

Measuring the Public Value of e-Government: Trust in Measurement Processes or Processes of Building Trust?

Alberto Savoldelli ¹, Gianluca Misuraca ² and Cristiano Codagnone ³

¹Independent Researcher, Milan, Italy

²European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Seville, Spain

³Milan State University, Milan, Italy

savoldellia@gmail.com

gianluca.misuraca@ec.europa.eu

cristiano.codagnone@unimi.it

Abstract: In the recent past several authors have addressed the issue of the 'e-Government paradox' which is exemplified by the contrast between the level of investments made on deploying ICT-enabled services and the little impact produced and/or demonstrated so far. To this regard, in most maturing countries, main barriers hindering the adoption of e-Government services are those related to the lack of both a structured policy measurement process and an effective stakeholders' engagement. In particular, critical success factor for e-Government adoption seems to be a transparent and trustworthy policy decision-making process and its key prerequisite is the definition and implementation of a well organized and fully participatory measurement framework, enhancing stakeholder trust in policy decision. Starting from these findings, the paper explores the existing relationship between measurement and trust on e-Government decision-making processes, discussing which could be the possible trade-off between high quality measurement of public e-services and the high level of trust in policy decisions for their adoption and long term sustainability. The methodological approach underpinning the analysis is based upon a critical review of main e-Government measurement frameworks, selected according to their effective capability to support policy decision-making in implementing e-Government strategies as well as their expected value to reinforce 'trust' with citizens and stakeholders.. As a result of the analysis a new measurement model capable of measuring the public value of e-Government services is proposed. The model has been tested in a real context of usage for the measurement of the Telematics and Informatics Policies Implementation Plan (PiTER) of the Emilia-Romagna Region in Italy in the period 2011-2013. The paper therefore discusses the main findings emerged from the concrete application of the proposed model in light of the feedback received from the public administration and the stakeholders participating to the measurement process. It then outlines its conditions of applicability in other policy contexts as well as new possible research directions.

Keywords: e-government, evaluation, measurement, public value, trust, policy-making

1. Introduction

After more than two decades of policy efforts and investments into e-Government, not only we do not have conclusive evidence on its impact, but both the scientific and practitioners-generated literature is ridden with conceptual and terminological inconsistencies and ambiguities around concepts such as evaluation, assessment, measurement, etc. In this paper, after clearly delimiting and defining our domain of analysis, we propose a new framework to 'measure' the public value of e-Government that we call eGEP-2.0 as it represents the evolution and improvement of the eGEP¹ measurement framework that one of the author of this paper elaborated for the European Commission (Codagnone et al 2006). We argue and show that, with respect to other available methodologies and framework, the original eGEP framework represented the most comprehensive approach but suffered from the lack of the dynamic element needed to capture the processes that in each public agency move from initial planning, through implementation, up to monitoring and measuring results (Misuraca & Rossel, 2011). Before doing this, as anticipated, we need to clearly delimit the domain and the ambitions of our proposed framework as to clear the field from conceptual and terminological ambiguities that may ingenerates incorrect expectations as to what our proposal, as well as other frameworks, can produce. This requires making a clear distinction between evaluation and measurement. We do this with the support of figure 1 below. In much of the literature addressing e-Government the two terms 'evaluation' and 'measurement' are often used ambiguously and inconsistently, with the impression that the two may be synonyms. Both evaluation and measurement consider input, output, outcomes, and impacts, but only evaluation in strict scientific sense must also looks at covariates/confounders. Strictly defined impact evaluation, in fact, aims at demonstrating that the realisation of an outcome Y can be causally attributed to the

¹ The eGEP acronym stands for eGovernment Economics Project.

combination of input/output X (the policy treatment) and not to any other cause. On the contrary, measurement is the process by which the attributes or dimensions of some phenomenon (in this case any variable among the blocks of inputs, outputs, outcomes, and impacts) are determined and counted, as amply documented in the OECD work on public sector measurement (OECD, 2006a, 2006b, 2009). The all body of work on “Performance Measurement” or “Impact Assessment”, as well as many other types of labels, can be seen as belonging together with evaluation to the ‘extended’ family of what we can generically refer to as “assessment”, but they are clearly different from evaluation *strictu sensu*. Hence, neither the original eGEP framework nor other similar exercises reviewed in next section can be and should be presented as evaluation frameworks for none of them can be used to demonstrate that the changes in a given variable of interest can be causally attributed to a given e-Government service, unless they also add an experimental or quasi-experimental component.. It is important to make this clear as to avoid making claims that are not supported scientifically and empirically. The eGEP-2.0 framework we propose is rigorously only an e-Government measurement framework that as such raises no claim as to demonstrating causally (evaluate) the effect that a given service or bundle of services (i.e. e-Government programme or policy) have for different constituency on a given sought outcome. This, however, does not necessarily mean that a measurement framework cannot be linked to, and support, a counterfactual impact evaluation. If the measurement is built on scientifically sound and empirically robust model of causal impact and if data are gathered on the objects of measurement steadily and reliably then eventually that can be used for a true impact evaluation. This is the object of another forthcoming paper (Codagnone, Misuraca, Savoldelli, 2014) and we will not enter into this subject here.

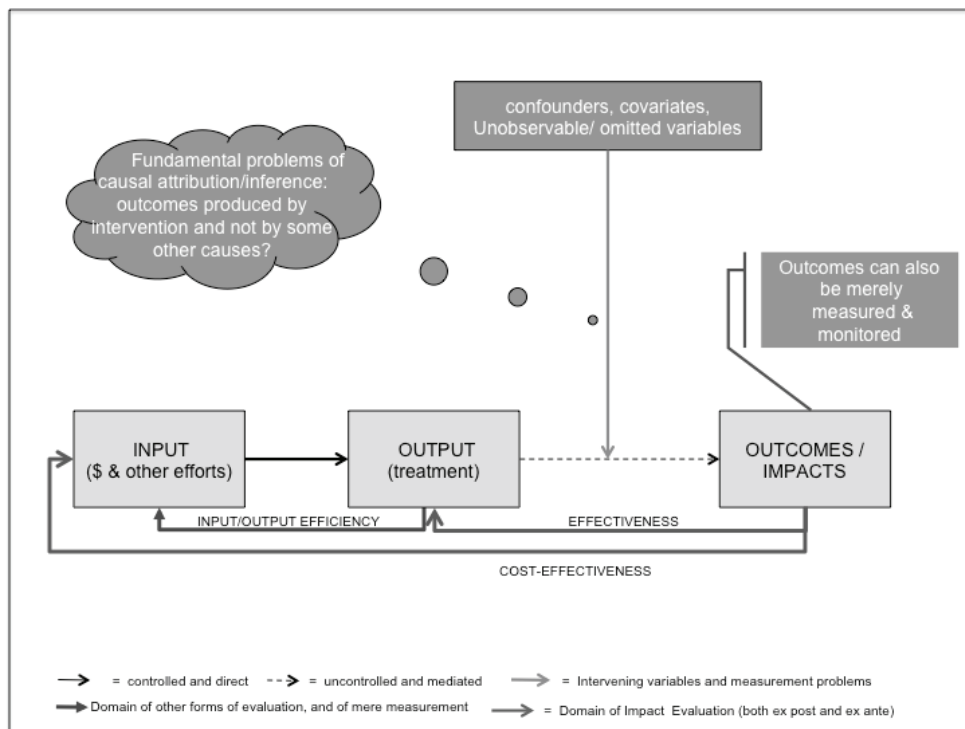


Figure 1: Stylised Logic chain for evaluation and for measurement (authors' elaboration²)

2. Brief state of the art

We have reviewed in depth the state of the art for what concerns e-Government assessment and the barriers deriving from its lack elsewhere (Codagnone & Undheim 2008; Misuraca et al., 2013; Savoldelli et al. 2012 and 2013). Below we extract a selective and compact summary strictly instrumental to our purpose in this paper. The first and most well-known exercises in our domain of interest have been and still are large survey based on scanning the websites of public agencies and scoring them in terms of either availability and sophistication of services provision or of level of participation embedded in them (Capgemini, 2004; 2010; UN-DESA, 2010). These approaches have been amply criticized and most of the e-Government measurement frameworks emerged in past decades, starting from the first version of eGEP, were launched to go beyond this supply-side focus, to look at more tangible outcomes and impacts, and to be more granular (Misuraca et al., 2013). Table 1

² Based on several sources: see among others (Algemene Rekenkamer, 2006; Boyne et al., 2003; Codagnone, 2009; Codagnone & Undheim, 2008; Hatry, 1999; Heeks, 2006; Heeks & Molla, 2009; Irani et al., 2005; OECD, 2006a, 2006b, 2009).

provides a synthetic overview of such frameworks, many of which include also user-centric measures to track take-up and satisfaction – two central parameters which allow governments to learn more about user needs and demands as well as providing a structured approach to assess policy impacts and to support the continuous improvement of eGovernment services. The frameworks or methodologies included in Table 1 have been selected using the criterion that they are some of the most cited in literature and used in practice (see Kunstelj & Vintar, 2004; Gil-Garcia & Pardo, 2005; Foley, 2006; Esteves & Rhoda, 2008)³.

Table 1: Comparison of selected e-Government measurement frameworks (Savoldelli, Codagnone and Misuraca, 2013)

Evaluation methodologies	Policy plan evaluation	Project and/or Services Evaluation and Benchmarking	exAnte Evaluation	exPost Evaluation	Business case template	Risk assessment methodology	Sustainability Assessment methodology	Public Value Evaluation Criteria											
								Effectiveness	Efficiency/Productivity	Organizational efficiency	User Centrality	PA services integration	Strategic alignment	Privacy and security	Social Value	Democracy			
eGovernment Signposts		X		X				X	X		X	X	X						
Mareva		X	X		X	X	X		X	X	X	X	X		X				
WeBe 4.0		X	X				X	X	X	X	X	X	X	X					
eGEP		X		X				X	X	X	X	X	X				X	X	
Metodologia NOIE		X	X	X			X	X									X	X	
GOL Performance Measurement and Business Case Template	X	X	X	X	X	X	X	X	X		X	X	X		X		X	X	
General Services Administration		X		X			X	X	X	X	X	X	X						X
VMM		X	X	X	X	X	X	X		X		X		X	X				X
DVAM	X		X			X	X	X	X			X					X	X	
Gateway Process		X	X	X	X	X	X		X	X	X	X	X	X					

In Table 1 these methodologies are assessed against two criteria: a) the dimension of public value (Carbo & Williams, 2004; Johansen, 2004; Ebrahim & Irani, 2005; Codagnone & Undheim, 2008; Heeks & Molla, 2009; OECD, 2009; Stanimirovic & Vintar, 2012) covered by the areas of impacts and/or indicators proposed; and b) coverage of the various possible stages in the policy planning process. From this comparative analysis it emerges that current approaches are not exhaustive and comprehensive across these two criteria, which confirms the claim that the lack of a structured and comprehensive measurement and assessment framework, especially for local governance (see also Anttiroiko, 2008; Belanger & Carter, 2008; Esteves & Rhoda, 2008; Kolsaker & Lee-Kelley, 2008; Kunstely & Vintar, 2009; Von Ryzin, 2009; UN-DESA, 2010; Stanimirovic & Vintar, 2012), is among one of the key barriers delaying full adoption of e-Government (Savoldelli, Codagnone & Misuraca, 2012). Furthermore, the majority of such frameworks are shaped by a technology-driven approach (Dawes, 2008), under-estimating the key importance of outcome oriented approaches strictly connecting e-Government with the policy making process (Titah & Barki, 2005; Perrin, 2006; Codagnone, & Undheim, 2008). This myopic behavior often brings eGovernment initiatives into a “lock-in/vendor-driven” situation with the consequence of risking to loose most of the expected benefits (Foley, 2006). Also important to stress the lack of covering all the relevant stages where a measurement and assessment framework would be needed, that is to say both *ex-ante*, *in- itinere*, and *ex-post*, and the need to define a well-structured *ex-ante* measurement (see also Gil-Garcia&Pardo, 2005; Foley, 2006; DEP, 2012).

While eGEP presents some of the limitations mentioned above, it has been largely recognized that it provides a more robust approach in assessing outcomes of e-Government initiatives (Misuraca and Rossel, 2011; Stanimirovic & Vintar, 2012). Therefore, our proposal for a new measurement framework has been built starting from the eGEP framework, which has been improved in various aspects, especially in the participation mechanisms for involving stakeholders and beneficiaries in the measurement process of e-Government services.

In this regards, as rendered in figure 2, the proposed measurement framework aims at overcoming the previous approaches, helping to establish a trust-based relationships among citizens, policy makers, civil servants and other stakeholders, so to balance the precision in the measurement of the impacts of e-

³ They are: eGovernment Signpost (Danish Digital Task Force, 2004); MAREVA (ADAE, 2007); WeBe 4.0 (Rothig, 2004; 2010); eGEP (Codagnone et al 2006); NOIE (Australian Government, 2005); GOL Performance Measurement (Treasury Board of Canada, 2004); eGovernment Satisfaction Index (Freed, 2009); VMM (Booz-Allen-Hamilton, 2004); DVAM (AGIMO, 2004); Gateway Process (DFP, 2012).

Government projects, with a more transparent and participatory assessment process since the early stage of the policy decisions (Savoldelli, Codagnone & Misuraca, 2013).

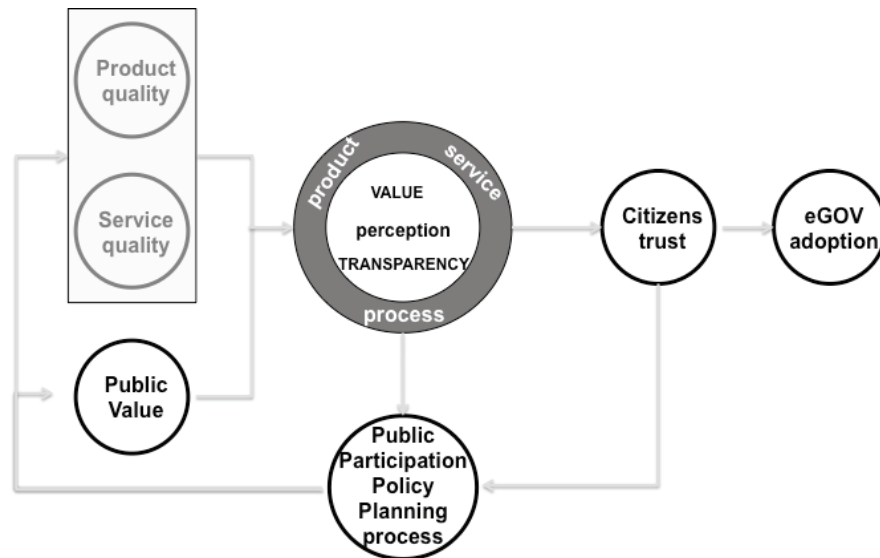


Figure 2: Key drivers of e-Government adoption (source: Savoldelli, Codagnone & Misuraca, 2013)

3. Key dimensions of eGEP-2.0 as an impact assessment model of policy decisions

The simplest method to represent the consequential chain of events to be considered for an impact assessment is an Analytic Hierarchy Process (AHP) model (Saaty, 2008). From a policy-model perspective, an AHP starts from the ultimate policy goal and it is organised in several levels linked each other with mutually dependent relationships. In literature several examples of AHP applied to policy decision-making process exist (Mansar, 2006; Kahraman, Demirel, & Demirel, 2007; Parra-Lopez, Groot, Carmona-Torres & Rossing, 2009; Saaty, & Vargas, 2012), however most of them adopt AHP for modelling projects' selection and/or evaluation purposes, and few of them has been used for modelling policy-making decisions. Also eGEP (Codagnone et al., 2006), that is our starting point in the development of eGEP-2.0, does the same. eGEP is structured into three levels: overall goal (level 0); outcomes criteria (Level 1); impacts indicators (Level 2), and it has been applied for benchmarking the performances of e-Government web portals across administrations belonging to different EU Member States, therefore its nature mainly descriptive was successfully used in *ex-post* assessment of e-Government initiatives (Codagnone & Undehim, 2008). However eGEP as it was designed cannot be used to model a policy decision-making process as eGEP-2.0 aims to do, mainly because:

- it does not allow to represent the policy strategy formulation process, from the definition of the overall goals of a given policy planning cycle, to policy guidelines definition and approval (Savoldelli, Codagnone & Misuraca, 2013);
- it does not provide the necessary decisional links between the policy strategy dimension and the implementation projects dimension (Lundqist, 2006; Suggett, 2011);
- it does not have the ability to model the circular nature of the policy-making process (see figure 3 and also Heeks, 2006; Savoldelli, Codagnone & Misuraca, 2012).

In general terms, in fact, expected policy outcomes shape expected policy impacts (usually called *political guidelines*). For achieving these guidelines, public administrations implement projects which start their lifecycle as *project ideas*, by defining projects' expected outcomes, usually called *needs*. Upon these needs, an *ex-ante* estimation of the degree of achievement of quantifiable objectives is provided before deciding the *projects' portfolio* suitable for implementing a given *policy plan*. These objectives are usually called expected impacts and are used for justifying project expected outputs. *Vice versa* the degree of achievement of given projects' outputs, allows estimating projects' impacts and to determine to what extent projects have satisfied the need for which they have been implemented.

Of course this is a simplification of reality, where there are no deterministic cause-effect links amongst policy decisions–projects' outputs–projects/policy impacts. As anticipated, only a cause-effect analysis based upon a robust counterfactual approach can evaluate the probabilistic and stochastic relationships that more likely

represent complex realities where policy decisions should have to produce their effects (Svensson, & Pettersson-Libdom, 2008; Garbarino & Holland, 2009; Hargraves, 2010; Misuraca et al., 2013). However the above description of the logical links between policy decisions and implementation projects allow us to organize a policy-decision model easier to be adopted in a participative process aiming to achieve consensus among stakeholders. This is also the logic through which eGEP-2.0 was designed. The main differences between eGEP and eGEP-2.0 are described in table 2, by considering four comparison criteria which are further explained below.

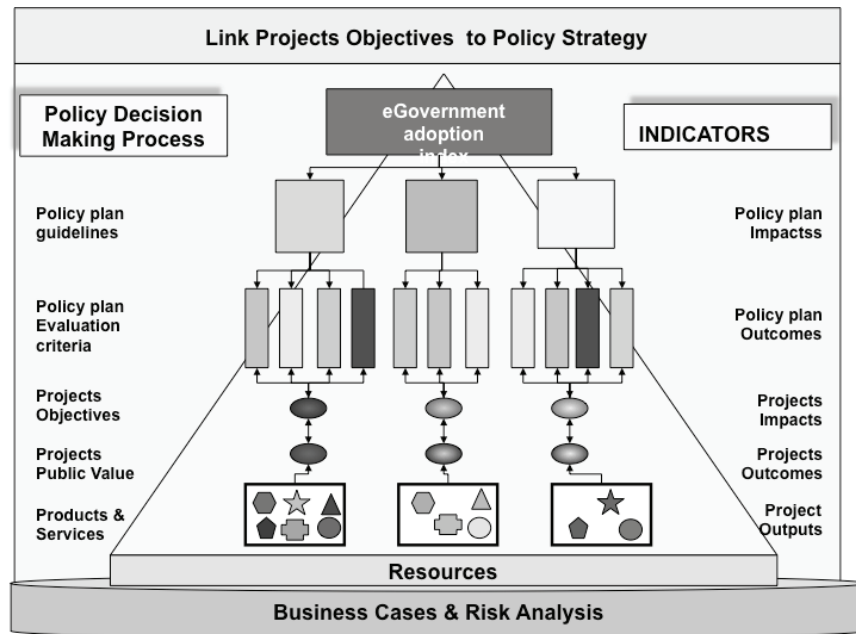


Figure 3: eGEP-2.0 logic model that provides a link amongst projects objectives and policy strategy

Table 2: Comparison eGEP-2.0 - eGEP in relation to their degree of applicability to an e-Government decision-making process

Comparison criteria	eGEP-2.0	eGEP
Degree of flexibility in policy planning process assessment	High	Low
Degree of flexibility in e-Government projects measurement	High	Medium
Degree of flexibility in participative measurement through stakeholders and citizens involvement	High	Low
Types of impact assessment stages supported	<i>ex-ante – on-going – ex-post</i>	mainly <i>ex-post</i>

1) Degree of flexibility in policy planning assessment. The majority of the assessment frameworks, including eGEP, are static by nature, based upon predefined criteria that are mainly related to projects that they are going to measure or compare, but rarely are designed to measure the link between policy objectives and e-Government projects (Savoldelli et al., 2013) as eGEP2.0 does;

2) Degree of flexibility in e-Government project measurement. The eGEP model, as other models analysed is based upon a static hierarchy constituted by a fixed number of measurement criteria and indicators that do not allow addressing all the characteristics of an e-Government policy plan and its related implementation projects. eGEP-2.0 model instead is structured with a dynamic hierarchy (Schmoltdt et al., 2001), that can be easily adapted to any policy plan;

3) Degree of flexibility in participative measurement through stakeholders and citizens involvement. The eGEP model, as all others, does not allow an effective participation of stakeholders and beneficiaries in the policy planning process. eGEP-2.0 instead provides the necessary support to involve all relevant stakeholders since the beginning of the policy-making process. Their involvement is foreseen in three stages of the measurement process as described in figure 4:

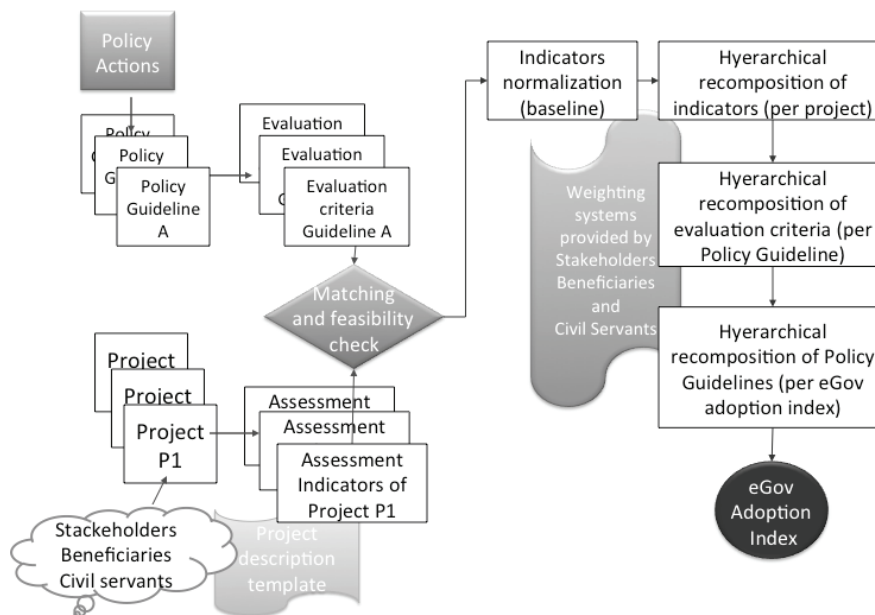


Figure 4: eGEP-2.0 measurement models. Logic flow of measurement and their relationships with policy actors stages

- *Defining e-Government projects to be evaluated/funded. In the figure this is represented by the steps placed in the lower-left side of the diagram. The involvement of stakeholders is foreseen through the fulfilment of a web-based project description template (Carbone, 2012), which allows to reach a consensus among policy actors on key dimensions constituting the project's characteristics;*
- *Choosing indicators suitable for measurement projects in coherence with the policy guidelines (left side of the flow-diagram). This is guided by a feasibility-check procedure that allows verifying the compliancy of project's objectives with policy guidelines;*
- *defining weighting system needed for hierarchical re-composition of the impact assessment model and the quantification of the e-Government adoption index. This is represented in the right side of the figure. In this case the key difference with eGEP re-composition approach consists in the adoption of weighting systems based upon stakeholders preferences and the usage of a negotiation process amongst policy actors based upon a sensitivity analysis of the weight assigned to the various levels of the hierarchical model (Munda, 2004; Gasparotos et al., 2008; Nordstrom et al., 2012).*

4) Types of impact assessment stages supported. As the majority of the impact assessment framework analysed, also eGEP has been designed to support mainly *ex-post* impact assessment. Its applicability to other assessment stages, even if it could be possible in theory, in practical terms it is difficult, especially for *ex-ante* expected impacts estimation, because it does not have enough flexibility neither in modelling the policy plan, nor in supporting participative measurement of the related implementation projects.

4. eGEP-2.0 applied: the case of the Emilia-Romagna region

In this section we describe the experience conducted in the last three years (2011-2013) in the Emilia-Romagna Region in applying the eGEP-2.0 assessment framework to the Telematics Plan of the Region (namely “Piano Informatico e Telematico della Regione Emilia-Romagna – PITER 2011-2013”). Figure 5 below presents the first three levels of the Assessment Model of PITER, based upon the eGEP-2.0 model structure described in the upper-left side of figure 4. The first three levels of the model are constructed in coherence with the objectives of the political guidelines of PITER and in agreement with the technical and political committees that constitute the governance structure of the ICT policy implementation in the Emilia-Romagna territory (Carbone, 2012; PITER, 2012). In particular, level 1 of the eGEP-2.0 model applied to the Telematics an Informatics Plan of the Emilia-Romagna Region is based upon the key policy elements of the European Digital Agenda (European Council, 2010) declined on the specific needs of the Emilia-Romagna territory. The selected criteria of level 2 of the eGEP-2.0 applied to the Plan have been based upon a consultation process involving all key actors in the Region and it has given us the possibility to design the measurement model in a transparent and trustworthy way. Level 3 in the model is constituted by the impact measurement indicators dynamically

adapted to the characteristics of the projects that the policy plan intends to implement in achieving its objectives.

Figure 5 provides an example of the process for selecting impact measurement indicators in the case of policy guideline dealing with the development of ICT network for all in the regional territory. This guideline is mainly aimed at: “completing the broadband in the whole region” and “providing of equal condition of connectivity for all citizens” (Carbone, 2012).

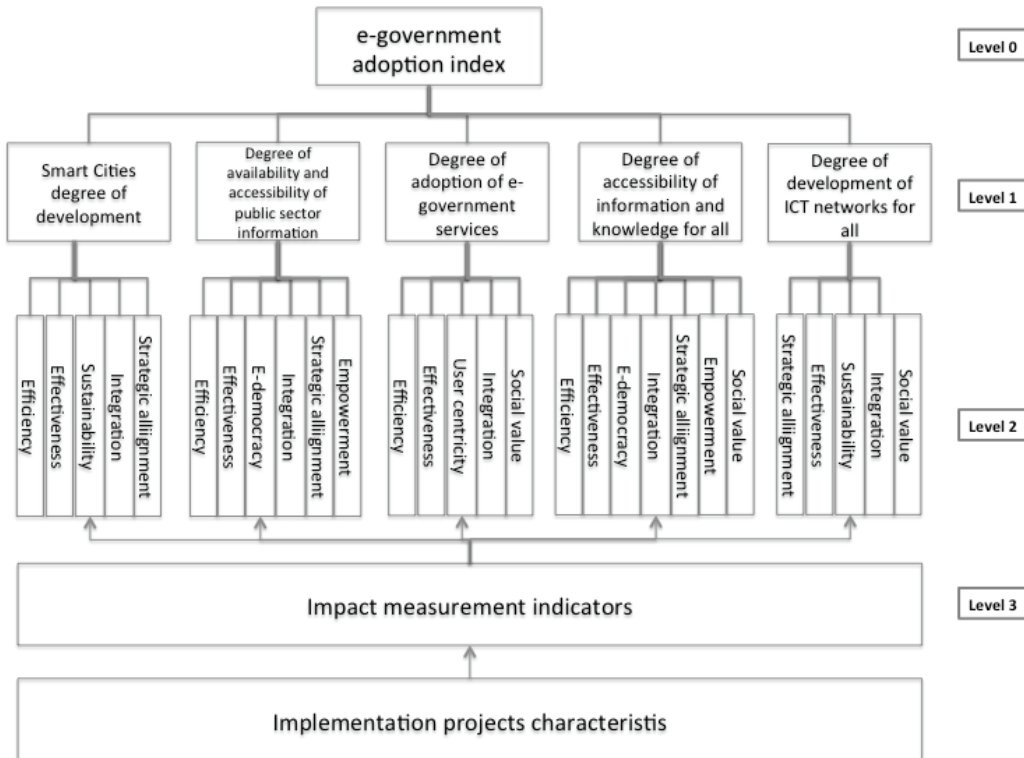


Figure 5: First three Levels of eGEP-2.0 – In the case of Telematics and Informatics Plan of Emilia-Romagna Region (PITER)

During the PiTER modelling phase, per each objective of the plan, the governance structure of PiTER defined the set of measurement criteria to be used which have then been specified in the data gathering template to help stakeholders identifying which combination of policy guideline-line objectives-criteria better matches their project idea (see also figure 4, left side).

This matching process was based upon a series of interactions amongst the project proposers and the governance structure of PiTER, creating a participatory process for the construction of the implementation plan, during the duration of this consultation process (September – December 2011) exchanging and discussing on the basis of quantitative and qualitative data about the project.

Table 3 provides some evidences of such participation for the year 2012 when eGEP-2.0 has been applied for the first time to the whole decision-making process of PiTER (2011-2013). Its application not only has allowed to speed up the yearly *ex-ante* evaluation process of at least six months in comparison to previous adopted methodologies, but it has also allowed to assess 34 projects, with a degree of coverage of the policy plan objectives of PiTER close to 90%. Moreover the eGEP-2.0 model has also allowed achieving consensus among main e-Government actors of the Emilia-Romagna region upon about 100 assessment indicators, which in average terms means about 3 indicators for each policy implementation project or above 4 indicators for each policy objective.

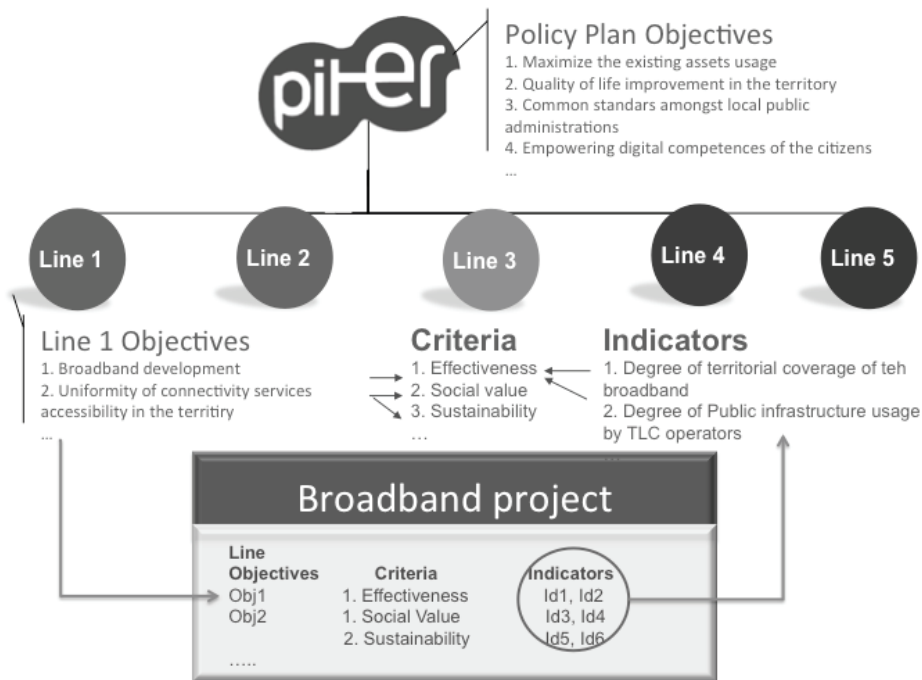


Figure 6, Impact measurement indicators selection process in PiTER

Table 3: eGEP-2.0 application to the eGovernment Telematics and Informatics Plan of the Emilia-Romagna region in Italy

POLICY GUIDELINES	# of policy objectives addressed on total	# of eGovernment projects assessed and funded	# of assessment indicators selected	Average # of assessment indicators per project	Average # of project per policy objective	Average # of indicators per policy objective
ICT Networks for all	6 (86%)	4	12	3,0	0,7	2,0
Information and knowledge inclusion for all ages	6 (100%)	7	21	3,0	1,2	3,5
eGovernment services for citizens and companies	4 (100%)	11	37	3,4	2,8	9,3
Open data and open government	5 (80%)	4	12	3,0	0,8	2,4
Smart cities and smart territory	5 (71%)	8	26	3,3	1,6	5,2
TOTAL	26 (87%)	34	108	3,2	1,3	4,2

eGEP-2.0 was used in the year 2012 for a second measurement stage and for other 35 e-Government projects and for measuring the *in- itinere* impacts of the projects selected in the first application of eGEP-2.0 (year 2011). allowing us to The feedback from these two stages of application of eGEP-2.0 to the Telematics Plan of the Emilia-Romagna Region clearly shows considerable advantages for the policy planning process of e-Government in the territory, such as:

- a significant time reduction in implementing the planning process;
- an increase of transparency and traceability of information and data processed;
- an increase of participation of stakeholders in policy-making;
- a significant reduction of the risk of failure of individual projects;
- a better allocation of financial resource with greater “social-value for money” perspective;
- a better quality of data collection from three-stage measurement process which, in mid-term perspective would be beneficial for an evaluation of the impact of the plan through a counterfactual approach.

5. Conclusions and future work

In this paper we have discussed the issue of measuring e-Government and analysed some of the main frameworks of measurement used in practice and at policy level. In light of the comparative analysis of

selected measurement framework, we have discussed how in order to overcome the 'e-Government paradox', the measurement of e-Government should be participatory and address a public value perspective as eGEP-2.0 does. The real-life experimentation and application in the case of the Emilia Romagna Region demonstrates the validity of the model and its usefulness for assessing impacts of e-Government projects in each of the three stages of the policy measurement process (*ex-ante – in-itinere- ex-post*). The results from the application of the eGEP-2.0 shows that it presents significant improvement with respect to the approach underpinning the original eGEP methodology, as: 1) it is based on a process of consensus building that allows all actors involved in e-Government to be an active part in the decision process; 2) it provides a coherent solution establishing a match between political guidelines and implementation process easily traceable and documented, which guarantees a continuous and circular measurement process supporting *ex-ante-in-itinere-ex-post* measures; 3) it is faster and more effective than previous solutions.. At the same time further research is required to better understand the interrelations between the various dimensions of the eGEP2.0 model, as well as to test on a larger scale its validity and with a more depth. This would require for instance to set-up a social (e.g. quasi-natural) experiment to observe and monitor the changes that e-Government interventions are generating in different contexts, or comparing similar experiences in measuring the impact of e-Government. The findings from the 'validity test' suggest, in fact, that the framework is robust enough for being an initial starting point to guide the possible development of theoretical perspectives and practical applications required, on the one hand, to contribute developing a better theoretical understanding of the impacts of e-Government policy interventions; and on the other hand to implement a practical-oriented and participatory measurement instrument to assess e-Government policies and the consequences of different policy implementation options. The proposed methodology is also a clear enhancement in respect to the existing approaches proposed so far and it is easily replicable in different policy contexts. However it clearly shows further areas of improvement both from a research and practice perspective. This implies that further research should explore possible intersections of the proposed methodological approach and the one aimed at establishing *cause-effect* relationships between policy actions and social impacts, in order to better appreciate how their synergic use in different stages of the policy planning process could be considered. Moreover it should be investigated better how to improve the citizens participation mechanisms in the consensus building process underpinning formal policy-making procedures related to the various aspects of the proposed methodology. At present, in fact, the participation of citizens to the decision-making process is mediated by stakeholders and doesn't include any direct mechanism for achieving consensus around specific policy decisions..

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.*

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Biographies

Conference Chair



Walter Castelnovo, Ph.D., is Assistant Professor of Information Systems at the University of Insubria (Italy). His research interests concern technological and organizational innovation in Public Administration and Interorganizational Information Systems. He is co-founder of the Research Center for Knowledge and Service Management for Business Applications (K&SM) of the University of Insubria and he is member of the Scientific Committee of the Interdepartmental Center for Organizational Innovation in Public Administration of the University of Milan. He is also member of the Department of Institutional Reforms, E-Government and Institutional Federalism of the Association of the Municipalities of Lombardia (Italy). He served as member of the committee for many international conferences on E-

Government and ICT evaluation; and he was the General Chair of The 5th European Conference on Information Management and Evaluation (ECIME). He is co-founder of the "ICT for Development International School" (ICT4DEVIS) and is the Director of the first edition of the school in 2012.

Programme Chair

Elena Ferrari is a full professor of Computer Science at the University of Insubria, Italy and scientific director of the K&SM Research Center. She received the IEEE Computer Society's prestigious 2009 Technical Achievement Award for "outstanding and innovative contributions to secure data management". In 2011, she has been named ACM Distinguished Scientist and she received a Google research award for her research on social network privacy. Her research activities are related to various aspects of data management, including access control, privacy and trust in social networks, secure cloud computing and emergency management, secure semantic web, multimedia databases. On these topics she has published more than 170 scientific publications in international journals and conference proceedings. She gave several invited lectures and tutorials in Italian and foreign universities as well as on international conferences and workshops. Prof. Ferrari is in the Editorial Board of the IEEE Transactions on Knowledge and Data Engineering, the IEEE Transactions on Dependable and Secure Computing, the Transactions on Data Privacy, and the International Journal of Information Technology (IJIT). She is a distinguished member of the ACM and senior member of IEEE.



Keynote Speakers



Dr Gianluca Misuraca is a Senior Scientist at the Information Society Unit of the European Commission's Joint Research Centre, Institute for Prospective Technological Studies (IPTS) based in Seville, Spain. Before joining IPTS, he was the Managing Director of the Global Executive Master in e-Governance at the Ecole Polytechnique Fédérale de Lausanne (EPFL). Previously he held several positions as policy advisor for different International Organisations and bilateral cooperation agencies as well as working with various consulting and industrial organisations in the area of e-Government, regional development, research and innovation. His background is economics with focus on the interface between ICTs and public administration, specialised in the area of business process reengineering and e-Transformation. He holds also a Diploma of Specialisation in European Union Economics and Law, a specialisation in Security Management, an Executive Master in e-Governance and a PhD in Management of Technology from EPFL.

Dr Antonio Cordella is a Lecturer in Information Systems at the London School of Economics and Political Science. His main research focus is on the impact of ICT on public sector organisation and government service delivery. He has published extensively in the area of e-government. He has led and participated in international research projects looking at different aspect associated to the deployment of ICT to reform public sector organisations. His most recent contributions in the e-government field are: Cordella, Willcocks, L. paper "Government Policy, Public Value and IT Outsourcing: The Strategic Case of ASPIRE", Journal of Strategic Information Systems, Forthcoming; Cordella, A., Bonina, C. "A Public Value Perspective for ICT Enabled Public Sector Reforms: A theoretical reflection", Government Information Quarterly (2012), vol. 29 (4), pp. 512-520; Cordella, A., Iannacci, F. "Information systems in the Public Sector: the e-Government enactment framework", Journal of Strategic Information Systems (2010), 19(1), pp.52-66; Cordella, A., Willcocks, L. "Outsourcing, Bureaucracy and Public Value: Reappraising the notion of the "contract state"", Government Information Quarterly (2010) 27(1), pp. 82-88.



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