Measuring for Knowledge: A Data-Driven Research Approach for eGovernment

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Abstract: As ICT provide a lot of possibilities, high expectancies exist towards the electronic public service provision. All governments are increasingly establishing their e-strategies. However, eGovernment still faces many challenges as it continues to develop. The current status of electronic services delivery opens up a lot of questions, both for practitioners and researchers. Therefore, further progress of eGovernment needs a profound knowledge base. eGovernment policy has focused several years on bringing online public services and on benchmarking their availability and sophistication. Simultaneously, eGovernment measurement and monitoring activities are often based on the so-called supply-side benchmarking. Although this is important knowledge, it is under criticism because it lacks a user-centric viewpoint of eGovernment development. This article presents and discusses a bottom-up and data-driven approach about how research can help to manage (user-centric) eGovernment strategies. Based on statistical testing (techniques of structural equation modeling, SEM) of large-scale sample data from the Belgian government, the authors have investigated which relations do exist between contextual variables and the availability and/or satisfaction of electronic public services. By doing this, this manuscript presents an illustration of a data-driven approach in eGovernment monitoring and it explains how this can support and enrich the management and evaluation of eGovernment policy.

Keywords: eGovernment, methodology, management, benchmarking, evaluation, satisfaction, structural equation modeling (SEM)

1. Introduction

Since the mid-90s the rise of information and communication technologies (ICT) has started. The public sector could not ignore the new developments and was forced to implement innovations and to explore new possibilities, just as the private sector (Heeks, 2003). In the middle of this 'e-evolution' eGovernment became the buzzword and was believed to be the driving force behind the modernization of public administration (Bekkers & Homburg, 2007). After more than a decade, all Western countries have developed eGovernment policies that enable the offering of services by hand of different channels. Although the Internet still is the main channel for electronic service provision, some governments are experimenting with a so-called multichannel delivery (OECD, 2005). In addition, the sophistication of electronic public services is continuously increasing: electronic full case handling and advanced identification methods become more common in eGovernment.

Despite the promising expectations, eGovernment still faces many challenges as it continues to develop (Jaeger & Thompson, 2003; Traunmüller & Wimmer, 2004; Verdegem, 2009). One of the main pitfalls of eGovernment is its relative low uptake: in most Western countries the usage of e-services is no longer increasing in the last years (Eurostat, 2009). Therefore, the current status of electronic service delivery opens up a lot of questions, both for practitioners and for researchers (Carter & Bélanger, 2004; Dimitrova & Chen, 2006; Hung, Chang, & Yu, 2006; van Dijk, Peters, & Ebbers, 2008). In this regard, eGovernment development and monitoring needs a profound knowledge base: knowledge is needed about user needs, ICT literacy levels, satisfaction of e-services, impact of online public services, etc.

In this article a data-driven research approach is discussed that can help in (the evaluation of) eGovernment policies. Efforts are needed to bring together knowledge concerning both technical developments and evolutions in user needs. In addition, several scholars have emphasized the need of investigating the demand side of eGovernment, instead of a purely supply-oriented approach (van Dijk et al, 2008; Kunstelj, Jukic, & Vintar, 2007; Verdegem & Verleye, 2009). This approach entails the centralization of different sources of information that have an influence on eGovernment progress. Simultaneously, it needs to be decided what and how to measure eGovernment development.

Reference this paper as: Verdegem, P, Stragier, J and Verleye, G "Measuring for Knowledge: A Data-Driven Research Approach for eGovernment" *Electronic Journal of e-Government* Volume 8 Issue 2 2010, (pp227-236), available online at www.ejeg.com

First of all, we argue in this paper why eGovernment measurement is increasingly put in the foreground. We explain why there seems to be a shift from efficiency to effectiveness in the evaluation of public e-services delivery. Starting from the conceptual viewpoint, we move to the daily-based activities in eGovernment measurement in Belgium. Furthermore, we discuss research results on the development of a Belgian eGovernment monitor and how a data-driven approach is helpful in this. Last but not least, some lessons learned as well as recommendations for future measurements are presented.

2. EGovernment policies and eGovernment measurement: A need for rethinking?

2.1 EGovernment policies: The shift from efficiency to effectiveness

There are many definitions of eGovernment and the term itself is not universally used. The differences are not just semantic and may reflect priorities in government strategies (Heeks & Bailur, 2007; Relyea, 2002; Yildiz, 2007). Moreover, definitions and terms adopted by individual countries have shifted, as priorities have changed and as progress was made towards particular objectives (Verdegem & Hauttekeete, 2010). This is as it should be: the area is a dynamic one and policies as well as definitions need to remain relevant. The Organisation for Economic Co-operation and Development (OECD) defines 'eGovernment' as:

> *"The use of information and communication technologies, and particularly the Internet, as a tool to achieve better government (p. 23)" (OECD, 2003).*

It can be stated that this is a more 'traditional' definition of eGovernment in which the focus is mainly on the government itself.

In line with the definition of above, eGovernment policies in Europe have focused several years on bringing online electronic public services and on benchmarking their availability and sophistication (Codagnone, 2008). This is important knowledge, however, it is not free of criticism stating that too much attention is given to the supply-side of eGovernment (Kunstelj et al, 2007; Reddick, 2005; van Dijk et al, 2008). Given the relatively low uptake of eGovernment – one of the main arguments to rethink the electronic service delivery – several authors made a plea for more user-centric development of eGovernment (Bertot & Jaeger, 2006; 2008; Verdegem & Verleye, 2009).

Closely related with the shift from a government orientation to a citizen orientation is the paradigm shift from efficiency to effectiveness (Verdegem & Hauttekeete, 2010). The latter refers to goals of government policy in general and eGovernment in particular. Millard (2008) distinguishes three types of goals concerning public policy: efficiency, that can be seen as the search for savings. Consequently, efficiency mainly deals with value for government. Effectiveness has more to do with the search for quality services and, as a result, the emphasis is on the value for the users (both citizens and businesses). Lastly, and more in general, governance is about the search for good governance, in which value for society is the keyword.

The paradigm shift, i.e. equal attention for both efficiency and effectiveness, has partly originated from the rethinking of e-services policy as well as the strategies concerning the evaluation of eGovernment (measurement activities). Not only the supply-oriented approaches of eGovernment have come under criticism, critiques also exist towards the so-called supply side benchmarking (Bannister, 2007; Heeks, 2006; Janssen, Rotthier, & Snijkers, 2004; Peters, Janssen, & van Engers, 2005). Codagnone & Undheim (2008) summarized the main lines of criticism of this: the overall relevance and validity of purely supply-side approaches and the reliability, comparability and transparency of the methodologies used are strongly questioned. In addition, the model of stages in development (Andersen & Henriksen, 2006; Layne & Lee, 2001) as well as the 20 basic online public services (e.g. benchmarking studies performed by consultancy firms such as Accenture or Capgemini) seem to be no longer sufficient for accurately evaluating eGovernment progress.

2.2 EGovernment monitoring: Measurement for knowledge

Policymakers increasingly use electronic channels to deliver a wide range of information, interaction and transaction services at a growing level of sophistication. Consequently, the measurement of progress of eGovernment development became a hot topic in e-services policy (Heeks, 2006; Janssen et al, 2004; Kunstelj & Vintar, 2004; Peters et al, 2005). It can be stated that these evaluation

activities serve a double goal: first of all, in the light of rethinking of eGovernment policies and moving towards a more user-centric approach, not only the current provision of services should be evaluated. A thorough understanding of the demand side is also important (Kunstelj et al, 2007; van Dijk et al, 2008; Verdegem & Verleye, 2009). This relates to the question of effectiveness of eGovernment strategies. Secondly, governments are also under pressure to offer more and better services while spending less at the same time. This way, eGovernment is seen as a catalyst for a productivity-driven way of working (Jaeger, 2003; Millard, 2008).

It must be clear that the electronic service delivery as well as the underlying business processes and information flows are quite complex whereby it is difficult for governments to determine adequate measures for evaluating efficiency and effectiveness of the spending of their public money (Kunstelj & Vintar, 2004; Peters et al, 2005). Measurement for knowledge is thus an important but difficult to achieve challenge. For this reason, it must be based on a holistic framework of different information sources. The framework should be comprehensive on the one hand, but flexible to adapt to new trends and evolutions on the other hand (Centeno, van Bavel, & Burgelman, 2005). Another point of attention is that eGovernment measurement strategies should be integrated in the daily-based activities. Once-only screenings of spending of government on IT or assessment of user needs and expectations prevent to develop long term eGovernment strategies (Bertot & Jaeger, 2006; Jaeger & Bertot, 2010; Kunstelj & Vintar, 2004). Therefore, robust methodologies and measurement frameworks are needed.

Question remains what to measure and how to develop a holistic framework? Figure 1 depicts the classical conceptual framework for (the measurement of) efficiency and effectiveness of public sector policies and services (based on: Codagnone & Undheim, 2008).

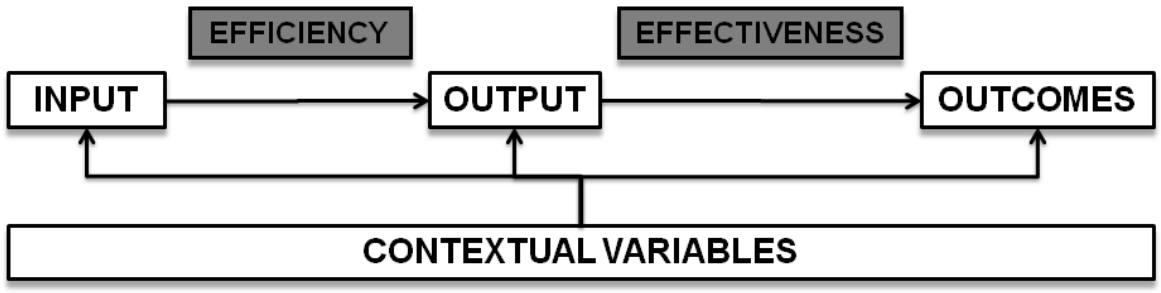

Figure 1: Basic framework – efficiency versus effectiveness

This framework distinguishes three elements in the public service value chain: input, output and outcomes (Heeks, 2006). According to Codagnone & Undheim (2008) input are all the monetary and non-monetary costs that go into the production of an output and in the achievement of outcomes. Output can be seen as the final product of processes and activities that is less influenced by external variables and more under the control of the producing unit. This way, efficiency can be seen as the input/output ratio. In addition, outcomes can be seen as the result of the input & output activities, or, in other words, outcomes can be measured by the degree to which input and output are capable of achieving the intended results for different groups of stakeholders (citizens, businesses as well as governments).

The 'input-output-outcomes' relation does not exist within a vacuum. Other variables may have an influence on input, output and outcomes as well as on efficiency and effectiveness. In general these variables can be aspects of (amongst other) regulation, public sector functioning, economic and social factors, cultural attitudes, politics (Codagnone & Undheim, 2008). Especially with regard to eGovernment, these variables also may be related with (e-)readiness and other external variables (Heeks, 2006; Millard, 2008; van Deursen & van Dijk, 2009).

3. Evaluating eGovernment development in Belgium

3.1 Context and field experience

EGovernment in Belgium is an important driver for public modernization. However, like in the neighbouring countries, a lot of work remains to be done. In the OECD Peer Review Report of Belgium (OECD, 2008) it is stated that:

> "*Belgian governments could consider acquiring a systematic basis on knowledge of user needs and channel this knowledge into the design and development of targeted eGovernment services, with the purpose of making these services more attractive to users and more adapted to their true needs* (p. 19)."

This is a clear call for more user-oriented strategies. Other points of attention are the intergovernmental co-operation management strategies of integrated eGovernment (regarding the complex state structure) as well as reducing the digital divide (stimulating ICT access and use is necessary to make up arrears in comparison with other OECD countries), and are thus important challenges for Belgian eGovernment policy (OECD, 2008).

The OECD Peer Review report highlights eGovernment measuring and monitoring activities as an important plan for action in Belgium. Some first initiatives were already started in the last few years. The Federal Government has monitored user needs (Fed-e-View/Citizen) as well as the computerization of administrative departments (Fed-e-View/Administration) since 2004 (OECD, 2008). Another Fed-e-View study (focusing on eGovernment for businesses) is planned for the near future. The Fed-e-View studies are good initiatives, however, a systematic framework for monitoring and evaluating eGovernment is currently lacking. Hence, the need for setting up an eGovernment monitor. Although this monitor can build on the experience of the Fed-e-View studies a holistic framework still needs to be developed.

More in particular, this framework should provide a complete overview of all aspects that relate to eGovernment progress. Therefore, the measurement initiatives regarding to citizens' needs and expectations should be combined with a continuous assessment of the administration back-office development, as well as other aspects related to the provision of electronic public services. In a nutshell, the measurement of eGovernment should pay attention to information containing the different aspects of the eGovernment value chain.

3.2 What to measure?

One of the most important questions regarding the measurement and evaluation of eGovernment is the strategic decision what to measure, or, in other words, which domains can be distinguished? And how can adequate measurement indicators (as the basis of concrete data collection) be formulated? Based on prior research in this field (Codagnone & Undheim, 2008; Heeks, 2006; Kunstelj & Vintar, 2004; Millard, 2008) a general framework has been developed. Figure 2 provides an overview of this framework. The five key domains are: contextual variables, input, output, outcomes and impact.

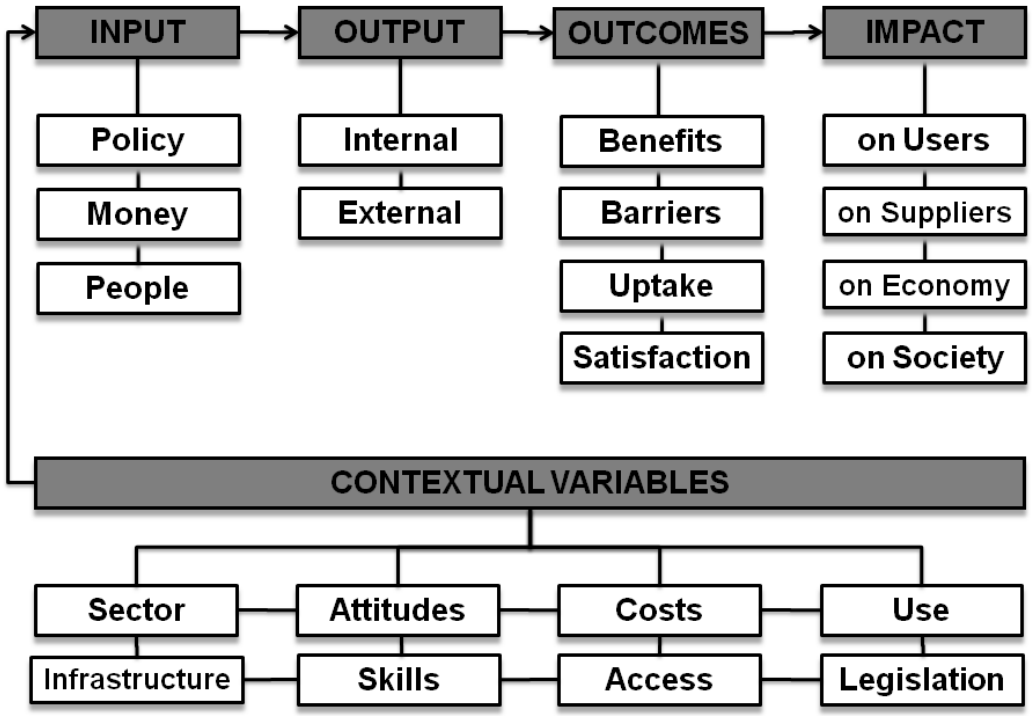

Figure 2: General framework for measuring eGovernment in Belgium

On the figure it is illustrated how each domain can be subdivided in underlying blocks of indicators that will consist of different (key) indicators. In our research project, a total of 830 eGovernment measurement and evaluation indicators are formulated, corresponding with around 160 key indicators. The indicators originate from different sources such as Eurostat, eUser, SIBIS, eGEP, etc. as well as the national statistics department (ADSEI – FOD Economie).

'*Contextual variables*' consist of different categories of indicators that have an indirect influence on eGovernment progress. It contains information about the ICT sector (e.g. '*employment and turnover, investment in ICT research*', etc.), infrastructural variables (e.g. '*availability of Internet access points*', '*geographical coverage of Internet or GSM/DTV by access platform*', etc.), attitudes of users towards ICT (e.g. '*intentions to purchase ICT infrastructure*', '*reasons for not having access to Internet*', '*reasons for not using a computer*', etc.), skills of users (e.g. '*levels of computer and Internet skills*'), costs (e.g. '*price of cheapest Internet access by access platform*'), levels of access to ICT of both citizens and businesses (e.g. '*level of Internet access at home by access device*', '*level of Internet access in enterprises by type of connection*', '*availability of ICT equipped workstations in public administrations*', etc.), use of ICT (e.g. '*computer use by individuals*', '*Internet use in enterprises*', '*use of ICT devices in public administrations*', etc.) and legislation matters (e.g. '*the legal framework to regulate ICT*'). In sum, these contextual variables mainly correspond with e-readiness and related issues.

The block '*input*' deals with investments of government (monetary and non-monetary) with regard to eGovernment provision. Under the category 'policy' key indicators are listed such as '*the acceptance and implementation of strategic eGovernment elements*' or '*strategic policies regarding ICT*'. The categories 'money' and 'people' are self-explanatory.

'*Output*' corresponds with two groups of indicators: 'internal' and 'external'. The first group assembles key indicators such as '*the implementation of joined up service delivery*' or '*the use of monitoring tools or the use of technical eGovernment components*'. Under the second group, we have listed variables such as '*accessibility of government websites*', '*availability of electronic public services by channel*', '*online availability of basic public services for businesses by type of service*', etc.

The blocks '*outcomes*' versus '*impact*' are less self-evident. Especially, it is the question which indicators should fall under outcomes and which under impact. We decided to see outcomes as the collective term for both issues preceding eGovernment acceptance (benefits and barriers), the uptake of electronic public services itself and the direct results of eGovernment usage (satisfaction). Examples of indicators measuring benefits are '*the ease of use of online public services*', '*the perceived benefits for enterprises of using online public services*', etc. 'Barriers' is the opposite category of benefits, containing indicators such as '*the perceived barriers for citizens to uptake eGovernment*' or '*the perceived cost of eGovernment for enterprises*', etc. The uptake of eGovernment can be measured using variables such as '*channels used by citizens for interaction with public authorities*' or '*the use of basic online public services for enterprises by type of service*', etc. Satisfaction is also a sub domain of outcomes and assembles key indicators such as '*citizens' evaluation of government websites*' or '*satisfaction of enterprises using the Internet for interaction with public authorities*', etc. Other projects such as eGEP (Codagnone & Boccardelli, 2006) or authors (Heeks, 2006) view user satisfaction as a part of the impact of eGovernment. This contrasts with our (preliminary) perception of 'outcomes' versus 'impact'.

In this framework '*impact*' is perceived as the (direct or indirect) results of eGovernment uptake. Therefore, four categories can be distinguished: impact on users, impact on suppliers, impact on economy and impact on society. Unlike other domains, a lot of work needs to be done in order to develop reliable variables for measuring impact of eGovernment.

3.3 How to decide what to measure?

Regarding the development of a measurement framework, at least two issues needs to be clarified: first of all, the frameworks consist of different types of variables. Some are quantitative while others are more qualitative of nature. We also have to be aware of the distinction between different types of indicators: key indicators, indicators, sub indicators and composite indicators. Secondly, it is important to decide what to include in the monitor and what not. Particularly, various indicators concerning eGovernment exist. Our research database consists of more than 800 indicators. Therefore, in order

to keep the monitor manageable it is important to explore strategies to give prioritization to indicators. Different approaches and techniques could help on this.

A first approach is a top-down approach, meaning that (key) indicators could be selected by hand of input of experts. Via Delphi-analysis (Linstone & Turoff, 1975) for instance, it becomes possible to move to consensus about which indicators (and underlying data) can or should be measured. A second approach is a bottom-up approach. This way of working is data-driven as statistical techniques can be used in order to detect which (key) indicators having the most impact while they are simultaneously covering the overall model. In the next part, we reflect on research activities as part of a quantitative approach in eGovernment measurement.

4. Illustration of the data-driven research approach

4.1 Methodology

The second method that is elaborated in this article, consisted of a bottom-up approach. Structural equation modeling (SEM) was applied to the data in order to determine whether a set of sub indicators all measuring the same underlying construct, being the indicator they are supposed to measure. The models that are developed within this analysis (using the Amos software, from SPSS) (Arbuckle, 2005) also give an indication of which sub indicator performs best in measuring this construct.

The applied statistical technique, i.e. structural equation modeling, allows for estimation of the goodness of fit of a hypothetical model given the data at hand. Estimating measurement models to validate conceptual (theoretical) models have a long tradition in marketing and consumer research (Bagozzi, 1980; Chin, 1998). SEM offers a sub model (measurement model) to test assumptions regarding the strength of the relationships between indicators (items in the questionnaire) and the latent variables (the concepts), with simultaneous estimation of the correlations/co-variation between the concepts.

Two series of sample data were used in the application of the bottom-up approach. The first set of data originates from a longitudinal panel research, consisting of three data waves, carried out among both Internet users and non-users. This set of data was collected by a commercial Internet research company, commissioned by the Federal Public Service for Information and Communication Technology (Fedict, Belgian federal government). The second set of data was collected by the national statistics department of Belgium (ADSEI, part of the Federal Public Service for Economy, SMEs, Self-employed and Energy).

4.2 Results

During the analysis we collected sub indicators in the data corresponding to several indicators within the conceptual model (see Figure 2). Where this was possible, a SEM model was built to test the assumption that the sub indicators do a good job in measuring the same underlying indicator. In Figure 3 an example is shown of one of these models that were developed. In this case, several questions measuring the same construct were analyzed.

This SEM model is based on four variables (squares). These four variables are supposed to be sub indicators for the indicator '*Citizens' evaluation of government websites*'. The question that was used to measure this was: "*how satisfied are you with the website of your …*":

- City (City);
- Province (Prov);
- Regional government (Regio);
- Federal government (Federal).

For each of these websites the respondents were asked to give their evaluation on a scale ranging from 1 to 10, in which 1 corresponds with 'not satisfied at all' and 10 with 'very satisfied'.

The ellipse in the model is the latent variable (which means that it is not directly measured in the questionnaire) that is supposed to be measured by the four manifest variables (which means that they are directly measured in the questionnaire).

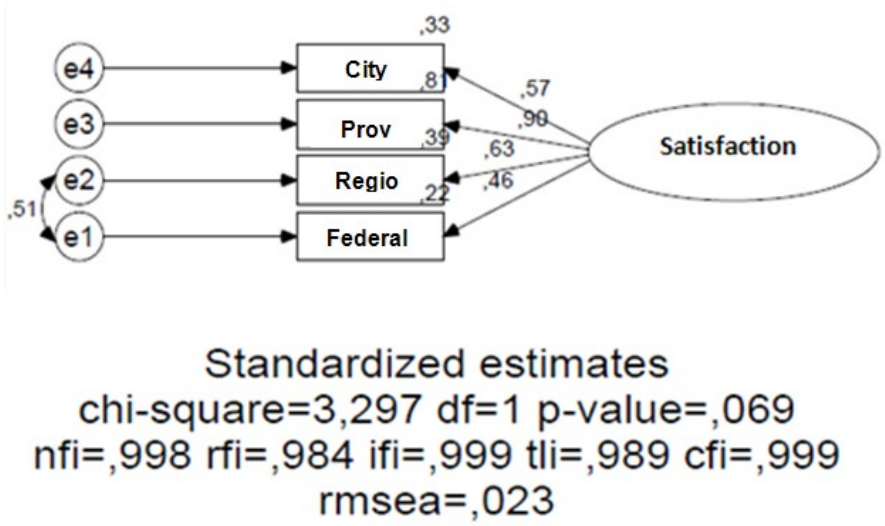

Figure 3: Example of a structural equation model

The four small circles represent the measurement errors for each of the variables. The effect of the construct 'Satisfaction' on its four indicators is represented by the single arrows. The numbers on these arrows are the standardized regression coefficients. These coefficients have a value between -1 and 1. The higher their absolute value, the more important the corresponding variable is as a source of information about the underlying concept ('Satisfaction'). The number in the right upper corner of the manifest variables gives us the amount of variance explained by the latent variable. The double arrow between error e1 and e2 represents a correlation between these measurement errors. An error correlation can only be added if a meaningful explanation can be found for it. The hypothesis in the example of Figure 3 is that citizens do not see any difference between the Federal and Regional government level, as they are both perceived as part of the national (central) government.

Besides the detailed parameters on the model there are also a number of goodness of fit parameters that give a global evaluation of the model have to be assessed. For any model, the Chi-square (Chi^2) should not be significant, the fit indices NFI (Normal Fit Index), RFI (Relative Fit Index), IFI (Incremental Fit Index), TLI (Tucker-Lewis Index) and CFI (Comparative Fit Index) should have a value of at least 0.90 and the RMSEA (Root Mean Square Error of Approximation) should be lower than 0.05.

The model presented in Figure 3 confirms that the four manifest variables measure the concept of satisfaction with government websites in a reliable way. The same methodology was applied for a range of indicators and corresponding data (when available) as was illustrated in the conceptual model of figure 2, including 'contextual variables', 'input', 'output' and 'outcomes'. For the category 'impact' no existing indicators and data were available yet.

5. Discussion and recommendations

The main finding of our analysis is that the data we were provided with to build structural equation models (SEM), gave us validated indicators that are highly representative for the population. Also, a database with almost 10000 respondents makes it possible to get statistically very significant results.

However, some important reflections should be discussed. First of all, the questionnaire was not designed to fill in the indicators in the presented conceptual model. It was designed to measure items on an individual level, not on an aggregated level, such as for building models like ours. An example of this is that a lot of the questions were to be answered in a binary way (either 'yes' or 'no'). Statistical methods like SEM require ratio scaled variables for good results. This means that questions should have answer categories that go more into detail than yes/no possibilities. Rather they need answering scales of five-points or even higher. Of course, this is not possible for every question, but for long list of items concerning motivation, attitudes, etc. these scales are a better way to go.

Another problem with working with databases originating from other research/data collection projects, is that they can contain a lot of information that is not relevant to our own research. So, a selection has to be made on which data could be used and which could not. In addition, the lack of possibilities

to aggregate the data from sub indicators to indicator models (as shown in the example) make it hard to fill in the indicators in the conceptual framework.

The ultimate solution to these problems is the development of a questionnaire that is rooted in the conceptual framework. This approach makes it possible to formulate adequate sub indicators while keeping the indicators they are supposed to measure in mind. Developing the questions yourself will give the possibility to formulate them in way that allows the application of advanced statistical techniques such as modeling (e.g. SEM). This way of working allows to develop valid indicator models.

Once these models are developed, the analyses do not have to stop. They allow to start testing assumed relationships between different indicators within the domains of the conceptual framework. Using SEM, numerous hypotheses can be formulated and can be tested statistically, such as how perceived benefits and barriers of eGovernment use are related to the uptake of eGovernment services? What is the role of a person's Internet or computer skills in this context? Does gender or other socio-demographic variables have a moderating role in these relationships? All of these insights can be obtained using structural equation modeling (SEM) as the proposed method.

More on a general level, it must be emphasized that a well-elaborated framework for monitoring eGovernment development is absolutely necessary. This framework needs to be comprehensive but also flexible in order to adapt to new trends. Based on our research experience, however, we argue that measuring impact of eGovernment only becomes possible when good data collection goes in hand with a well-considered conceptual framework. This way, robust methodologies will support monitoring in the long term.

6. Conclusion

In this article it is demonstrated why eGovernment measurement is increasingly important. After a long period of (pure) supply-oriented measurement approaches, a strong plea is made for a more comprehensive way in analyzing eGovernment development. The presented research is part of a larger research project that is carried out in order to develop an eGovernment monitor, commissioned by the Belgian government.

During the research a conceptual model was developed covering the full eGovernment value chain. This conceptual model corresponds with a database containing 160 key indicators and more than 800 indicators. For some of the indicators data is already collected while for other indicators no information is currently measured. In order to keep the eGovernment measurement activities (and the eGovernment monitor) manageable, an approach is needed to select indicators and data that are more important in comparison with the others. During the research project, both a qualitative (top-down) and a quantitative (bottom-up) approach was applied. In this paper the methodology of a data-driven approach is illustrated.

Based on structural equation modeling (SEM) it was possible to validate indicators based on several sub indicators using statistics. This statistical validation technique of the models (groups of indicators) also allows to give indication of which sub indicator is more suitable in measuring the proposed variable. This data-drive approach is one method to develop a measurement framework that needs to be comprehensive and flexible regarding new developments at the same time. The first aspect refers to the goal to cover the overall eGovernment value chain while the latter refers to new types of services and channels that will become available in the future.

The statistical testing must be seen as an approach offering valuable knowledge for policymakers. Firstly, an evaluation can be made whether the indicators employed in the questionnaire do a good job in measuring the proposed variables. In other words, SEM (or other validation techniques) is helpful in testing validity of the measurement instruments. Secondly, as there exist a lot of indicators that can be used for the assessment of eGovernment progress, an approach is needed to decide what to measure. A bottom-up and data-driven approach is at least important as a top-down approach. Thirdly, when evaluating the current measurement activities based on existing data, several recommendations can be formulated in profit of eGovernment practitioners. More specifically, feedback can be provided on methodology (data collection, answer categories, sample size, etc.) and related aspects. This knowledge is necessary when developing a comprehensive framework for measuring eGovernment development. A robust instrument is needed for setting up assessments

over the time: only when we are capable of using validated frameworks for measurements in the long term, we will be able to build reliable knowledge on eGovernment impact.

Acknowledgments

The results of this paper are based on a research project funded by the Belgian Science Policy (Agora Programme) and is conducted in close collaboration with Fedict, Federal Public Service for Information and Communication Technology (Belgian federal government).

References

Andersen, K. V., & Henriksen, H. Z. (2006). EGovernment maturity models: Extension of the Layne and Lee model. *Government Information Quarterly*, 23(2), 236-248.

Arbuckle, J.L. (2005). *AMOS 6.0 User's guide*. Chicago, IL: SPSS.

Bagozzi, R.P. (1980). *Causal models in marketing*. New York: Wiley.

Bannister, F. (2007). The curse of the benchmark: An assessment of the validity and value of eGovernment comparisons. *International Review of Administrative Sciences*, 73(2), 171-188.

Bekkers, V. & Homburg, V. (2007). The myths of eGovernment: Looking beyond the assumptions of a new and better government. *The Information Society*, 23(5), 373-382.

Carter, L., & Bélanger, F. (2004). The influence of perceived characteristics of innovating on eGovernment adoption. *The Electronic Journal of EGovernment*, 2(1), 11-20.

Centeno, C., Van Bavel, R. & Burgelman, J.C. (2005). A prospective view of eGovernment in the European Union. *The Electronic Journal of EGovernment*, 3(2), 59-66.

Chin, W.W. (1998). Issues and opinion on Structural Equation Modeling. *MIS Quarterly*, 22(1), 1-11.

Codagnone, C. (2008). Editorial: Efficiency and effectiveness. *European Journal of ePractice*. No. 4, August 2008, 2-3. Retrieved 14/01/2010, from: http://www.epracticejournal.eu/volume/4.

Codagnone, C. & Boccardelli, P. (2006). *Measurement framework final version*. Delivered within the eGEP Project for the European Commission, DG Information Society, Unit H2. Retrieved 14/01/2010, from: http://82.187.13.175/eGEP/Static/Contents/final/D.2.4_Measurement_Framework_final_version.pdf.

Codagnone, C. & Undheim, T.A. (2008). Benchmarking eGovernment: Tools, theory and practice. *European Journal of ePractice* , No. 4, August 2008, 4-18. Retrieved 14/01/2010, from: http://www.epracticejournal.eu/document/4970.

Dimitrova, D. V., & Chen, Y.-C. (2006). Profiling the adopters of eGovernment information and services: The influence of psychological characteristics, civic mindedness, and information channels. *Social Science Computer Review*, 24(2), 172-188.

Eurostat (2009b). *EGovernment usage by individuals by gender - Percentage of individuals aged 16 to 74 using the Internet for interaction with public authorities*. Retrieved 14/01/2010, from: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsiir130.

Heeks, R. (2003). *Reinventing government in the information age. International practise in IT-enabled public sector reform*. London: Routledge.

Heeks, R. (2006). *Understanding and measuring eGovernment: International benchmarking studies*. Paper presented at the UNDESA Workshop, e-Participation and eGovernment: Understanding the present and creating the future, Budapest, Hungary, 27-28 July 2006.

Heeks, R. & Bailur, S. (2007). Analyzing eGovernment research: Perspectives, philosophies, theories, methods and practice. *Government Information Quarterly*, 24(2), 243-265.

Hung, S.-Y., Chang, C.-M., & Yu, T.-J. (2006). Determinants of user acceptance of the eGovernment services: The case of online tax filing and payment system. *Government Information Quarterly*, 23(1), 97-122.

Jaeger, P. T. (2003). The endless wire: EGovernment as global phenomenon. *Government Information Quarterly*, 20(4), 323-331.

Jaeger, P.T. & Thompson, K.M. (2003). EGovernment around the world: Lessons, challenges, and future directions. *Government Information Quarterly*, 20(4), 389-394.

Jaeger, P.T. & Bertot, J.C. (2010). Designing, implementing, and evaluating user-centered and citizen-centered eGovernment. In: C.G. Reddick (Eds.) *Citizens and eGovernment: Evaluation policy and management* (pp. 1-19). Hershey, New York: Information Science Reference (IGI Global).

Janssen, D., Rotthier, S. & Snijkers, K. (2004). If you measure it they will score: An assessment of international eGovernment benchmarking. *Information Polity*, 9(3-4), 121-130.

Kunstelj, M., Jukic, T. & Vintar, M. (2007). Analysing the demand side of eGovernment: What can we learn from Slovenian users? *Lecture Notes in Computer Science*, 4556, 305-317.

Layne, K., & Lee, J. (2001). Developing fully functional eGovernment: A four stage model. *Government Information Quarterly*, 18(2), 122-136.

Linstone, H.A. & Turoff, M. (1975). *The Delphi method, techniques and applications*. Reading, M.A.: Addison-Wesley

Millard, J. (2008). EGovernment measurement for policy makers. *European Journal of ePractice*, No. 4, August 2008, 19-32. Retrieved 14/01/2010, from: http://www.epracticejournal.eu/document/4971.

OECD (2003). *The eGovernment imperative*. Paris: OECD EGovernment Studies.

OECD (2005). *EGovernment for better government*. Paris: OECD Publications Service.

OECD (2008). *Belgium: OECD Country Report*. Paris: OECD EGovernment Studies.

Peters, R., Janssen, M. & van Engers, T. (2005). *Measuring eGovernment impact: Existing practices and shortcomings*. In Proceedings of the 6th International Conference on Electronic Commerce, session: EGovernment services and policy track (Copenhagen, August 22-26, 2005), New York, ACM Press, 480-489.

Relyea, H.C. (2002). E-Gov: Introduction and overview. *Government Information Quarterly*, 19(1), 9-35.

Traunmüller, R. & Wimmer, M. (2004). EGovernment: The challenges ahead. *Lecture Notes in Computer Science*, 3183, 1-6.

van Deursen, A. & van Dijk, J. (2009). Improving digital skills for the use of online public information and services. *Government Information Quarterly*, 26(2), 333-340.

van Dijk, J., Peters, O. & Ebbers, W. (2008). Explaining the acceptance and use of government Internet services: A multivariate analysis of 2006 survey data in the Netherlands. *Government Information Quarterly*, 25(3), 379-399.

Verdegem, P. (2009). *The digital divide and/in eGovernment: Challenges for policymakers in the information society. Unpublished Ph.D. dissertation*. Ghent University – Department of Communication Sciences.

Verdegem, P. & Verleye, G. (2009). User-centered eGovernment in practice: A comprehensive model for measuring user satisfaction. *Government Information Quarterly*, 26(3), 487-497.

Verdegem, P. & Hauttekeete, L. (2010). A user-centric approach in eGovernment policies: The path to effectiveness? In: C.G. Reddick (Eds.) *Citizens and eGovernment: Evaluation policy and management* (pp. 20-36). Hershey, New York: Information Science Reference (IGI Global).

Yildiz, M. (2007). EGovernment research: Reviewing the literature, limitations, and ways forward. *Government Information Quarterly*, 24(3), 646-665.

