the services and anything new going on around them.

Tameside Council are another example of a council who have experimented with electronic reporting mechanisms for waste and recycling. Towards the end of 2008, Tameside Council instigated an email campaign to drive citizens to use the online channels that were available to them through targeted emails related to waste and recycling services (Experian, 2009). It was estimated that 1 in 7 calls to Tameside Council relate directly to these services with each call costing an average of £1.28 for Tameside Customer Services team to administer. Tameside had noticed that the ratio of web access for these services stood at 1 in 50 visits to the Tameside website with each visit costing around 6p to administer through this channel. The email campaign was designed around the concept of producing a behavioural shift by the local citizen in moving to e-services rather than the use of a phone call. In addition by publicising services related to waste and recycling the council hoped to increase the demand for other online services. The email campaign consisted of a number of targeted broadcasts to local residents using the database of email addresses gathered. 66% of the emails delivered to local residents were opened and there was a massive increase in the number of web visits throughout the duration of the campaign. Tameside Council also provides a form based system for the customer registration of council services such as bulky waste collection allowing residents to report anything such as abandoned cars and fly tipping. Finally, Bracknell Forest Borough Council decided to purchase a system with a single point of sale facility for reporting services, which could help customers in interaction with individual services at each council service point. This system has not only improved the front of house services, it has also helped the staff by generating more efficient management reports and allowing them to entertain customers with more time within the facilities.

Geo-spatial services

Geo-spatial services are being used to aid waste management services with Daventry District Council using geospatial information to improve their refuse collection routes to provide savings by the reduction of distance travelled by the vehicle. This route optimisation service has reduced costs by up to £153,000 per year. In addition, South Tyneside Council created a geo-spatial project called ‘My South Tyneside’ to bring citizens more localised information about services. They provided a simple web based personalised interface to citizens based on a Unique Property Reference Number. The information provided is mainly about the planning permission in the local areas as well as for waste and recycling services but it has also included email alerts and subscription for local vicinity news. In 2009, over 2000 subscribers were using the system and they calculated estimated savings of £146,669 for 2008-2009.

Online Information Provision

Case studies were also identified relating to the availability of online information instead of print leaflets (Department for Work and Pensions, 2006; Kirklees Metropolitan Council, n.d.). For example, Kirklees Council have adopted a web based multi directional communications system to aid with citizen interaction. The system uses a low cost SMS service to enable council-citizen and citizen-
council messaging. People register with the service and text key words about the information that they want. Responses to their information requests are sent to their phones. This service has been used to provide a mechanism for engaging young people with council services providing information about events happening in the region, and information regarding entitlements to benefits etc. In addition, the system has been used to help communication between the council and those in debt arrears from rental accommodation (with the levels of response from tenants in arrears increasing by 85%) and to provide a communication system for the deaf community. Additionally, Reebok Sports Club London have also used SMS messages for communication between customers and in the provision of booking facilities. This has reduced errors and misunderstandings in the booking process. It gave surprised changes in terms of declines in missed appointments, and an increase in customer satisfaction. Also linked to online information provision, Surrey County Council has identified the most requested leaflets and prioritised them on the basis of their level of importance to provide the leaflet service online. Similarly, the Department of Work and Pensions (DWP) have also tried to reduce the number of leaflets by combining information between services. The DWP and others e.g. Surrey County Council note the importance of knowing the most frequently requested leaflets, their age and level of importance. The DWP have actively sought to reduce the number of leaflets they provide by taking steps such as combining information between services which are of a similar nature and in Surrey County Council's case (and other councils) sharing production costs between neighbouring counties. A number of councils are also making available where possible the most frequently requested leaflets online cutting down on the cost of production but potentially causing problems in relation to consistency between web and print versions.

Benefits Provision

Benefits services in the UK include items such as housing benefits, job seekers allowance, free school meals and clothing grants, etc. Different councils are taking advantage of channel shift in giving benefit services to citizens in various ways. For example, Tameside Council has introduced a system of online application for child related benefits (PublicTechnology.net, 2009). The online system focused initially on providing applicants with an online form for applying for school meals benefits. However, Tameside quickly realised the linkage between benefits schemes and introduced a mechanism for using single forms to apply for multiple benefits i.e. many of the individuals who claim for certain benefits are also entitled to other benefits e.g. in this case school clothing grants. Instant decisions are provided to the customer on their entitlement, with the web system carrying out the validation of data entered and checking benefit entitlements. It is estimated the system has reduced the number of transactions for the service by 40,000 and reduced the majority of transaction costs to 6p. Dundee City Council has also used a single application form for access to benefit services. The system pre-fills in form information for benefits claimers on an annual basis, without the need to re-visit the council, or re-submit proof of eligibility. Calculations are performed and payments are directly made to the customers’ account.

Another example where councils are reviewing their benefits systems is that of the city of Edinburgh Council who have realised that the application forms used to apply for benefits are far too complex, with the majority of applicants for benefit services needing help and advice to complete the process. In addition, many forms are received which are incomplete or poorly completed resulting in significant time cost to applicant and council. The council collaborated with BT and EzGov to develop an online benefit system with pre-completed forms from simple questions asked to the applicant at the start of process. The online service is streamlined and also calculates the level of benefits to which each applicant is eligible, thus giving the applicant simple and efficient feedback about their access to benefits services. The benefit to the city of Edinburgh council have been improvements in efficiency of service and reductions in the number of transactions because of falls in the number of errors on forms.

Online Transactional Services

Similarly, Her Majesty's Revenue and Customs (HMRC) introduced their online self-assessment service over ten years ago in 1999. Initially, the service only attracted 39,000 individuals to submit their returns in this fashion. In 2005/06 this had grown to around 25% of returns but this was still low when benchmarked against other countries where levels of e-Government were mature. However, since this point the numbers of users using the service have grown substantially. Changes to the process and targeted marketing strategies have brought about significant shifts to online services with
5.75 million completing self-assessment forms in 2009, this represents a 52% increase in online completion since 2007/08. Presently 11,000 forms are completed on a daily basis and at its peak the system has dealt with up to 40,000 returns an hour and almost 400,000 in a day. HMRC have done this through strategic planning of channel migration for their customer groups. For example, HMRC have provided self-help material for understanding how to complete the application, moved deadlines for paper returns giving more time to complete online submissions and have focused on transforming the online process into a much leaner, simpler process to complete for individuals than just an online version of the paper form. Individuals can also tailor the system to meet their own requirements and the system provides tax calculation facilities to better enable this aspect of completing self-assessment.

Finally, as an example of online transactional systems, Dudley Metropolitan Council process over 2,500 planning permission applications per year. Prior to 2009, they had in place online planning permission services but these were not designed in such a way as to encourage individuals to use them. In 2009, in conjunction with ThePlanningPortal they introduced a re-vamped service which enabled people in the local community to pay online, manage their applications online, and to stop the need for the submission of multiple physical copies of documentation. With the introduction of the new system, planning permission applications made online rose to more than 60 percent from 30 percent previously.

In the majority of identified successful case studies clear thought has been placed into providing targeted systems which linked back office to front end services. It was also evident that UK councils are not quick to communicate on the fundamental benefits of transformation of their services, even where there has been quite evident success. Taking into account documents such as the Channel Strategy Guidance (Cabinet Office, 2010) and Citizen Service Transformation (CSTransform, 2010), it is clear that at the heart of a successful transformation is an understanding of information such as present channel strategy, cost per transaction, customer satisfaction and potential scope for savings. Key lessons learnt from the case studies include:

- The need to clearly target the service or part of service for channel shift.
- To think clearly about the marketing strategy including segmentation of customer groups.
- Take time establishing key performance indicators which can be used to support a case for channel shift and to evaluate success.
- That channel shift can reduce costs and a proportion of customers are willing to move but it will not replace frontline services.
- That channel shift does not need to come at an expense to customer satisfaction but can improve the service through customised and personalised provision.

5. Investigation of customer perspectives on channel shift

Following the identification of case studies of best practice for channel shift in the UK attention switched to gaining knowledge of customer perspectives on the migration of council services to self-help web based channels. A multi-part questionnaire was designed in order to capture customer views to channel shift in relation to Council services. The multi-part questionnaire essentially covered a range of generic information related to access to council services, web access and future access; captured information from leisure users about potential for channel shift; captured information from tourists about potential for channel shift; and captured information from residents about potential for channel shift across a range of services. Many of the questions asked can simply be quantified however some of the questions encouraged participants to air their views more fully.

The survey was completed by 197 individuals consisting of 53% male and 47% female participants. The questionnaire was conducted across six town centre locations (all of which were close to council service points) on three separate days from nine in the morning until five in the evening. Individuals over 55 formed 50% of the sample set and 46% of the respondents were employed. There were limitations which impacted on the make-up of the participant group. These limitations were: locations selected (attracting sub-sets of council customers); timing (limits sample respondent group reducing the number of employed individuals surveyed and nature of participant employment); and the methods of collection (some individuals will not respond to the survey method chosen). However, the survey provides a selection of customer responses to service transition. The main findings from the
survey are outlined below. Access to the full report and findings can be requested from the authors (Mundy and Foster, 2010).

Observation 1: Whilst there may be an economic imperative to switch service provision to web based self-help services there are some major problems. The results of the survey suggest that there is a sub-set of the local customer group who access council services that are not equipped in knowledge, equipment or in terms of motivation for access to channels other than face-to-face and telephone. 46% of survey participants reported never having accessed council web pages. A wide range of barriers to access were stated, however, 69% of those sampled who had infrequent or no access to council pages cited either a lack of a computer, lack of an Internet connection, lack of knowledge, lack of interest or preference of the personal approach as their main barrier to council web page access.

Observation 2: Whilst the findings do not establish a substantial demand for channel shift in relation to council services, many of those questioned recognised that provision of council services through more cost effective channels was a good thing (for other people), or in the case of web access was inevitable. In terms of the services residents would like to see online, parking attracted the largest interest (17%) followed by reporting and general information (each attracting 10%). Some citizen: council interactions (e.g. loss of job, death, disabilities, licensing, parking permits etc) can involve a lot of clarifications, clearances and paperwork. Although, the channel shifting of these services may be beneficial for some customers groups there are associated risks, for example, privacy and security (as illustrated by customer comments, "I don't like filling in forms online, I feel uncomfortable" and the description of online services as a “total invasion of privacy") and fraudulent claims. Government organisations are sometimes reluctant to deal with these issues in the ways they can be dealt with by private enterprise (e.g. through customer log-in) because of the associated potential for 'big brother' related issues. In addition, there are financial issues regarding the need to properly link front end and back end operations.

Observation 3: It is clear that at present the most valuable service offered on the web by local government is access to local information. Of the 58% of citizens surveyed who accessed council web pages 35% suggested their main reason of use was to find out local information (interestingly for some this was the telephone number of particular services). Local government procedures and policies relating to delivered services can sometimes be difficult to gather and understand. Individuals requiring this information generally have to visit council offices or book appointments with advisors to guide them to more detailed information about these processes. For example, bus timetables, council tax rates, recycling information, and helpline and security numbers, etc. Availability of this information online can reduce these visits substantially.

Observation 4: Some current eGovernment services have not necessarily delivered a standard of service commensurate with the standard delivered previously. Taking an example, negative views were expressed regarding the provision of service in place for online planning applications. At present there are concerns over the reporting of planning permission status using the online system. Customers enquire about the status of planning applications through the site and sometimes the online system can present an inaccurate understanding of planning permission status e.g. at the top level of the site it can state rejection, but only when examined in detail at lower levels might you find that the application had been accepted on appeal. Of critical importance is, services when delivered through different channels should take advantage of the channel in order to improve the service. Comments about the provision of forms to complete and physically take into council facilities don’t promote a reason to ‘Do It Online’.

6. Developing a framework for service assessment

The last stage of the research project involved taking the research findings from each of the previous stages and using these to construct a business case template which could be used to assess the potential for successful channel shift. It is clear from the research above that present approaches to channel shift within governmental organisations do not generally go through a substantial planning process. Therefore there is a need to suggest a comprehensive strategy for assessing the potential for successful channel shift. The final output of this project is in the outlining of a business case template for channel shift evaluation.

The business case template (Mundy and Foster, 2010) was constructed from an analysis of the issues, concerns and requirements extracted from the project’s research findings. The initial stage in
its construction focused on the identification of a range of key criteria to enable evaluation when judging whether a service is or is not appropriate for channel shift. These key criteria are detailed in Table 1.

Questions relating to each of these criteria were then categorised and organised into a paper template document requesting information from the proposer so an evaluation can be made of the potential impact of the new channel and a decision can be taken on the project. The business case template would form part of a two stage process. A smaller form would be abstracted for an earlier stage in the project lifecycle to gain initial support before the development of the larger template, as there is recognition of the length of time it may take to complete the larger business case template.

Table 1: Key criteria

| Benefits to the Customer | Opening up new channels to access services will not necessarily provide benefits to the customer or provide savings to the service. Web based access has the potential to streamline processes, improve service provision and offer more substantial benefits to the customer but only when it is viewed as integral, not just as an add-on. Customers will often make the choice they perceive as the simplest, most effective and with the most benefits. When the digital services offer ease of access, joined up service provision and other added benefits to other forms of access, then this can lead to substantial shifts in usage. |
| Benefits to the Council | Changes made to service provision have the potential to bring clear benefits to local councils. However, these benefits need to be balanced with clear benefits to the public in the transformation of service, given that members of the public are unlikely to move to a different channel for the sole benefit of increased council efficiencies. As has been evidenced elsewhere mechanisms for public change may come in the form of simplified service offerings or by passing on the cost of channel interaction to the customer. |
| Complexity | All services contain varying degrees of complexity, from the simple provision of information through to transactional processes. Even what may seem to be the simplest service can often be full of system nuances and elements of complexity. Often such complexity is centred around impact of changes of customer groups and staff. Understanding such complexity can be key to successful transformation of process and can facilitate public change. |
| Cost and Savings | Gaining a clear and detailed understanding of cost to serve and use of service enables greater clarity when evaluating potential changes to channel provision. When this understanding is coupled with knowledge of how customer attitudes are changing over time (e.g. growth in web usage), this can lead to a better understanding of the potential savings from the shift of service. |
| Customer Demand | Each customer group contains a variety of attitudes towards switches in service channel. Awareness of customer attitudes towards changes to service can help in identifying the delivery of clear benefits to customer groups. In addition, awareness of those services with a high proportion of users willing to change the way they access services can help to realise efficiency savings in short time periods. |
| Service Integration | The creation of extra channels without clear thought about the linkage between front end and back end services can lead to new costs and customer dissatisfaction. Thinking carefully about how to best integrate front end and back end services can lead to service efficiencies. There is limited benefit to providing additional front end channels if these channels do not lead to back end savings. Additional front end channels without integration lead to continued costs as front end service staff are required to pass messages on and respond in similar ways to present face to face or telephone contact. |

Once these key criteria had been identified questions relating to them were categorised and organised into a business case template document requesting information from the proposer of a channel shift project. The aim of this was to enable evaluation of the potential impact of new channels so that decisions can be made about potential success.

7. Conclusions and further work

Changes in public funding are resulting in a drive towards austerity measures in public service provision. These measures involve publicly funded organisations reviewing their practice, in particular, the way that they deliver their services to the citizen. The drive is to reduce cost per transaction whilst maintaining sufficient levels of quality and service effectiveness. The problem with this drive is measures can often be taken in the face of substantial shortfalls of funding which are short term and are not well modelled. Often such decisions can result in a decreased level of service or substantial...
costs at a later date as channels are simply added without fully considering the financial impact and potential benefits to local customer groups. From the research conducted for this project come a number of simple steps forward towards the successful shift of delivery channel.

1. Success breeds success. Determining services which have the most potential for impact in terms of financial and added value for customers will lead to a growth in confidence in local council online services. This is particularly true when the service is reformed to add greater value to the customer than previously delivered through other channels. Once the transformation of service has taken place, these services need to be easy to use, and improve the user experience. Otherwise, as noted by a number of respondents the easiest thing to do is pick up the phone and talk to somebody.

2. Understand the ‘true’ cost. Public sector bodies need to gain a better appreciation of the cost of service through the multiple channels they provide to customers. In addition, Public sector bodies need to have a better understanding of the potential cost and continuing cost of service for any new channel provision.

3. Understand the ‘real’ system. Technology is only one part of a working system, often users have their own processes which can remain uncaptured by any technology. For example, take a local leisure centre with regular customers at specific times. An online system should not provide a completely open market such that it disrupts regular business. Capturing nuances, enabling greater personalisation and customising the interface for specific customer groups can provide an enhanced service to face-to-face or phone call engagement. Facilities such as online archiving, collection only of updated information, and tools for automation are examples of how online systems can be designed to make particular tasks much easier for the average customer to complete.

4. Who is the customer? Invariably services are used by different groups of users with each often having different requirements. In addition, each customer group may require different types of activity in order to attract them to use different forms of service. Some user groups will be quick to change service channel whilst other user groups will resist for substantial periods of time. Taking time to clearly understand the perspectives and requirements of different user groups can lead to the identification of clear marketing strategies or methods to promote engagement with new service channels. Some user groups will require very little encouragement to move.

5. Think ‘bigger’. Simply using an online form to capture user data does not provide clear service savings. Technology provides mechanisms for disintermediation; however, often it is used only at the interface level. The automation of channel processes which go beyond simple data entry has the potential to bring clear efficiencies to process, especially when these are linked directly to backend systems. In cases where there is a lack of integration this often means that the provision of different channels leads to additional tasks for front end customer service staff to handle.

Future work linked to this paper will centre around the implementation of the developed business case template in practice. This will enable evaluation of its potential to highlight services which have greater potential for channel shift success. The research has found that public sector bodies are not that great at highlighting their successes to the public and other organisations in their sector. Therefore more can be learnt from a better understanding of case studies in this area and others linked to eGovernment service success and failure.

In conclusion, with the current drive to decrease costs in public service comes a growing imperative to reduce costs of transaction across government services. With this pressure comes a risk of simply adding channels without fully considering the financial impact and potential benefits to local customer groups. With clear concentration on the development of business cases to support a shift of customer engagement with services, including time taken to understand and target customer groups, successful channel shift can be achieved.

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Towards an Information Strategy for Combating Identity Fraud in the Public Domain: Cases from Healthcare and Criminal Justice

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Abstract: Two trends are present in both the private and public domain: increasing interorganisational co-operation and increasing digitisation. More and more processes within and between organisations take place electronically, on local, national and European scale. The technological and organisational issues related to this prove to be difficult on a local scale and barely manageable on national and European scales. We introduce the theoretical framework of Chain-computerisation, which explains large-scale chain co-operation as an answer to a dominant chain problem. Identity fraud proves to be the dominant chain problem in many chain co-operation situations. Therefore, our main research question is: how to arrive at a successful information strategy to combat identity fraud in the large-scale processes that constitute the public domain? We demonstrate the problem of identity fraud on the basis of two Dutch cases, from the criminal justice chain and the healthcare sector. These cases are taken from our chain research programme in which we test empirical findings against the theoretical framework of Chain-computerisation to derive a successful chain-specific information strategy. In both cases, the problem of identity fraud presents a threat to the chain co-operation. Identity fraud has to be tackled with an approach focused on large-scale processes and with specific person-oriented security procedures and instruments preventing identity fraud from happening undetected. Taking into account that the problem of identity fraud rises in many other domains and countries as well, we conclude that it is a major threat to the European society. Finally, we argue that chain-specific information systems with random identity verification enable combating identity fraud.

Keywords: chain-computerisation, interorganisational information systems, chain co-operation, information strategies within the public sector, identity management, identity fraud

1. Introduction

Interorganisational co-operation is becoming increasingly important, as organisations are more and more interdependent. ICT can support the development of interorganisational relations through cost reduction and/or increasing possibilities for communication and coordination (Williams 1997). Since the internet has become mainstream, many organisations communicate with each other through this channel. This can be in the form of basic means like e-mail messaging, but nowadays also often takes place using advanced ICT applications like chain information systems. These developments are visible on local, national and European scales.

Research, strategy and policy often focus only on technological issues, like standards for interorganisational information exchange. Organisational issues however, like who co-operates with whom, shares which information and why, are complex and important as well. It can therefore be argued that attention should be given to both dimensions (Plomp and Batenburg 2010). Both technological and organisational issues prove to be difficult on a local scale and barely manageable on national and European scales, because the number of parties increases greatly and because of differences in culture, legislation and ICT infrastructure. These factors explain the difficulties and sensibilities that are encountered in large-scale interorganisational chain information infrastructures. Even when these large-scale communication initiatives are successfully deployed, there are many potential problems in their use that need to be taken into account. As interorganisational co-operation in the information age is becoming increasingly important, everyone working in (e-)government should be aware of its inherent risks. In this paper, we present those risks using two cases from the vital domains of criminal justice and healthcare. We argue that one of the main threats in these domains is identity fraud, and show the potential danger if this problem is not properly handled.

In this paper, we introduce the theoretical framework of Chain-computerisation that explains large-scale chain co-operation as an answer to a dominant chain problem (see §2). Identity fraud proves to be the dominant chain problem in many chain co-operation situations. Many people think that through
further securing the authentication process, the risk of identity fraud can be reduced (e.g. Drogkaris, Geneiatakis, Gritzalis, Lambrinoudakis and Mitrou 2008). This basic security is necessary, but we claim that this is only sufficient for small-scale situations. In large-scale chain co-operation situations, traditional authentication systems and procedures prove to be unable to cope with 'wrong person' identity fraud. Identity fraud proves to be hard to prevent in these situations. Therefore, our main research question is:

**How to arrive at a successful information strategy to combat identity fraud in the large-scale processes that constitute the public domain?**

In order to provide an answer to this question, the remainder of this paper is structured as follows. First, we present the theory of Chain-computerisation and the three components of its chain perspective. This provides the background against which we formulate our approach for combating identity fraud. We describe our research method and pay specific attention to the process of conducting a chain analysis and deriving an information strategy from that. Next, we present our two cases in which identity fraud plays a central role, and indicate how this phenomenon can be countered. We conclude with our main findings and suggest some topics for future research.

2. **Chain-computerisation and its specific chain perspective**

Chain-computerisation (Grijpink 1999; 2010) is a theoretical framework which explicitly focuses on large-scale social chains, not on logistic chains (the process of handling goods), nor on information chains (closely linked information systems). Examples of social chains are social security, criminal law enforcement or drug addicts’ healthcare: large-scale interorganisational processes that yield a social product such as income support, safety or survival.

Central to the theory of Chain-computerisation is a specific chain perspective to better understand large-scale chain co-operation processes and chain communication systems. This chain perspective consists of three components. The first component is the concept of a *dominant chain problem*; a problem that no party in the chain can solve on its own. The second component is the idea that a chain should be seen as a *multi-level phenomenon*, enabling a distinction between automation at the ‘base level’ and the ‘chain level’. The third component is the *acknowledgement of irrational decision making at the collective chain level*. The rationale of this chain perspective is recognising *fallacies of the wrong level*. They lead to invalid assumptions and unjustifiable expectations causing large-scale communication systems to fail or sometimes even backfire. We will now discuss these four central elements.

2.1 **The dominant chain problem as the trigger of chain communication**

In a social chain, thousands of organisations and professionals work together without a clear relationship of authority, in ever-changing combinations depending upon the actual case. However, co-operating with other organisations and professionals takes a great deal of effort, time and money. There must be a cast-iron reason for doing so. Chain partners only co-operate if they are forced to do so by a dominant chain problem. A dominant chain problem is one that none of the partners can solve on its own. It is only by effectively co-operating that chain partners can prevent the systematic failure of their own organisation and the entire chain. Because common interests are less pronounced than people usually think – and are also often unclear – the badly needed cohesion can only be provided by a pressing dominant chain problem. Only such a barely-manageable problem can create an interplay of forces which triggers large-scale co-operation of so many organisations and individuals and promotes the development and maintenance of a large-scale chain communication system focused on the dominant chain problem. In a chain analysis, the dominant chain problem – if any – is uncovered, defined, examined and tested against the theoretical requirements that must be fulfilled to qualify as a trigger for large-scale chain co-operation. If in a specific chain a dominant chain problem cannot be found or – upon examination – does not seem to be vigorous or tenacious enough, a large-scale ICT-project for this chain will predictably fail or falter. Thus, the dominant chain problem determines to a large extent the feasibility of a large-scale chain communication system.

2.2 **The chain as a multi-level phenomenon**

The theoretical framework of Chain-computerisation sees a chain as a multi-level concept (see Figure 1). It makes a distinction between interorganisational (or chain) information systems at ‘chain level’ on the one hand, and *intra*-organisational information systems (or source registers) at the ‘base level’ of
the chain, that can be linked to a chain information system, on the other hand. A chain information system automatically detects in which intra-organisational system relevant information can be found or, for instance, which organisation should be informed depending on the actual dominant chain problem that the chain co-operation is focusing on. The dominant chain problem determines the content of the necessary chain communication. This chain communication is brought about even when chain partners themselves do not know which organisations are involved in the case at hand.

<table>
<thead>
<tr>
<th>Chain level</th>
<th>Base level</th>
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<td><img src="image.png" alt="Diagram" /></td>
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**Figure 1:** Two distinct levels of analysis, with different types of information systems

This distinction is meant to analytically enable separating information collection and storage in source registers from communicating essential details throughout the chain using chain information systems. It directs our attention to two notions:

- According to the theory of Chain-computerisation, only the critical details that are absolutely necessary for preventing the dominant chain problem should be available at the chain level.
- Irrational decision making takes place at the chain level, as will be explained next.

This way, large-scale chain communication systems have only minor influence on the chain partners' autonomy; projects meet less resistance, so the critical mass of participating organisations is reached as soon as possible.

This multi-level scheme – for a better understanding of the problems inherent in large-scale chain co-operation and communication – can be applied to any large-scale phenomenon.

### 2.3 Acknowledgement of irrational decision making at the collective chain level

Because overall leadership or authority is absent, the chain is a difficult administrative domain in which decision making and information exchange proceed differently than *within* organisations. Rationality and efficiency are often hard to find at the collective chain level and, as a consequence, unpredictability and lack of control are the order of the day. A model of irrational decision making that fits well with the processes that take place at the chain level is the garbage can model of Cohen, March and Olsen (1972; March and Olsen 1976). This model states that the outcome of decision processes results from combining a random selection of problems, solutions and decision makers. Often this concept of irrationality at the chain level is hard to grasp. The crux is that – as there is no single party in command – group processes at the chain level are not rational, even if every individual
professional and organisation acts rationally. The theoretical framework of Chain-computerisation takes this lack of an overall co-ordinating and enforcing authority as its starting point. Large databases containing substantive data to be used by many independent organisations call for more authority and willingness to co-operate and pool resources than are usually present in chains. Collective decision making is chaotic and unpredictable. Therefore, chain solutions should be basic and non-complex. A simple alert mechanism using a chain information system at the chain level is often the maximum result that can be attained.

The significance of a decision model as a component of our chain approach is that it creates awareness of the inherent complexities of any large-scale situation and warns against expecting clear objectives, ample support or well-articulated decisions. At the chain level, these ideal conditions will not be found. Instead, the model teaches us to expect setbacks and to develop chain communication systems only in a very gradual way.

2.4 Fallacies of the wrong level

In information science – as well as in management – we usually derive insights from small-scale situations such as a local information system, a small group experiment or a regional pilot. Thus, we have gained insights into the power of recording data and in management tools such as time schedules and budgets. If we transpose such insights to large-scale situations without checking the validity of underlying assumptions at that level, we often make a ‘fallacy of the wrong level’ (cf. Galtung 1969). This might partly explain why so many policy measures and large-scale systems unexpectedly produce poor results, fail or falter – and sometimes even backfire.

The concept elaborated upon in the previous subsection provides a good example of such a fallacy of the wrong level. Expecting that chain decision making takes place in a rational and well-articulated manner seems logical, as individual organisations use to behave rationally. At the collective chain level, however, this cannot be the case because essential preconditions for rational decision making are not fulfilled. Another example is providing a single sign-on e-government architecture, as discussed by Drogkaris et al. (2008) for the Greek situation. Although this may seem convenient from the perspective of an individual user, it also means that once a malevolent person obtains the possibility to fraudulently sign on, (s)he has access to all e-government services. The notion that a person who provides the right credentials (e.g. username and password) does not necessarily imply that this is also the right person, is important in this respect. In small-scale situations, the focus is often only on optimizing the authentication procedure. In large-scale situations, the focus should also be on preventing malicious use of these authentication means by someone other than the authorised person.

The theoretical framework of Chain-computerisation suggests several remedies against making fallacies of the wrong level, while taking into account the needs and preconditions of large-scale chain co-operation. One such remedy could be, for instance, taking a gradual approach to the development and implementation of large-scale systems. Most of all, we must stop treating large-scale communication systems as intra-organisational information systems with a somewhat larger group of users. This is a classic fallacy of the wrong level. Chain-computerisation features a chain approach with its three pillars (§2.1 - §2.3) which – taken together – provide professionals and researchers with a compass that is better suited for a working environment without a co-ordinating and enforcing authority, thus preventing from making fallacies of the wrong level that cause projects and systems to fail or falter.

3. Chain-computerisation and its method of chain analysis

Apart from the chain perspective, the theoretical framework of Chain-computerisation offers a specific method for chain analysis, to better assess the feasibility of large ICT-projects and information systems. The examples that we present in the following two sections are case studies taken from our chain research programme at Utrecht University based upon this method. This programme has an exploratory, empirical character and mainly consists of conducting chain analyses. A chain analysis tests empirical findings against the theoretical framework of Chain-computerisation, to derive a suitable chain-specific information strategy to cope with the dominant chain problem.

By now, we have performed over 25 analyses of Dutch and international chains (Plomp 2011). For each chain analysis, desk and field research have been performed. Data collection took place from
By interviewing a number of stakeholders within a chain, we try to obtain an accurate picture of it, estimating the value of the variables used in the chain analysis. Each chain analysis consists of constructing the four assessment profiles provided by the theory of Chain-computerisation: the mission, coordination, information, and co-operation profile. Completing these profiles entails, among other things, determining what the dominant chain problem is and what critical details are necessary to prevent the dominant chain problem from spoiling the result of the chain co-operation effort, assessing the required coordination forms in this specific chain and gauging the current level of chain-wide co-operation. An example of constructed assessment profiles for the chain analysis of the manic-depressive disorder chain-of-care can be found in a recent article in the Journal of Chain-computerisation (Grijpink, Visser, Dijkman and Plomp 2010, pp. 5-6). The results of this chain analysis, together with other input from the interviews, make it possible to formulate a successful information strategy (Grijpink et al. 2010, p. 7).

Generic, recurring results of the more than 25 conducted chain analyses thus far have bearing on the dominant chain problem, fallacies of the wrong level and identity fraud (Plomp 2011). We have already seen the dominant chain problem and fallacies of the wrong level. In practice, identity fraud is poorly understood causing many social chains to dysfunction or be disrupted. Therefore, before turning to our two examples, we briefly explain the peculiar character of identity fraud. Identity fraud – using or stealing somebody else’s identity with malicious intent – is becoming a major issue in our information society. The real problem is that if an identity fraud succeeds, all clues and traces lead to the victim instead of the culprit. Afterwards, the culprit cannot be found and the victim subsequently has much difficulty proving his/her innocence. Identity fraud is difficult to detect while it is taking place unless special preventive tools and procedures are installed. This is usually not the case. Thus, identity fraud goes by unnoticed. A major challenge, indeed.

The phenomenon of identity fraud leaves us with difficult puzzles. Identity checking as a process is greatly predictable and observable because it takes place in public spaces. Making identity checking less predictable is a major challenge, but rewarding because identity fraudsters do not want to be caught. Usually, we check identities with only one ID-instrument, which makes the process vulnerable because checks with one ID-instrument can easily be manipulated. But how can we check identities with two or three independent ID-instruments at the same time? That requires a careful situational design of the process, which has to be variable in order to diminish the predictability of the process. Another difficult characteristic of identity fraud is that its magnitude is very hard (if not impossible) to measure. Every statistic is useless, as it only indicates how often the fraud has been detected: successful identity fraud goes by unnoticed. With this realisation in mind, news items stating that “the incidence of fraud has gone down” suddenly become much less positive.

The chain perspective provides a better understanding of the problem of identity fraud by revealing that its real damage will ultimately be the disruption of important large-scale communication systems. Moreover, once a person has fraudulently changed his/her identity in one chain, the new ‘identity’ can affect other chains as well in which it is no longer possible to see through the preceding fraudulent identity change. Thus, our chain research programme has resulted in a more realistic view of our interorganisational world and will in turn lead to better information strategies for successful large-scale information infrastructures for national or international chain co-operation.

4. Case 1: Identity fraud in the Dutch criminal justice chain

4.1 The criminal justice chain at the national level

Because successful identity fraud cannot easily be detected and mostly goes unnoticed, only rarely can a successful fraudster be detected because (s)he is still there. One such situation where this is possible, is the prison cell. If a criminal finds someone willing to sit out his/her sentence in his/her place, we find his/her stand-in person in the cell. Alternatively, if the criminal has been successful in using the identity of someone else, we find the right person in the cell but with an identity that is not his/her own. If this identity fraud goes undetected, the criminal is untraceable after his/her release because the administrative details of the verdict – stored in the criminal registry for later use – point to someone else. This scenario could explain how a criminal sometimes succeeds in pursuing his/her career with a clean slate without links to his/her previous aliases.

In 2004, more than 100,000 sets of criminal fingerprints linked to more than one administrative identity had been registered in the Dutch national forensic biometrics system HAVANK (Grijpink 2011). The
cleverest criminals had succeeded in using more than 50 aliases, implying that they had managed to get their criminal verdicts spread to as many criminal records of other persons (who may not be aware of this). Note that this volume of identity fraud may be even bigger because a fingerprint set linked to a single name does not guarantee that this name actually belongs to the criminal. This volume of aliases was the result of only fifteen years of automatic biometric fingerprint checking in only a limited number of criminal cases, because until October 2010, the Criminal Procedure Law allowed the use of forensic biometrics only if necessary to prove someone's involvement in the criminal case at hand. An immediate confession thus prevented biometric identity checking. If the criminal retracted his confession in court, he could be pretty sure that fingerprint checking would not be done in this stage of the prosecution. Since January 2011 however, the Dutch Criminal Procedure Law provides for compulsory biometrical identity checking for every serious crime.

Apart from the HAVANK system, which is positioned at the base level of the chain, the criminal justice chain also has a chain information system at the chain level, a reference index for persons called VIP. This chain information system contains for every registered criminal a personal criminal number (the VIP-number) and a set of references pointing to criminal law enforcement agencies actually involved in this person’s criminal justice procedures. The VIP-number is issued to a criminal when (s)he is registered in the information system of one of the chain partners for the first time; it will never be re-issued to another person and will be used at every new contact with one of the chain partners during the rest of his/her life. By 2004 however, the VIP system had already administered more than 1.2 million VIP-numbers since the introduction of the system in 1993. In 2004, this huge amount of VIP-numbers issued to first offenders suggested a large volume of identity fraud, because the Dutch population could not possibly account for so many criminals.

The above two systems, HAVANK and VIP, illustrate the apparent pollution that is present in the information systems of the Dutch criminal justice chain, as a consequence of successful identity fraud. In the future, this can be prevented or at least reduced by improving identity checking of criminals (i) by the police and (ii) in prisons:

(i) The police perform identity checking at the beginning of the chain. They used to do this by asking for an identity document or for name and address which are then checked against the residents' register of the relevant municipality. However, if name and address go together but belong to another person, this checking causes a wrong name mentioned in the official report as well as in the subsequent summons and criminal verdict. This way the criminal will leave the chain with a clean slate when using his real identity. In the new procedure since January 2011, the police have to perform a biometric identity check first together with high resolution photographs, both taken simultaneously at the start of the procedure. If more than one trustworthy identity comes up, a thorough identity investigation is required by law with the possibility of special detention.
(ii) Until recently, the detention process was only supported by an administrative information system. Nowadays, prison management also uses biometric details in order to check at every internal movement or leave whether there is a biometric match.

If the above is done properly by the police and the prison, the value of trying to use another name or sending somebody else to serve a sentence is greatly diminished. Still, we are left with the challenge of verifying that older verdicts have been booked under the right name.

4.2 Fading borders: The criminal justice chain at EU-level

As criminals more frequently operate internationally, criminal justice will also need to operate across national borders more often. Let us now see how extending this national scale to an international scale complicates our national approach. The difficulties that make national chain processes barely manageable hold even more for the European situation.

An example of this increased complexity is the case of Michel Fourniret. This Frenchman was sentenced in France to long-term imprisonment having raped and murdered several young women. By moving to Belgium, he was able to start with a clean slate and even work at a school there. Apparently, the Belgian police never questioned the French criminal registry. The Belgian education chain might have questioned the Belgian criminal registry because, in many EU member states, Fourniret's job was considered sensitive enough to ask a job candidate for a so-called declaration of good conduct. However, consulting the Belgium criminal registry would wrongly have produced a clean slate, as his criminal past was only registered in France. To avoid this from happening in the
future, criminal record information must be exchanged between EU-member states at the moment of a sensitive appointment of a person with another nationality. This communication will only be correct if two conditions are met:

- The national criminal law enforcement chain in every member state prevents identity fraud in its own criminal procedures.
- Each member state sends every criminal verdict to the convict’s member state of nationality while preventing identity fraud during this transfer.

This implies a close co-operation among police forces within the EU, focused on the identity of their nationals in other EU-countries using the forensic biometrics procedures of the home country (i.e. the country of origin, not the country were the crime was committed). Chain-computerisation theory tells us that a physically centralised EU registry for criminal justice cannot be expected to work adequately at this enormous scale. Fortunately, at the moment, the efforts are being aimed at a bilateral exchange of criminal verdicts regarding member states’ nationals based on a central access system and the use of the national biometric identities. In line with the theory of Chain-computerisation, this will eventually lead to a distributed EU criminal registry based on biometric identities that might be able to prevent criminal cases such as Fourniret’s from happening again. At the moment, we are very far from this ideal situation, but much will already be gained if every criminal verdict that is to be exchanged between EU-member states is accompanied by fingerprints and photographs, similar to the Dutch national solution.

5. Case 2: The importance of identity in Dutch medical chains

We now shift our attention to another vital domain of our society where identity plays an important role: the healthcare sector. In the Netherlands, the government aims at introducing a national system of medical information exchange based on the national personal number as the sole identifier for recognition of persons and linking of data. Recently, there has been much debate about the implementation of this Electronic Personal Record (Schäfer et al. 2010). With the chain perspective of Chain-computerisation in mind, it is clear that the usual small-scale concept of the doctor-patient relationship does not adequately reflect the large-scale field of forces in healthcare between more than half a billion EU-patients and the EU’s hundreds of thousands of medical service providers. A simple risk assessment might reveal, for instance, that some patients have a clear interest in using somebody else’s personal number to be treated in cases (s)he is not insured for healthcare, to hide his/her illness from other persons or from his/her life insurance company. This identity fraud can take many forms but inevitably contaminates the medical record of the patient and of his/her victim. Identity fraud will probably surface in many large-scale healthcare chains as the dominant chain problem to be countered. This problem proves to be barely manageable on a regional scale. On a national scale, many preventive measures are needed; on an international scale, even more. At the moment, adequate preventive measures are generally absent.

Consider the large-scale nation-wide electronic patient record on the one hand, and the small-scale doctor-patient situation on the other. In the Netherlands, even national policy makers usually think about healthcare with the small-scale situation in mind. It is the situation they are most familiar with. When someone (‘patient X’) receives treatment in a hospital and enrolls with the health identification number of someone else (‘patient Y’), the victim (Y) usually will not suffer much from this as long as the geographical distance between the treatment locations of X and Y is large enough. Both doctors – trapped in their small-scale thinking – believe they know their own patient Y very well. But if all medical data would be combined in a nation-wide information infrastructure – now we are in the realm of large-scale information systems – the data of patient X would also be part of the virtual medical file of patient Y. None of both physicians would notice, as both name and number of their patient are correct. So, in most cases identity fraud goes by unnoticed, as the data point to their own patient for both doctors. It should be clear that these situations can easily lead to medical errors.

We are very far from an ideal situation, but much will already be gained if any national linking of medical records would not be based on the patient’s personal number alone and – additionally – would also automatically present a high resolution photograph of the patient on the doctor’s computer screen. In the near future, research should also establish which infrastructural elements and which additional safeguards are needed for the safe exchange of medical information on a European scale.

One such infrastructural element – that is also relevant for computerisation on national level – is the consideration that not all medical chains are similar, and thus may benefit from different information.
infrastructures. In our chain research we have found differences between for example the diabetes control chain and the manic-depressive disorder chain-of-care (Grijpink et al. 2010). These two diseases require fundamentally different medical data in order to provide adequate treatment. Furthermore, for diabetes it is usually sufficient to share patient data regionally, whereas manic-depressive people tend to be less ‘sedentary’, so it may be wise to share their data on a larger scale. And there are more relevant variables that vary across medical chains: differences in speed required, differences in the role of the patient (active/passive) and differences in the nature of the process (e.g. monitoring an illness, discovering an illness). For instance, the aforementioned illnesses are both chronic, but it is not hard to see that the acute medical care chain has other requirements.

Similar to the criminal justice example, we again see that a central – be it national or European – database for healthcare records is undesirable, as this facilitates identity fraud, makes it harder to keep all information up to date, and is more difficult from a privacy perspective.

6. Conclusion and discussion

Identity fraud/theft is easy and very profitable. In both cases discussed above, the dominant chain problem of identity fraud presents a threat to the relevant chain co-operation that has to be tackled with a large-scale approach and with person-oriented security procedures and instruments that are indeed able to prevent identity fraud from happening undetected. Taking into account that this problem exists in many other domains as well, we conclude that identity fraud is a major threat to our society. The main reason is that our social systems are not designed to prevent or detect identity fraud. Because committing identity fraud is not a seriously sanctioned criminal offence, the culprit can effectively evade such unpleasant consequences as long-term imprisonment. Often, the cost-benefit relationship is in his/her favour. Moreover, the interests and motivations of the target persons in a chain process vary greatly, depending on the dominant chain problem. We have seen that only preventive measures can protect against identity fraud.

Our examples illustrate that the chain concept is a powerful tool in understanding how large-scale public information infrastructures can effectively tackle identity fraud, even on an enormous scale. The chain perspective and chain analysis have proven useful to uncover hidden aspects of large-scale social systems and to develop and deploy successful chain information systems geared to the dominant chain problem at hand. Therefore, we argue that basic, but chain-specific information systems, combined with random identity verification procedures enable combating identity fraud.

An important contribution of this paper is that we have shown how the chain analysis method (Grijpink 2010) is tuned towards the peculiarities of large-scale chain co-operation and the corresponding chain information infrastructures. The impact of a dominant chain problem and of irrational decision making at the collective chain level bring about that simply scaling up the usual authentication procedures and traditional defence measures is not good enough. They do not take into account identity fraud of the ‘wrong person’-type that cannot easily be detected within large-scale systems and surreptitiously spreads from chain to chain.

Future research could focus on how identity fraud differs across social chains as for severity of the consequences, ease of detection and available prevention methods. We have already seen in this paper that there are similarities but also great differences between identity fraud in the context of serving a sentence in a prison cell and receiving medical treatment at a hospital. Another possible future stream of research could focus on the relationship between the identity fraud problems covered in this paper and the processes occurring in ‘for-profit chains’, e.g. online ordering in web shops.

Politicians and public managers like to simplify complicated interdependencies between and within large-scale systems and preferably produce simple measures. Our chain research has taught us that this is fruitless in the real world; we had better deal with the world as it really is. This does not exclude a simple solution, as these two examples show. The example of the criminal law enforcement chain also applies to many other large systems at EU scale. If it proves to be that easy to use other people’s identity under the watchful eyes of the criminal law enforcement officials, we must not delude ourselves about the future of identity fraud in less well-guarded public information infrastructures, such as employment, education or travel. If, in the future, we are not able to adequately counteract identity fraud – even, for example, in large-scale EU co-operation in the vital fields of identity management and healthcare – governments will ultimately lose much of their legitimacy.
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