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EVALUATING E-GOVERNMENT SERVICES FROM A CITIZENS' PERSPECTIVE: A REFERENCE PROCESS MODEL

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Abstract

Evaluating and optimizing e-government services is imperative for governments especially due to the capacity of e-services to transform public administrations and assist the interactions of governments with citizens, businesses and other government agencies. Existing widely applied evaluation approaches neglect to incorporate citizens' satisfaction measures. Several citizen satisfaction models and indicators have been suggested in academia; however a reference process model that can assist practitioners to apply these performance measures is missing. In this paper we draw upon the evaluation approach proposed by the EU funded project CEES and propose a reference process model that captures re-usable practices for e-government evaluation from a citizens' perspective. The novelty of the proposed approach is that using DEA for evaluating the e-services the assessment results in suggestions for strategic improvement of the e-services.

Keywords: reference process model, evaluation, e-services, public administration

1 INTRODUCTION

E-government services refer to technology-based services that enable the digital interactions between a government and citizens (G2C), government and businesses (G2B), government and employees (G2E), and government and governments/agencies (G2G). The methods for e-government evaluation are mainly focusing on assessing the readiness of a national government to deliver public services

electronically. In order to evaluate e-government services provided by European countries eGovernment Benchmark Measurement (i2010 benchmarking framework) traditionally evaluates sophistication maturity and online availability of the e-services; services that include information provision, one-way interaction, two-way interaction, full electronic transaction or personalization. Similarly, UN E-Government Survey (United Nations E-Government Survey 2010) evaluates Member States regarding their e-government readiness using the stages of emerging, enhanced, interactive, transactional and connected e-services. Additionally, the UN E-Government evaluation framework assesses the e-participation level of the e-government services by categorizing them into services that support e-information, e-consultation or e-decision-making. Hence, the assessment approaches tend to focus on the front-office of the e-services. Although the above frameworks support the assessment of electronic services' capacities, they do not capture the citizens' perspective and satisfaction. The latest European eGovernment Benchmark Measurement framework (8th eGovernment Benchmark Measurement, 2009) has incorporated an additional user-centric focus by including qualitative and quantitative indicators of user satisfaction and user experience.

Indeed, several researchers have also highlighted the need for citizen-centric evaluation of e-government. Combining various approaches (Alshawi and Alalwany, 2009; Naz, 2009; OECD, 2005); Zeithaml et al., 2001; Johnston, 1995; Parasuraman et al., 1988) numerous Key Performance Indicators (KPIs) for citizens satisfaction on e-government have been promoted in e-government literature. Some of them include ease of use, functionality, accessibility, information quality, interactivity, information security and privacy, etc. However, literature lacks of generic guidelines towards evaluating e-government from a citizens' perspective.

Such generic guidelines can be found in reference process models of an application domain. Reference models are generic conceptual models that formalize recommended and reusable practices for a certain domain (Curran and Keller, 1997). However, a reference model for the e-government evaluation domain is missing in information systems literature. In this paper, a novel e-government evaluation approach developed within the EU funded project Citizen Evaluation of E-Government Services (CEES) is described. The approach is general enough to provide the flexibility to the evaluator to select the KPIs and develop the evaluation framework that is most relevant to the specific context. As a result of this research we provide in this paper a reference process model that will enable the customized application of this evaluation approach in different institutional and cultural settings. Reference models provide an efficient and effective means for capturing and disseminating best practices. Hence the development of such a reference process model is expected to assist practitioners in conducting e-government services' evaluation with taking into account citizens' satisfaction.

Following this introduction, the background on process modelling and data envelope analysis used in the paper is provided. In section 3 a description of the process followed to apply the evaluation approach is described using the experience gained from the application in Turkish e-services. In the same section the proposed reference process model is presented and the conclusions of the paper follow.

2 BACKGROUND

2.1 Process and process modelling concepts

Process models are core concepts in the discipline of process engineering. Defining the term *process* is challenging because several definitions exist. Davenport (1993) defines a process as "a structured, measured sets of activities designed to produce a specified output for a particular customer or market". Similarly, White and Miers (2008) define a process as "a sequence of activities performed on one or more inputs to deliver an output". Despite the various definitions, in essence all conclude that processes are relationships between inputs and outputs, where inputs are transformed into outputs using a series of activities, which add value to the inputs (Aguilar-Savén, 2004). A *process model* is an abstract description of an actual or proposed process that represents selected process elements that are considered important to the purpose of the model and can be enacted by a human or machine (Curtis et al., 1992). There is no widespread consensus on the constructs that collectively form the essential basis

of a process model (Acuña and Ferré, 2001), as these vary between different domains. However the ones that are commonly used in all domains and most frequently mentioned include (Acuña and Ferré, 2001; Curtis, 1992; Bendraou and Gervais, M., 2007):

- *Activity*: a logical, self-contained unit of work within the process that may be atomic or compound.
- *Agent*: an actor (human or machine) who performs a process element.
- *Role*: a coherent set of process elements to be assigned to an agent as a unit of functional responsibility.
- *Artifact*: a product created or modified by the enactment of a process element.

2.2 Data Envelope Analysis

Data Envelopment Analysis (DEA) is proposed in this paper as an evaluation approeach to measure the satisfaction level of citizens with the e-government services and to provide guidelines for determining strategic areas for the services' improvement toward a higher satisfaction level. An extensive description of DEA is beyond the scope of this paper. DEA requires a clear definition of a decision making unit (DMU) and its required inputs and outputs variables. Input variables have normally values to be minimized, while output variables have values to be maximised within DEA context for the DMU to achieve a high "productive efficiency" (or satisfactory) score. Here the DEA productive efficiency score is a relative measure, which is derived for each DMU from the DEA analysis based on the quality of the DMU transformation of inputs into outputs. The DEA score is the ratio of the weighted multiple-output values over the weighted multiple-input values, with weights optimized in the best interest of each DMU relative to its peers. A highly productive-efficient DMU by DEA analysis will be considered as a highly satisfying DMU from citizens' perspectives.

3 APPLYING THE CITIZEN SATISFACTION MODEL: A REFERENCE PROCESS MODEL

In order to construct a Citizen Satisfaction Model (CSM) and apply DEA for the e-government services' evaluation *thirteen e-services* in Turkey were assessed. The evaluation approached proved to enable assessment with richer explanations that traditional statistical evaluations, such as structured equation modelling. Based on this application, a reference process model was developed that can provide 'know-how' for future applications of the approach in variant institutional and cultural settings.

3.1 The Evaluation Process

The first step towards applying the approach is the identification of the e-government services whose performance will be measured with regard to citizen's satisfaction. An important requirement for applying the evaluation approach is to ***select e-government services*** with variant sophistication maturity. Different e-government classification schemes exist which categorize e-services in different groups; nonetheless, most of the models outline three or four stages starting with net presence and often moving through to a stage of incorporating elements such as a rich array of information, the full provision and payment of services, or interaction with citizens (Shackleton et al., 2006; Irani et al., 2006). However, according to the distribution of the data collected by the citizens, the evaluator during the process might need to return to this decision point and consider applying different classification scheme, to assure that Data Envelope Analysis requirements are satisfied. The next step would be to ***determine the evaluation duration***, although the evaluator might need to extend the duration beyond the original estimation until sufficient citizens' input is gathered.

As a second phase of the evaluation, the decision-maker needs to ***formulate an evaluation framework*** which includes KPIs. However, the formulated model should organize the KPIs into groups of input and output variables as a requirement of DEA theory. According to DEA, a Decision Making Unit (DMU) should be specified, which in our case is "a citizen using the e-government service combined with her evaluation after the execution of the service". Each DMU requires input from citizen and a

computerized tool to transform it into citizen's output. The ultimate objective according DEA is to explore ways to minimize input variables and maximize output variables. For our empirical investigation the COBRAS model (Osman et al., 2011) was chosen, which organizes the factors that influence e-government success into four major categories (Table 1): Cost, Benefit, Risk and Opportunity.

Type of Variable	Category	Variables
DEA Input Variables	Cost Factor	Tangible Cost
		Intangible Cost
	Risk Factor	Personal Risk
		Financial Risk
DEA Output Variables	Benefit Factor	Service Quality
		Information Quality
	Opportunity Factor	Service Support
		Technology Support

Table 1: COBRAS evaluation framework

The different components of the evaluation framework should now be connected. The decision maker must ***formulate hypotheses*** regarding the way(s) that the four factors, and ultimately the related variables, are related to citizens' satisfaction. These hypotheses will be tested using the empirical data collected from the citizens. For the empirical investigation the following hypotheses were made:

H1. The lower the e-service cost is the higher the user satisfaction

H2. The higher the e-service benefit is the higher the user satisfaction

H3. The lower the e-service risk is the higher the user satisfaction

H4. The higher the e-service opportunity is the higher the user satisfaction

The third phase of the evaluation refers to ***validate the evaluation framework***. A survey questionnaire is designed and validated against content validity and face validity. In sequence the data collection can initiate. In case sufficient responses are collected at the end of the specified period, the data collection may finish or otherwise extended. For our empirical study, the survey was extended to 6 months. At this time, 3506 responses were collected and after filtering to remove incomplete answers, 2785 responses were found to be valid (i.e. 79.44% of the total responses). The Turkish population is estimated around 70 million, out of which 9% are ICT users, thus leading to an estimate of 6.3 ICT million users. Taking into account that the sample size for a population of 10 million at 2% margin of error at 95% level of certainty is estimated to be 2400 (Saunders et al., 2007), this number of responses was more that sufficient. The evaluator using the empirical data should undergo the ***statistical validation of the constructed evaluation framework***. These include normality tests, internal consistency reliability tests, and constructs validity tests. Finally, structured equation modeling and multiple regression will be used to test the model. The empirical data collected in Turkey validated all proposed hypotheses and the prediction of satisfaction equation was expressed as follows:

Satisfaction= 1.9 + 0.385*Opportunity + 0.026*Benefit – 0.023*Risk – Cost

As a final phase the evaluator will ***identify improvements to the target e-services***. DEA is adopted to measure the satisfaction level of citizens and to provide guidelines for determining strategic areas for the services' improvement toward a higher satisfaction level. DEA evaluates the relative efficiencies of a homogeneous set of DMUs where each DMU (in our case the citizen) utilizes multiple inputs and resources (cost and risk variables) to produce multiple outputs and outcomes (benefit and opportunity variables). The efficiency score of a unit is measured by an aggregate function defined as the ratio of the total weighted outputs to the total weighed inputs. A unit with an aggregate efficiency score of 1 (slack values =0) is considered to be efficient (satisfying users) and a score of less than 1 indicates that the e-service unit is inefficient (dissatisfying users). The variables incorporated to the evaluation framework will be analysed using two DEA models, namely: DEA-VRS input-oriented variable to scale, and DEA-VRS output-oriented variable to scale to evaluate a single e-service or multiple e-services. In our case, our model included four input variables (tangible cost and intangible cost,

personal risk and financial risk) and four output variables (quality of service, quality of information, service support and technology support). First, ***satisfaction analysis for a single e-service*** is conducted by taking the average of all individual users' DEA scores for the specific e-service being evaluated. An analysis of the average VRS scores from single satisfaction analysis can provide us with the e-services with the best and the ones with the worst input-oriented and the best output-oriented scores. A further analysis can provide us with recommendations for policy-makers regarding the efficiency improvement, by either setting targets for increasing output levels while keeping the input levels constant (output-oriented DEA) or setting targets for reducing input levels while keeping the output levels constant (input-oriented DEA). For each e-service, DEA analysis can provide with target improvements in relation to the factors affecting satisfaction, but also can classify these improvements into priorities by processing the average weights of the measured variables. For example, the results of a Turkish e-service indicated that the service could be improved by a range of potential outputs increase (e.g. 1% increase of service support, 11% increase of service quality, and others) or by a range of potential inputs reduction (e.g. 43% reduction of financial risk, 55% reduction of tangible cost). By comparing the average of weights for the measured variables it was concluded that tangible cost, service quality and technology opportunity have the highest weights and hence the highest priorities. Following, ***satisfaction analysis for multiple e-services*** is performed to combine all target e-service. DEA scores of users of a specific e-service are averaged to get an aggregate user satisfaction score of that particular e-service. Similarly to the single e-service analysis, an analysis of the average VRS scores for multiple e-services can provide us with the e-services with the best input-oriented and output-oriented scores and the ones with the worst scores. Recommendations for improvement can be produced by analysing the weighted average of the variables. For example, as a result of this phase at the Field Trial it was concluded that target changes could be reduction of inputs ranging from 22% to 52%; each change related to specific e-service. Moreover, target changes could be increase of outputs ranging from 25% to 109%. For achieving these changes the most important factors were found to be tangible cost (77%), service quality (38%), financial risk (28%) and technology support opportunity (26%) followed by service support and information quality (18% each).

3.2 A reference process model

The reference process model for e-government as produced by the empirical application of the proposed evaluation approach in Turkey is depicted at Figure 1.

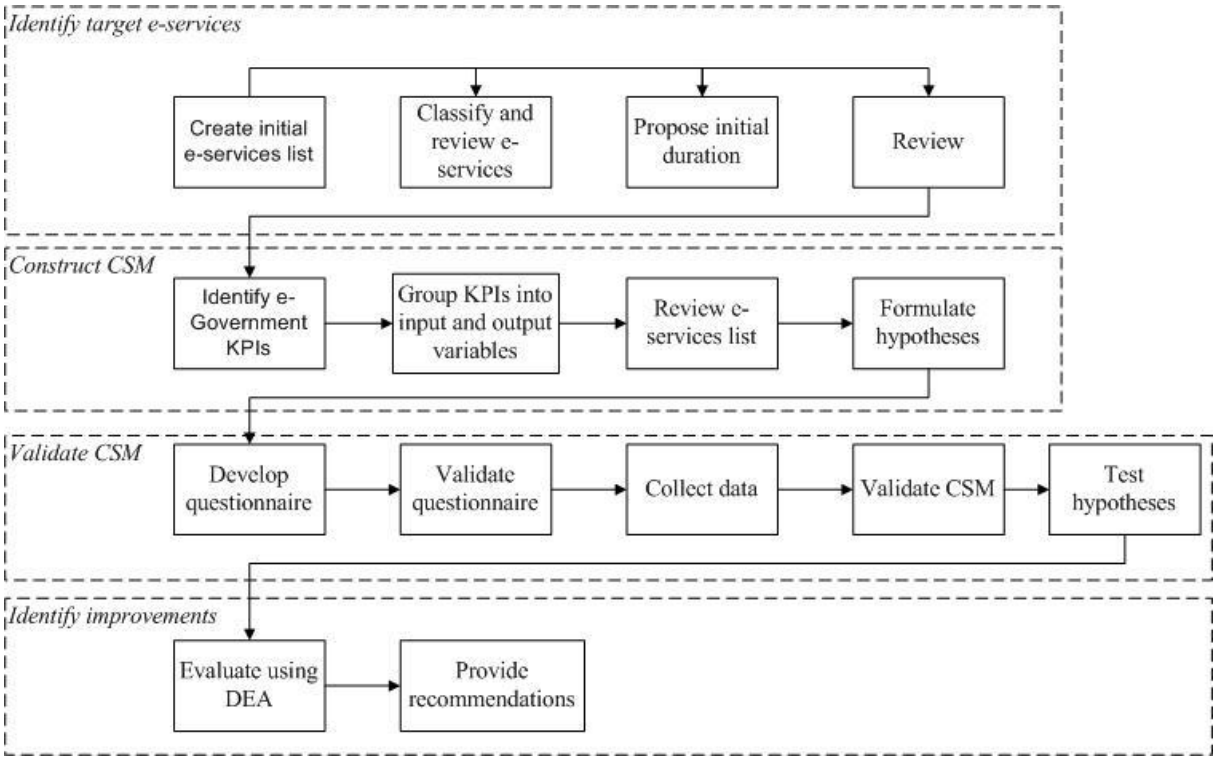

Figure 1: A reference process model

A further description of each step for the reference process model is provided at Table 2.

Top Level Activities	**Second level Activities**	**Third Level Activities**
Identify target e-services	Create initial e-services list	-
	Classify and review e-services	Select e-services with high usage
		Classify e-services with initiation time
		Select both new and old e-services
		Select maturity representation
		Classify e-services with maturity
		Select e-services from all maturity levels
		Review e-services list
		Develop contact list
	Propose initial duration	-
	Review	-
Construct CSM	Identify e-Government KPIs	-
	Group KPIs into input and output variables	Identify input and output factors
		Identify cost variables
		Identify risk variables
		Identify opportunity variables
		Identify benefit variables
	Review e-services list	-
	Formulate hypotheses	-
Validate CSM	Develop questionnaire	-
	Validate questionnaire	Organize first workshop
		Collect reviews
		Revise questionnaire
		Organize second workshop
		Collect reviews
		Revise questionnaire
		Organize face validity assessment
		Collect reviews
		Revise questionnaire
		Finalize questionnaire
	Collect data	Collect completed questionnaires
		Review collected questionnaires
		Terminate data collection
	Validate CSM	Calculate Skewness
		Calculate Kurtosis
		Compute Cronback' Alpha
		Perform principle component analysis
	Test hypotheses	Calculate correlation coefficients
		Enter IVs in the hierarchy multiple regression models sequentially
		Review hypotheses
Identify improvements	Evaluate using DEA	Calculate DEA output-oriented VRS scores for each e-service
		Calculate DEA input-oriented VRS scores for each e-service
		Calculate aggregate user satisfaction input-oriented and output-oriented scores for a particular e-service with frontier analysis
		Calculate aggregate efficiency input-oriented and

		output-oriented scores for responses from all users
	Provide recommendations	Identify e-service with best input-oriented score
		Identify e-service with worse input-oriented score
		Identify e-service with best output-oriented score
		Identify e-service with worse output-oriented score
		Identify input-oriented improvements for each e-service
		Identify output-oriented improvements for each e-service
		Analyze weighted average of the variables

Table 2: The reference process model steps

4 CONCLUSIONS

E-goverment evaluation is not only significant but also complex. The complexity of evaluating e-goverment systems and tools derives mostly from the multiple stakeholders and relevant political, social and financial interests, the combined social and technical nature of the evaluation and the difficulty to quantify benefits and inefficiencies. Its importance lies on the reliance and vision of goverments to reform public administration and reduce administrative and financial burdens via delivering public services online. The challenges that literature identifies for developing an e-government evaluation framework are the investigation of various perspective, the quantification of benefits and the consideration of both social and technical aspects. Existing assessment approaches focus on the readiness of a national governments to deliver public services electronically. The widely applied evaluation frameworks seem to neglect the citizen perspective, while the variety of performance indicators that reflect citizen satisfaction proposed by researchers show that e-government evaluation remains an immature and ambiguous area; i.e. the variant assessment approaches have been divided into technical, economical, and social groups of proponents (Alshawi et al., 2007). Moreover, existing evaluation approaches may acknowledge inefficiencies but do not incorporate the capacity to enable strategic improvement options to optimize e-government services.

In this paper we have proposed a reference process model for the e-government evaluation domain. The reference process model derives from the development of a holistic approach that is customizable to reflect key performance indicators from different perspectives. This approach has been empirically applied to Turkish e-government services and refined by the lessons learnt. The reference process model is expected to trigger the dissemination of a set of re-usable practices that may act as a reference point or repository of to knowledge for practitioners to evaluate e-government services and optimize them according to citizens' suggestions. Further research includes the application of the reference process model in other cultural settings and the reflection of the experience gained at the reference process model.

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References

Aguilar-Savén, R. S. (2004), Business process modelling: Review and framework. International Journal of Production Economics of Production Planning and Control, 90: 2, 129-149.

Alshawi, S. and Alalwany, H.(2009), E-government Evaluation: Citizen's Perspective in Developing Countries, Information Technology for Development, 15 (3) 193–208

Alshawi, S., Alalwany, H. and Alahmari, A., (2007) E-Government evaluation factors: Citizen's perspective, European and Mediterranean Conference on Information Systems 2007 (EMCIS2007)

Bendraou, R. and Gervais, M. (2007). A Framework for Classifying and Comparing Process Technology Domains, IECSA 2007: 5.

Curtis, B., Kellner, M., Over, J. (1992), Process modeling. Communications of the ACM, 35: 9, (September 1992), 75-90.

Davenport, T.H. (1993), Process Innovation: Reengineering Work through Information Technology. Harvard Business School Press, Boston, MA, USA.

European Commission (2009). Smarter, Faster, Better eGovernment. 8th eGovernment Benchmark Measurement, November 2009. European Commission, Available online at: http://ec.europa.eu/information_society/eeurope/i2010/benchmarking/index_en.htm

Irani, Z., Al-Sebie, M. and Elliman, T. (2006), Transaction Stage of e-Government Systems: Identification of its Location and Importance. Proceedings of the 39th Hawaii International Conference on System Sciences (HICSS-39), Grand Hyatt Regency Resort Kauai, Hawaii

Naz, R. (2009), E-Governance for Improved Public Service Delivery in Fiji, Journal of Service Science and Management, 2(3): 190-203

Osman, I. H., Anouze, A., Irani, Z., Lee, H., and Weerakkody, V. (2011), A new COBRAS framework to evaluate e- government services: a citizen centric, Proceedings of tGov Workshop'11 (tGOV11), 2011, Brunel University, West London, UK.

Parasuraman, A., and Zeithaml, V.A. and Berry (1988), SERVQUAL: A multiple-item scale for measuring customer perceptions of service quality, Journal of Retailing, 64 (1): 12-40

Shackleton, P., Fisher, J. and Dawson, L. (2006), E-government services in the local government context: an Australian case study, *Business Process Management Journal*, 12(1): 88-100.

United Nations E-Government Survey 2010, Available online at: http://www2.unpan.org/egovkb/global_reports/10report.htm

White, A. S. and Miers, D. (2008), BPMN Modeling and Reference Guide: Understanding and Using BPMN. Future Strategies Inc.

Zeithaml, V.A., Parasuraman, A. and Malhotra, A. (2001), A conceptual framework for understanding e-service quality: implications for future research and managerial practice, MSI Monograph, Report number 00-115