ROI Analysis in e-Government Assessment Trials: The Case of Sistema Piemonte

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Abstract. Assessing the returns of public investments in information and communication technologies (ICT) poses important practical and research challenges. Scholars and practitioners that have embarked in ICT assessment activities have encountered many difficulties which, to a large extent, have remained pending issues. This paper reviews the exiting literature on public return on investment (ROI) and presents an assessment conducted on an Italian circuit of eGovernment services. The paper intends to share the experience gained from our study with the rest of research community. Also, it proposes a perspective on public ROI that differs from a strictly bottom line approach to stimulate a debate on the role of such evaluation activities in the process of eGovernment implementation.

1 Introduction

The implementation of eGovernment services as well as streamlining of the public functions represents a strategic goal for most Western countries. Thus significant amount of financial resources are being devoted to ICT related investments. This modernization process still requires a considerable amount of effort and, in order to be sustainable overtime, must be supported by an adequate evaluation of the public returns generated.

Assessing the returns of public investments in ICT poses important practical and research challenges. Scholars and practitioners that have embarked in ICT assessment activities have encountered numerous difficulties which, to a large extent, remain as pending issues. Some examples include the intangibility of the benefits generated, the time at which benefits have to be measured, and the cross-sectional nature of information technologies. In such a situation there is room for some reflections on what role public ROI should play in the process of eGovernment implementation. In particular, the extent to which ROI should be considered as a process with a value in and of itself, rather than simply an objective oriented activity. This paper attempts to stimulate such a debate. The paper is divided into three sections. In the first section we define terms such as

ROI, IT, ROI in IT, and provide a review of the existing literature on different methods and models utilized for measuring ROI in government IT investments. In the second section we present an ROI assessment experience on an Italian circuit of eGovernment services named Sistema Piemonte. In the third and final section we discuss lessons learned and propose a new perspective on ROI analyses that departs from a pure bottom line approach.

2 Assessing Return on IT Investment: Literature Review

2.1 What is ROI in IT?

Research on ROI in IT and attempts to build models and methods for measuring both tangible and intangible benefits of IT is becoming increasingly widespread in the social science community. Measuring return in IT investment is complex and requires a thorough understanding and knowledge of both the business process and the context in which it is embedded. Therefore, it is necessary to understand the relationships between the costs, benefits and risks of IT investments as well as different contextual factors including organizational, institutional, and environmental. Currently more and more governments are investing in IT. While the average annual growth rate of IT investment is growing year over year[3], the benefits and value of IT investments are still being questioned by many researchers and practitioners. The inconsistency in the research results is viewed as a metaphor on the subject of IT investment decision-making, meaning that "there are no single, simple methodologies that will give a consistent, reliable and optimal solution to managers facing an IT investment decision" (Schniederjans et al. 2004).

Before analyzing the ROI in IT, it is important to define ROI in IT as well as to understand the meanings of IT, ROI, and IT investment separately. It is not the purpose of this paper to show similarities and differences between different definitions of IT, ICT, ROI, and ROI in IT. However, a quick overview of existing definitions is useful for understanding the concepts underlying the discussion.

Defining IT: The term information technology also used for information and communication technology and their abbreviations IT and ICT are used very frequently in different fields, across different disciplines, and across all geographical continents. However, there is still no universal consensus with respect to what IT/ICT is and what their main characteristics are. First, it is important to understand the difference between technology and IT/ICT, and that IT/ICT is not equal to technology. Interestingly, there is a difference between the definitions developed in Europe and the USA. According to the European Commission, the importance of ICTs lies in the ability to create greater access to information and communication, and not in the technology itself. On the other hand, many definitions of IT/ICT developed by US scholars, practitioners, and/or organizations

[3] Analysis of data extracted from Detailed Fixed Asset Database, U.S. Bureau of Economic Analysis (BEA) shows that the investment in ICT, and particularly in software, is growing year over year.

still tend to emphasize and separate the hardware, software, telecommunications and other means of technology used for creating the output – useful information systems. For purposes of this paper, information technology can be defined as modern technologies used for the creation, management, use, handling and retrieval of information.

Defining IT investment: There are different approaches to defining IT investment. On the one hand IT investment is viewed as investments in equipment, applications, services, and basic technologies (Keen 1995). On the other hand, IT investment is viewed as expenses associated with acquiring hardware, software, communications, networks and personnel to manage and operate management information systems (Weill et al. 1989). For this paper, an IT investment encompasses all of the following components: personnel, application software, system software, and hardware (Schniederjans et al. 2004).

Defining ROI: The definition of ROI is much more confusing compared to the definitions of IT and IT investment. There is a wide range of methodologies for defining both tangible and intangible returns on IT investments. The traditional definitions of ROI consistently focus on the financial returns to determine how the investment will repay the investor.

In search of defining and measuring ROI in IT: Currently there is no comprehensive and accepted definition of ROI in IT. ROI in IT is associated with both tangible and intangible benefits, costs, and risks. The intangible benefits, costs, and risks are sometimes the most important factors for IT decision-makers, but they are typically the most difficult to quantify and measure. Thus, there is a concurrent need for conducting a comprehensive literature review and categorizing research in ROI in IT.

2.2 Is There a Value From IT Investment? The Productivity Paradox

The productivity paradox refers to the absence of a positive relationship between spending on IT and its resulting contribution to productivity/profitability (Lucas 1999). "In the early 1990s, researchers found a productivity paradox concerning IT investments. This paradox showed IT investments with negative or zero returns" (Dehning et al. 2002). Since then many researchers and practitioners attempted to give different explanations, reasons, justifications, and solutions for the paradox of IT productivity. According to Dos Santos and Sussman, "even though organizations invest in the latest technology to increase efficiencies and profits, failure to redesign and reorganize delays the return on that investment" (Dos Santos et al. 2000). Brynjolfsson and Yang attempted to uncover the productivity paradox of IT investment by examining four different approaches: (1) mismeasurement of outputs and inputs; (2) lags due to learning and adjustment; (3) redistribution and dissipation of profits; and (4) mismanagement of information and technology. The authors noted that the first two approaches are based on shortcomings in research and methodology to measure ROI in IT, and not practice (Brynjolfsson et al. 1996). However, the last two approaches can be explained by shortcomings in management practice.

Today many organizations are employing a variety of methods to support their decision-making processes when investing in IT. Regardless of the method or combinations of methods employed for supporting decisions, investment in IT is associated with conditions of uncertainty and risk, indicating that some acts have more than one possible outcome, and "the decision maker cannot fully control which outcome will occur" (Edwards et al. 2001). Cost and expected financial return are important factors in IT investment decision-making processes, but so are expected non-financial returns provided by the IT investment, which are hard to measure and have multiple attributes. Intangible benefits such as increased quality, variety, customer service, speed and responsiveness are poorly accounted for in productivity statistics as well as in most firms' accounting numbers (Brynjolfsson 1994) leading to systematic underestimates of IT productivity (Brynjolfsson et al. 1996).

The probability of obtaining a positive return in IT investment depends on the type of IT investment (Lucas 1999). ROI in IT as a *strategic application* will be different from ROI in *transformational* IT. It is easier to estimate a range of possible costs, benefits and risks, and probability of each in the case of strategic IT investment. It is much harder to estimate the costs, benefits and risks associated with transformational or innovative in nature IT investments as often they change the nature of company, the industry, and even the way people live and work.

2.3 Return in IT Investments in Public Sector

There is a range of methods, strategies, and tools used to measure the value of IT and ROI in IT. Traditional ROI analyses are typically based on financial models (Arlotto et al. 2003). Recently traditional financial models and methods including net present value, return on sales, and return on assets have been criticized on different grounds. First, the traditional ROI models are criticized for not being able to accurately predict ROI due to uncertainty and difficult decisions involved in IT investments (Benaroch et al. 2000). Second, traditional ROI models are based on the assumptions that costs and benefits are always known and expressed in a common metric – dollar value (Laudon et al. 1999). Third, traditional ROI models do not take into consideration the political position in the organization. "While political position has very little to do with IT, it usually affects the period of time allowed for ROI" (Forrer et al. 2001). The traditional financial ROI models have more limitations including the exclusion of social and political returns.

Success through IT in the public sector is different from that in the private sector. In measuring ROI in IT, private sector organizations usually focus on the "bottom-line," while the public sector organizations usually focus on policy initiatives (Forrer et al. 2001). Public sector organizations, unlike private ones, are not primarily concerned with investing in IT with the expectation of gaining economic return; they are more concerned with fulfilling political goals such as collaboration among government entities, improved government services and citizens access to public services (Dufner et al. 2002). In addition, public

sector organizations face more competing goals and are more bound to legal and staffing restrictions than private sector organizations (Guy 2003). Thus, what is actually considered a positive return and benefit in the private sector may well be considered a threat and potential risk in public sector. For example, private organizations may have an incentive to invest in IT targeted to automating tasks and reducing headcounts. However, reduced headcounts would be a potential risk for public agencies as they have limited discretion to fire and/or reassign employees in order to achieve similar efficiencies from IT (Chircu et al. 2003). "Job security, computer phobia, management freedom, and that ever-prevalent line "we've always done it that way" are among the reasons why it is difficult and sometimes undesirable to measure ROI" (Forrer et al. 2001).

2.4 Brief Overview of Public Sector Return in IT Investment Models

During the last decade a range of models were developed to measure the return on IT investments in the public sector with the purpose of creating a solid decision base for public managers (see Table 1). The common similarity among the different models is that all of them evaluate IT investments in the public sector as a *portfolio problem* as opposed to traditional private sector way of evaluating IT investments as a single problem of measuring financial returns. Thus, all the models take into consideration a package of both tangible and intangible factors when assessing IT investments in the public sector – *cost* (analysis of both financial and non-financial investment cost), *benefit/value* (assessment of both financial and non-financial benefits and value), and *risk* (assessment of potential risks). Most of the models emphasize different levels of benefits and value created from IT investment, including political, social and economic. All the models attempt to develop a shared scale for quantifying and analyzing the package of factors, i.e. cost, benefit/value and risk associated with IT investments. The end result of each model usually is a calculated score and some kind of diagram that presents the IT investment results.

The wide range of the models suggests that no single model is universally applicable to all government IT projects and across different geographical areas. Thus, we developed a hybrid approach for the assessment of the case presented below. Our hybrid approach draws from best practices found in the literature and also includes additional components to make the analysis adherent to context peculiarities. In the next section of this paper we provide some background information and a description of the methodology adopted.

3 The Case of Sistema Piemonte

3.1 Background Information

The region of Piemonte has historically adopted a systemic approach towards the management of public IT implementation. In the 1970s the regional government

Table 1. List of Public ROI in IT models

Name	Acronym	Year	Source
Social Return on Investment Model	SROI	1996	Roberts Enterprise Development Fund
Value Measuring Methodology	VMM	2001-2003	US Social Security Administration and the General Service Administration
Balanced E-Government Index	BEGIX	2002	Bertelsmann Foundation and Booz, Allen and Hamilton
Federal Enterprise Architecture Performance Reference Model	PRM	2003	U.S. Office of Management and Budget
Public Sector Value Model	PSV	2003	Accenture in cooperation with Kennedy School of Government, Harvard University
Performance Reference Model	PRM	2003	US Federal Enterprise Architecture Program Management Office (FEAPMO)
Interchange of Data between Administration	IDA VOI	2003	European Commission, DG Enterprise
Demand and Value Assessment Methodology	DAM & VAM	2004	Australian Government Information Management Office

established a public consortium (CSI-Piemonte) to support IT implementation projects throughout different administration levels. This decision was the result of two main considerations. To begin with, they acknowledged a high level of administrative fragmentation present on the territory. Second, they believed that a centralized and collaborative approach among the different administration levels would generate a number of benefits in terms of efficiency and effectiveness for the regional system. Following the same logic, CSI was given the responsibility to set up a project named Sistema Piemonte (Piedmont System) with the aim to promote the provision of public services via web-enabled interfaces. The project began in 2001 as a web-portal. Nevertheless, over the years it has evolved towards an integrated platform for the provision of eGovernment services. The structure of Sistema Piemonte was adjusted to increase its flexibility in order to respond to different needs present among local administrations.

Cantamessa et al. in their recent study highlighted how the evolution of eGovernment services at local level in the region has been stagnant over the last three years. Two types of issues in particular have been identified. The first issue is the inability for most small municipalities (below 5000 inhabitants) to set up any type of eGovernment activity. The second is the difficulty for medium-large municipalities to implement the back office solutions necessary to start providing fully transactional services through their websites (Cantamessa et al. 2005). Sistema Piemonte thus aims at responding to these two needs by offering a full-package service to the former and ad hoc back office support to the latter.

In 2005 CSI decided to undertake an ROI analysis to check the extent to which the logic behind Sistema Piemonte was economically beneficial. In addition, CSI identified a need for exploring applicable business models that could be sustainable over time. The case study presented below is the result of the ROI assessment conducted in collaboration with CSI.

3.2 Hybrid Model for ROI in Government IT Assessment

A literature review conducted on existing models for public ROI in IT represented a solid base for the creation of an ad hoc model that fitted the specific necessities of the Sistema Piemonte project. Although synthesizing existing models allowed us to create a new methodology, the intent of this article is not to propose our hybrid model as a better way for ROI in government IT assessments, but simply to share the lessons learned from its application. As a matter of fact, the main merit of the exercise was not so much in terms of methodology creation for IT assessments, but rather in terms of stretching the application of the existing methodologies to a further and more detailed level of quantification of costs and, most importantly, benefits.

The next two sections provide a brief description of the methodology implemented in the case of Sistema Piemonte. The description of the adopted methodology is divided into two blocks: the cost analysis and the benefits assessment.

Cost analysis: The primary goal of cost analysis was to discover and map the relationships between existing resources and the services offered. In this first phase it was important to distinguish between costs that could be directly associated with each single e-service and those that were common to all e-services. Thus, we conducted a background analysis in order to create a catalogue of e-services costs, which were divided into two main categories (see Figure 1):

- Costs associated with the development and management of each e-service,
- General costs associated with CSI's resources that are common to all e-services.

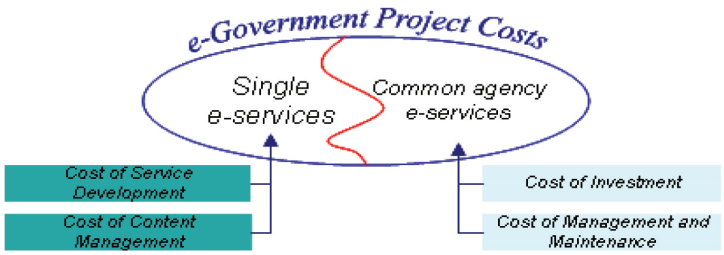

Fig. 1. Two categories of e-services costs

In order to create short-term and long-term scenario forecasts, both service specific costs and general costs were further divided into two subcategories: investment costs and operation costs. The calculation of service specific costs and general costs required the use of two different allocation procedures. While the former could be directly attributed to each individual service, a two step process was necessary for the latter:

1. A quota of the infrastructure's cost destined to Sistema Piemonte was calculated.

2. A cost driver (or a combination of cost drivers) adherent to the cost nature, was adopted to spread the cost across the services linked with the infrastructure.

In the end, the cost analysis helped us to reallocate the project costs among all the e-services. This was an important result for a number of reasons. First, it represented the basis for the evaluation of the added value generated by each service. Second, it allowed us to identify the main cost factors in the creation of different growth scenarios. Third, it permitted us to keep costs under control. Finally, it suggested what factors were most needed for the adoption of a sharing model. *Value/benefits assessment:* The goal of the benefits assessment was to develop a tool that could estimate the value created by each e-service for different stakeholders. The value is calculated based on an analytic comparison of the benefits introduced with government e-services implementations and the traditional way of providing services (before implementation). Our value/benefit assessment took into consideration the different aspects of value created from IT investments, i.e. economic, social and political, and was based on a two-stage process. The first stage began with an assessment of the models identified in the literature review presented earlier. The comparative analysis allowed us to identify a set of both tangible and intangible benefits associated with IT investments. At the end of this stage we developed a database containing forty generic benefits associated to the e-government services considered. In the second stage we developed a value assessment model. The model was based on MS Excel spreadsheet and tested for two different bundles of e-services and two hypothetical local administrations with five thousand and ten thousand inhabitants respectively. A detailed description of the second stage is provided below.

3.3 Assessment of e-Services Benefits

The fist step in the assessment consisted of linking each of the forty generic benefits with the e-services provided by Sistema Piemonte. Subsequently, benefits were categorized along three main dimensions: business line (or typology of value created), direction of value creation, and benefit unit of measurement. The categories presented in each dimension are listed below[4]

[4] We adopted Booz Allen Hamilton's methodology as described in "Building a Methodology for Measuring the Value of E-Service." USA Social Security Administration (2002).

Business Line
- Direct customer (user) value
- Social (non-user/public) value
- Government financial benefits
- Government operational / foundation value
- Strategic/political value

Direction of value creation
- Government to Constituency
- Government to Business
- Government to Government
- Internal Effectiveness and Efficiency

Unit of measurement
- Money
- Time
- Quality Countable
- Quality Uncountable

The next step was to associate each benefit with an analytic indicator in order to quantify the amount of value created. The following are sample examples for translating the e-services into benefits:

– *Reduction of displacement cost* ⇒ direct customer/user value – G2C – money
– *Faster implementation of procurement stages* ⇒ direct customer/user value – G2B – time
– *Improvement of service availability (24 hours x 7 days per week)* ⇒ direct customer/user value – G2C – quality countable
– *Increased citizen participation in public/political decision-making* ⇒ social (non-user/public) value – G2C – quality uncountable

The quantitative measurement of each indicator was based on an estimation of the value created per e-service request. At the beginning of the assessment process, the two local administrations considered had to choose among the list of e-services offered by Sistema Piemonte. Next, an estimation was produced about the improvements that the provision of the services via Internet could entail in terms of processing time and cost. The computation of the value generated by each service was based on the estimated average number of annual requests by a potential hypothetical e-government user.

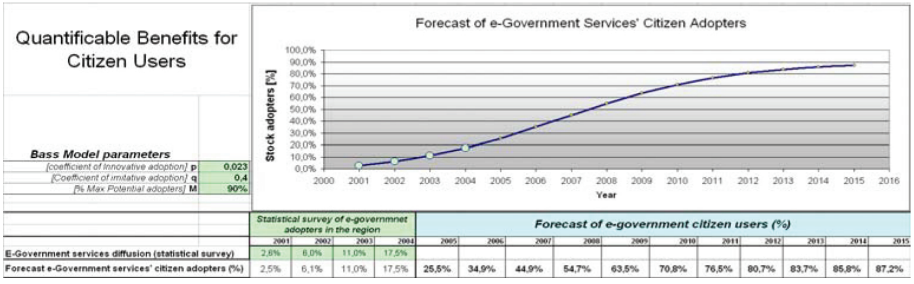

Fig. 2. Estimated number of citizens using of e-Government services

In order to forecast the number of potential adopters of the e-government services, we analyzed data from regional and national surveys on e-Government services diffusion. We applied the Bass model (1960) for the interpolation of the diffusion curve as shown in Figure 2. This process allowed to estimate percentage of e-Government citizen users and quantify the benefits for each given

year. A similar procedure was adopted for the estimation of both business and government users.

The final step was to group benefits into two categories: value created for the public administrations in Sistema Piemonte network, and value generated for other stakeholders including citizens, business users, and public administrations outside the Sistema Piemonte circuit (see Figure 3 below). The aim of this final distinction was to explicit the direct and indirect benefits that a local administration could enjoy by joining the Sistema Piemonte initiative.

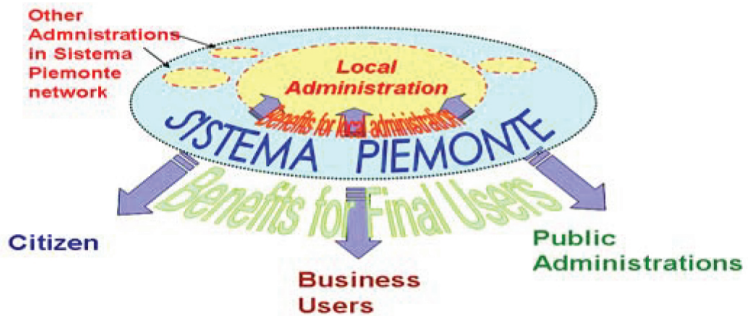

Fig. 3. The two fronts of benefits

Concluding, the main merits of the ROI analysis conducted may be summarized as follows. First, it permitted to identify the main stakeholders and beneficiaries of each e-service: citizens, businesses, or governments. Second, it made possible to quantify values and benefits created by the participation of a local administration in an e-government service network (Sistema Piemonte) and compare it with the related investment costs. Third, it allowed performing adoption simulations and identifying different probabilistic scenarios for the future diffusion of e-government services in the region. Fourth, it proved a useful decision-making support tool in the choice of the right business model for a sustainable e-service implementation. Finally, the hybrid model adopted for this case study may be used in assisting local administrations to understand the benefits brought to final users by the new e-services implementation.

4 Lessons Learned and Policy Implications

A number of lessons can be learned from the cost analysis and value/benefit assessment experience described above. During the study we faced different problems that led us to revisit the process. The first barrier we encountered when conducting the cost analysis had to do with the cross-sectional nature of ICT. Despite the fact that Sistema Piemonte was an initiative managed by a single entity (i.e. CSI), the information concerning the project was very fragmented and scattered among different departments. As a result, a considerable amount

of effort had to be put in order to reach a comprehensive understanding of how the various components of the project were interacting among each other. Thus, the first important result generated from the cost analysis process was twofold. On one hand, we identified processes inside CSI that were involved in the development and management of Sistema Piemonte. On the other hand, the mapping of the services offered, allowed us to understand what areas needed to be further developed.

As per the benefit assessment, the main hurdle encountered was related to the scarcity of information about the impact of current and future ICT adoption. Although the procedure we adopted to estimate benefits was as rigorous and objective as possible, the uncertainty introduced by each estimation contributed to reducing the reliability of the bottom line result. Nevertheless, it must be emphasized that the model permits to easily identify best/worst and most likely scenarios, and thus provides an indication of the sensitivity of the final result.

Another important issue in the assessment of benefits was the time dimension. Some benefits manifest only years after a project has reached maturity. Thus, attempts to quantify them in the early stages of the investment may result as a difficult task highly based on "guesstimation".

All the issues described above, led us to think that a bottom line approach to public ROI analysis may be too risky and not extremely reliable. A legitimate question could then arise as to the value and purpose of carrying out such kind of analysis. The lessons learned with Sistema Piemonte experience has revealed that the merits of a ROI analysis in complex eGovernment projects should be searched for in the support it may provide to project management activities. As a matter of fact, the benefits generated from creating a complete, simple and understandable representation of the project for managers far exceeded the benefits stemming from reaching a final result stating that the project was generating a total value of "x" or "y". This thesis is reinforced by the fact that often managers base their decisions about whether to continue projects on a high amount of tacit knowledge as well as political reasons rather then hard figures. In conclusion if we consider that in 2003 Heeks estimated the world-wide rate of failure in eGovernment projects to be as high as 85% (Heeks 2003), it appears evident the need for some control and project management tools. In this respect, we believe public ROI analysis may provide a valuable contribution.

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