Proceedings of the 13th European Conference on Information Technology Evaluation

Genoa, Italy

28-29 September 2006

Edited by

Dr Dan Remenyi, Trinity College Dublin, Ireland

and

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Papers have been double-blind peer reviewed before final submission to the conference and the Electronic Journal of IS evaluation (www.ejise.com). A selection of papers will comprise a special edition of the Journal in. Initially, paper abstracts were read and selected by the conference panel for submission as possible papers for the conference.

Many thanks to the reviewers who helped ensure the quality of the full papers.

ISBN: 978-1-905305-34-6 Cd

Published by Academic Conferences Limited
Reading
UK
44-118-972-4148
info@academic-conferences.org

Measuring Return on Government IT Investments

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Abstract: Recently there have been many attempts to understand and measure the returns from information technology (IT) investments in public sector. Initially, most of the methodologies and models were based on traditional financial models. However, assessing the returns on government investments in IT poses important practical and research challenges. Scholars and practitioners that have embarked in IT 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 can be measured, and the cross-sectional nature of information technologies.

The primary purpose of this paper is to conduct a comparative analysis and describe the similarities and differences of different approaches, models and methodologies developed for evaluating ROI in public sector. Thus, the paper will be informed by an extensive review of the fragmented research and analyses of IT evaluation and different elements of IT evaluation in public sector.

Keywords: Return on investment; information technology; e-government; public sector

1. Introduction

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 on 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 state and local governments are investing in IT. While the average annual growth rate of IT investment is growing year over year, 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).

The purpose of this paper is twofold: (1) to provide a descriptive data analysis of trends in IT investments, and (2) to provide a review of existing literature on different methods and models developed and utilized for measuring ROI in IT investment, particularly in the public sector. The paper does not rely on original analysis of primary data, but rather pulls together the scattered literature on different aspects of IT evaluation to provide a good foundation to analysts and policymakers in their IT investment evaluation and decision-making efforts.

2. What is ROI in IT?

Before defining ROI in IT, it is important 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 under the discussion.

2.1 Defining IT

The term information technology is 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. The word technology originated from Greek words technologia, techne meaning “craft” and logia meaning “saying.” According to Marriam-Webster dictionary technology is a broad term and applies to the use and knowledge of humanity's tools and crafts to produce desired products and solve problems. In this sense technology includes technical methods, skills, processes, techniques, tools and raw materials such as computer technology, medical technology, etc. On the other hand, Information Technology is concerned with technology as well as with different aspects of managing and processing information. Thus, IT deals with the use of computers and computer software to manage data and information (i.e. convert, store, process, transmit, retrieve data and information). 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 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 technologies used for the creation, management, use, handling and retrieval of information.

2.2 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 in 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 (i.e. programming languages), system software, and hardware (Schniederjans, 2004).

2.3 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 investments. The traditional definitions of ROI consistently focus on the financial returns to determine whether a proposed investment is wise, and how it will repay the investor.

2.4 In search of defining and measuring ROI in IT

There is currently 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 as well as different methodologies and models of measuring ROI in IT.

3. Current trends in IT investment

In 1987 investment in ICT was about one-fifth of total investment in the United States, while in 2003, investment in ICT made up about one-third of total investment. Figure 1 below shows that investment in ICT as a proportion of total investment has been growing steadily since 1987, with a slight decline in growth in 2001-02 period, which can be attributed to the nationwide recession and general trend of decline in total investments.[1]

[1] Data for all the figures provided in this section has been obtained from U.S. Bureau of Econmic Analysis.

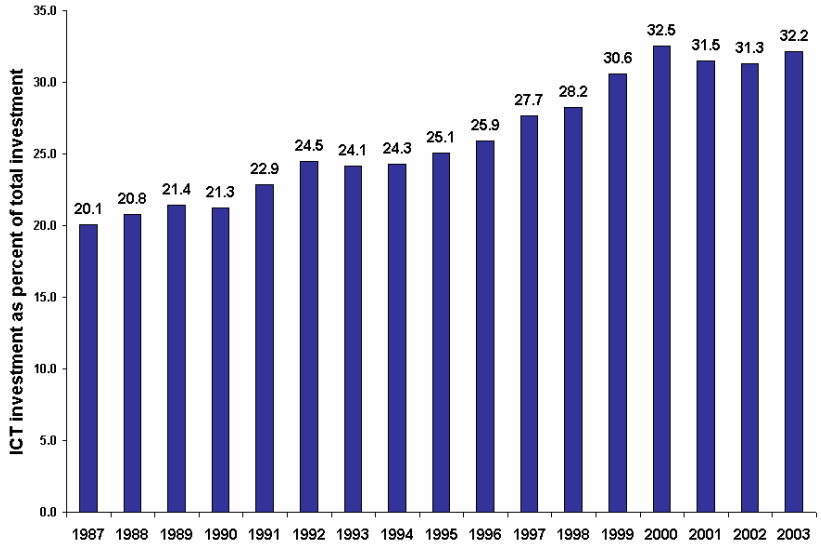

Figure 1: Proportion of all ICT investment as percent of total investment, USA, 1987-2003

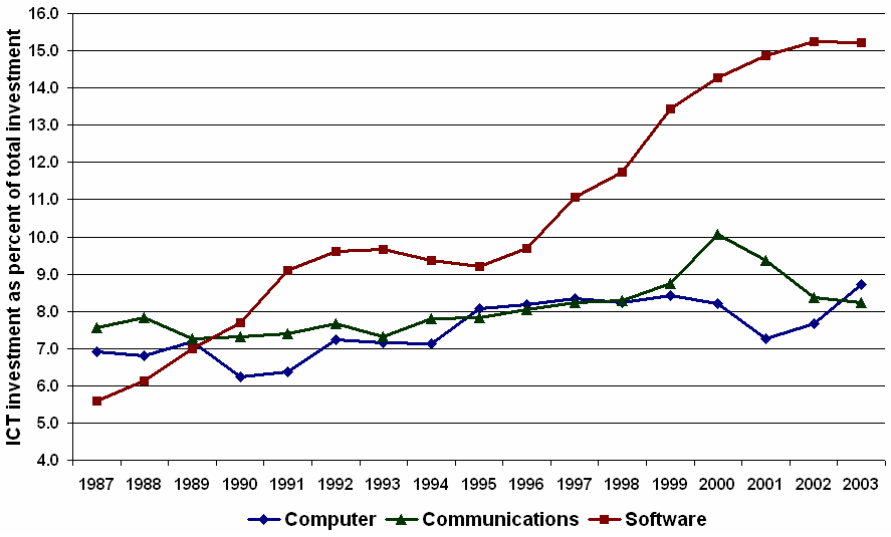

Figure 2: ICT investment trend as percent of total investment, USA, 1987-2003

Figure 2 shows the percent of investments in computers, software and communications separately as a proportion of total investments. As shown in Figure 2, there are interesting trends and patterns in different types of ICT investment, particularly throughout the last decade. While the investments in computers and communications had a fluctuating trend and slower growth rate, there was much steadier and faster growth in software investments. Even during the most recent recession years the investments in software continued to grow, regardless of declining growth rate in total investment as well as total ICT investments. In addition, Figure 3 shows that in 1989 investments were almost equally distributed in computers, software and communications, while in 2003 almost half of the investments were in software alone. One can hypothesize that there is a higher need for and higher return from investment in software compared to investments in computers and communications, therefore resulting in higher investment rates in software. Another hypothesis is that the software industry is growing at a faster rate compared to the computer and/or communications industry growth rate. One explanation for the slowdown in computer spending can be attributed to the effect of Moore's Law. In other words, because computer technology has grown

powerful without getting more expensive, the users simply have all the computer functionalities and power they could possibly need. However, these hypotheses need to be tested based on additional data.

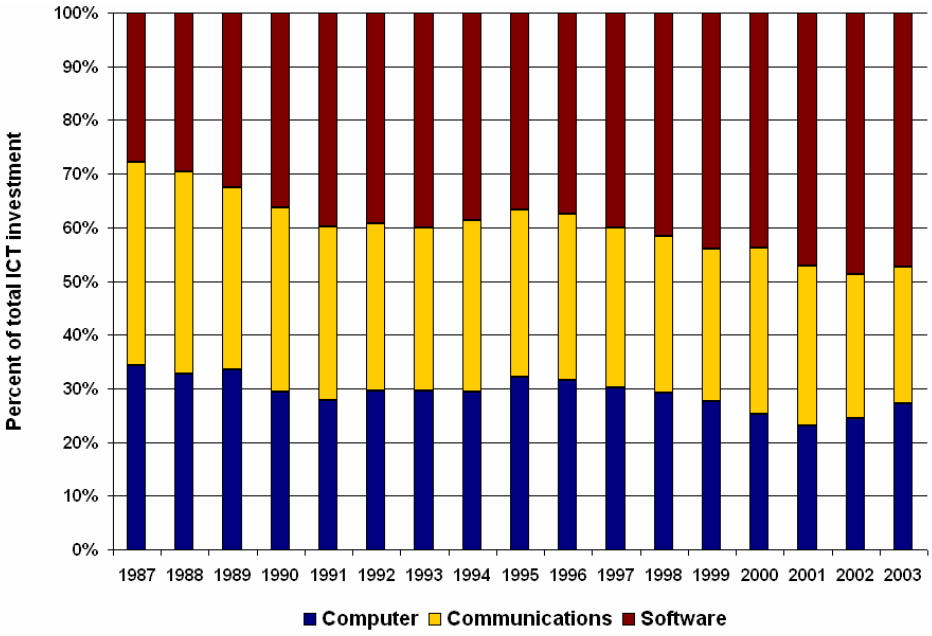

Figure 3: Proportion of ICT investment in total investment, USA, 1987-2003

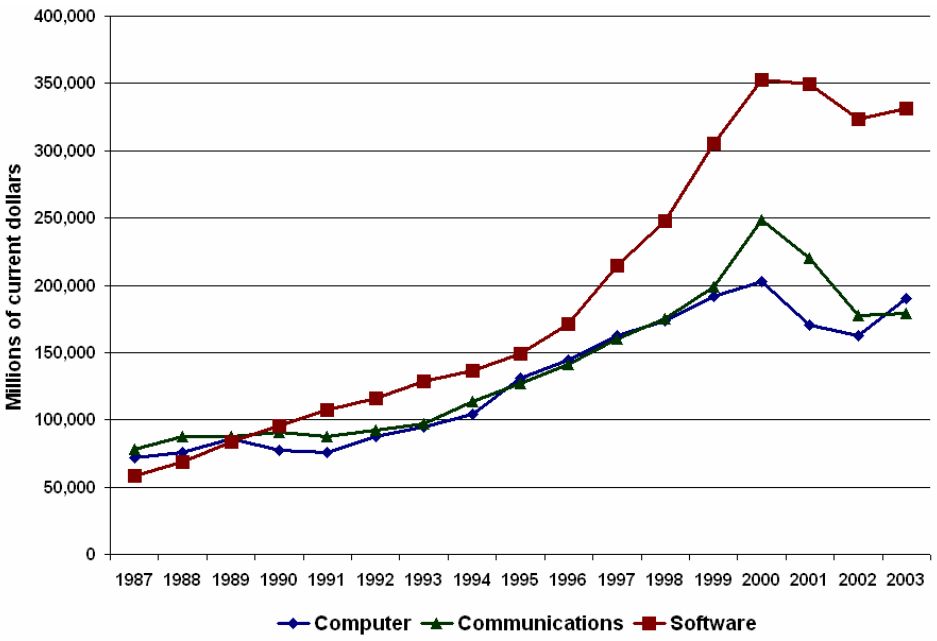

Figure 4: Dollar value of ICT investment, USA, 1987-2003

Figure 4 shows the dollar value of investments for software, computers, and communication separately. The total investment in ICT in the US grew from about $200 billion in 1987 to over $700 billion in 2003, or almost four times, while total investment grew at a much lower rate, from $1,036

billion in 1987 to $2,179 billion in 2003. Further data is needed to explore the widening gap between investments in software and investments in computers and communications. Finally, it will be interesting to explore the trends of IT spending in private versus public sectors. However, there is no comparable time-series data for the computer, software and communications spending in U.S. public sector.

The overall steady growth in IT spending raises a number of questions. Both researchers and practitioners have been constantly questioning the correlation between IT spending and firm profitability as well as the correlation between IT spending and firm performance. The next section of this paper will discuss the value created from IT investment, or the so-called productivity paradox.

4. 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 (2000), "even though organizations invest in the latest technology to increase efficiencies and profits, failure to redesign and reorganize delays the return on that investment." The authors particularly emphasize the need to think and act strategically and exercise "what-if" thinking instead of "what-now" thinking.

Brynjolfsson and Yang (1996) 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 point out that the first two approaches are based on shortcomings in research and methodology to measure ROI in IT. However, the last two approaches can be explained by shortcomings in management practice.

Today more and more organizations are employing a variety of methods including ROI calculations, cost-benefit analysis, return on assessment (ROA) analysis, net present value (NPV) calculations, 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 choices 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, more variety, better 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).

Some scholars argued that 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.[2] 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 IT investments as often they change the nature of company, the industry, and even the way people live and work. Transformational IT investments are usually driven by faith and vision and are successful only under a strong leadership and champion. In addition, it is important to consider different aspects of IT - spending, management, and strategy when implementing and assessing return from IT.

[2] Strategic application in here refers to existing and mature IT applications, while transformational IT in here refers to new and innovative techonogies, with no prior product evaluation.

5. Return on IT investments in public versus private sectors

There is a range of methods, strategies, and tools (such as ROI calculators and software) used to measure the value of IT and ROI in IT. Traditional return on investment analyses are typically based on a financial model, usually in a spreadsheet format (Arlotto et al. 2003). Most recently traditional models and methods including net present value (NPV), discounted cash flow (DCF), return on equity (ROE), return on sales (ROS), and return on assets (ROA) 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 are expressed in a common metric – dollar value (Laudon et al. 1999). Third, traditional ROI models do not take into consideration the political position of 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, predominantly 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 the success of 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).

6. Overview of return on investment methodologies and models

The field of ICT evaluation is still in its early development stages and is facing both theoretical and methodological challenges. As Berghout and Remenyi noted, "Clearly there is no single, superior, theoretical underpinning for research in this field of study" (Berghout et al. 2005).

Bannister and Remenyi (2000) provided a sound methodological approach for categorizing IT evaluation approaches. The authors suggested the following three techniques for classifying IT investment evaluation approaches: fundamental, composite and meta methods. According to Bannister and Remenyi, the characteristic of fundamental measures is to assign a single score to assess IT investment. The fundamental measures encompass both financial and non-financial performance metrics. The second technique, a composite approach of assessing IT investments, is based on a number of fundamental measures "to obtain a 'balanced' overall picture of value/investment return" (Bannister and Remenyi, 2000). Composite approaches include measurement techniques that are highly structured and standardized, as well as measurement techniques that are ad hoc and based on different weighing and scoring schemes impacting the decisions. The third technique, meta approaches, "attempt to select the optimum set of measures for a context of set of circumstances" (Bannister and Remenyi, 2000).

6.1 Public ROI models from the practitioners' perspective

During the last decade a range of models were developed to measure the return on investments in the public sector with the purpose of creating a solid decision base for public managers. The wide range of the ROI models suggests that no single model is universally applicable to all government IT projects and across different geographical areas. The common similarity among the different

models is that all of them evaluate investments in the public sector as a portfolio problem, i.e. the models strive to assess not only the financial returns, but also political, social and environmental returns of IT. On the contrary, most often the traditional private sector evaluates ICT investments primarily as a problem of measuring financial returns.

A list of prominent non-academic models mostly focusing on measuring ROI in IT in the public sector is provided in Table 1, followed by more detailed description and analysis of each model.

Table 1: Public return on investment models

Name	Acronym	Year	Source
Social Return on Investment Model	SROI	1996	Roberts Enterprise Development Fund
Balanced E-Government Index	BEGIX	2001-2002	Bertelsmann Foundation and Booz, Allen and Hamilton
Value Measuring Methodology	VMM	2001-2003	US Social Security Administration and General Service Administration
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
Interchange of Data between Administrations Value of Investment	IDA VOI	2003	European Commission, DG Enterprise
Demand and Value Assessment Methodology	DAM & VAM	2004	Australian Government Information Management Office

6.1.1 Social Return on Investment (SROI) model[3]

In 1996 the Roberts Enterprise Development Fund (REDF) published a retrospective cost benefit analysis of the social purpose enterprises run by a non-profit agency in the San Francisco Bay Area. The study was a precursor to REDF's subsequent approach to SROI published in 2001. REDF's SROI framework was specifically designed for social purpose enterprises run by non-profit organizations.

The SROI framework looks at value creation from the investor's perspective and assumes that value creation occurs simultaneously in three ways along a continuum, ranging from purely economic, to socio-economic and social. *Economic value* is created when there is a financial return on an investment. *Social value* is created when resources, inputs, processes or policies are combined to generate improvements in the lives of individuals or society as a whole. However, it is very difficult to measure the *true* social value created and in the social value arena there are factors that are beyond measurement, yet clearly *are* of value and worth affirming. *Socio-economic value* measurement builds on the foundation of economic value measurement by quantifying and monetizing certain elements of social value, and incorporating those monetized values with the measures of economic value created. SROI framework incorporates measures of economic value with monetized measures of social value to calculate socio-economic value (REDF, 2001).

SROI is a term now used by many foundations, private investors and philanthropists, government agencies, academics, private social service agencies and other nonprofits working to help their communities. The concept of SROI has been further analyzed by other organizations, practitioners, and scholars. For example, the New Economics Foundation extended REDF's SROI model (1) to serve as an investment decision-making and performance measurement tool and (2) to create social value (Aeron-Thomas et al. 2004). SROI methodology has also been extended by Olsen and associates. Olsen and Nicholls (2005) have proposed an SROI framework with the purpose of (1) providing a shared understanding of the various methods and options used for calculating monetized SROI, and (2) ensuring that organizations across different sectors and at different

[3] Even though the SROI model is primarily a private sector oriented model, it is included in here for its special philanthropic orientation.

stages of development can conduct SROI analysis. Olsen and Lingane (2003) developed ten guidelines for the calculation of standard SROI.

6.1.2 Balanced E-Government Index (BEGIX)

BEGIX was developed in 2002 by the Bertelsmann Foundation and Booz Allen Hamilton. BEGIX is an evaluation tool for e-democracy and e-government services primarily aimed at local communities. Unlike other models, BEGIX emphasizes qualitative performance criteria. BEGIX is based on the Balanced Scorecard approach and covers five major measurement dimensions: service portfolio (benefits), efficiency, participation, transparency and change management. Moreover, BEGIX identifies 49 predefined measurement indicators that are scored on the scaled of 0 to 100 for each of the five major measurement areas (BEGIX, 2002).

6.1.3 Value Measuring Methodology (VMM)

In 2001 the U.S. Social Security Administration (SSA) and the U.S. General Services Administration undertook the task of developing a methodology that will help to measure the value of e-services. The two federal agencies were supported by Booz Allen Hamilton and Harvard University's Kennedy School of Government and the report "Building a Methodology for Measuring the Value of e-Services" published in January 2002 built the foundation for the VMM. "VMM is based on public and private sector business and economic analysis theories and best practices. It provides the structure, tools and techniques for comprehensive quantitative analysis and comparison of value (benefits) cost and risk at the appropriate level of detail"

VMM is based on three elements - cost, value, and risk, which are analyzed from different perspectives. Moreover, VMM identifies six essential factors for creating a multi-dimensional decision-making framework for fully capturing and analyzing the value created from e-services. The six essential factors are: direct customer value; social/public value, government financial value, government operational/foundational value, strategic/political value, and risk (Mechling 2002). The VMM's decision framework helps to identify and evaluate different alternatives that address people, technology and processes (CIO Council, 2002b). In general VMM provides a clear framework and sufficient information for making tradeoffs among different alternatives and striving to optimize value, minimize cost, and diminish risk.

6.1.4 Public Sector Value model (PSV)

The PSV model was developed in 2003 by a group of Accenture executives from the global government practice in cooperation with Harvard's Kennedy School of Government. Accenture worked with Arizona's Department of Revenue in the Spring of 2003 for the pilot analysis of PSV. "Accenture's Public Sector Value model provides a baseline for comparing performance of a particular government agency over time and/or compared to other agencies" (Jupp et al. 2004) PSV looks at relative change; in other words it provides a retrospective and comparative analysis by showing how the particular agency is doing compared to the past year or compared to other agencies. Moreover, PSV allows agencies to isolate individual outcomes and assess the impact of each factor on overall value.

PSV is based on the principles of Shareholder Value Analysis (SVA) application - a private sector value methodology. PSV is an "analytical tool for quantitatively measuring and tracking the levels of Public Value generated by government departments and agencies" (Jupp et al. 2004). The PSV model considers two kinds of public value – outcomes and cost-effectiveness.

Upper management is the main target audience for the PSV. PSV can be used to identify low performing areas and high performing areas guiding upper management in creating new strategies, tactics and actions. "The Citizen" is the primary beneficiary for the PSV, as public services are more and more becoming customer-focused delivery organizations.

6.1.5 Performance Reference Model (PRM)

The PRM model was developed in 2003 by the US Federal Enterprise Architecture Program Management Office (FEAPMO). The PRM is a standardized framework for measuring the performance of IT investments and focuses on different Measurement Areas including mission and business results, customer results, process and activities, and technology. In addition, PRM identifies different Measurement Categories and Measurement Indicators for each Measurement Area.

The main strength of PRM is its measurement indicators. However, as noted in a FEAPMO report (2003b), "PRM implementation is not about perfect measures, but better measures that reduce uncertainty for project managers and key decision-makers."

6.1.6 Interchange of Data between Administrations Value of Investment

The IDA VOI methodology was developed in 2004 by the European Commission Directorates General (DG) Enterprise. "Benefits from IT investments are often difficult to describe and estimate directly in monetary terms" (European Commission DG Enterprise, 2003). Thus, VOI methodology allocates all benefits to two benefit categories: (1) secure / guaranteed benefits in terms of money, and (2) potential benefits in terms of money, time and quality. The potential benefits assessed in terms of time and quality are recalculated and translated into dollar value for a net benefit calculation.

6.1.7 Demand and Value Assessment Methodology (DAM and VAM)

The DAM and VAM was developed by the Australian Government Information Management Office (AGIMO) in response to "E-Government Benefits Study" conducted in 2003. It is a merger of two separate methodologies – Demand Assessment Methodology (DAM) and Value Assessment Methodology (VAM), and assists government agencies to assess demand and value proposition for e-government programs. DAM and VAM help to increase transparency and accountability in government by providing solid decision support to management for IT investments and standardized results for communicating and justifying government activities to different stakeholders (AGIMO, 2006). AGIMO is continuously reviewing and updating the DAM and VAM methodology. Currently, AGIMO is developing an expanded version of the methodology, called ICT Business Case Guide, which is part of the ICT Investment Framework. The new methodology is expected to be released in mid 2006.

6.2 Summary of Public ROI models

The wide variety of evaluation models and methodologies described above indicate that "there are too many issues and concepts and there are too many different ways of thinking about these issues and concepts" (Remenyi, et al. 2000). Table 2 below provides a quick comparison of the above described ROI models. As shown on Table 2, the models vary widely in terms of evaluation timing, variable types, decision support tools provided, etc. Some of the models are primarily developed for assessing local government investments, while others are more generic models. The models vary widely in terms of variables used and their specification. Some models are developed to forecast the potential value of investments, while others are developed primarily to assess the value realized from past investments. However, all the models take into consideration a package of both tangible and intangible factors when assessing 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 investment, including political, social and economic. Most of the models attempt to develop a shared scale for quantifying and analyzing the package of factors, and the end result of almost each model usually is a calculated score and some kind of diagram that presents the investment results.

Table 2: Public return on investment models' comparison[4]

Method Descriptors	Evaluation timing	Time frame	Government level	Variable types	Risk analysis	Decision support	Model output
SROI	ex-post	longitudinal	n/a	predominately quantitative	not included	Support materials	Monetary Value & Social ROI Report
BEGIX	ex-post	cross-sectional	mostly local government, global	mixed, predominately quantititative	not included	Self-evaluation tool	Balanced E-Government Index that ranges between 0 and 100
VMM	ex-ante	cross-sectional	national/ federal	mixed, predominately quantititative	included	decision tool included	Graph (Value/Risk; Cost/Risk)
PSV	ex-post	longitudinal	global	predominately quantitative	not included	Support materials	Graph (Outcomes/ Cost-Effectiveness)
PRM	ex-post	mixed	national (US)	Mixed	n/a	Support materials	Indicator values, prescribed accountability reports & processes
IDA VOI	ex-ante & ex-post	longitudinal	global	predominately quantitative	not included	"how to do it" guidelines	Guidelines for assessing past & future investments
DAM & VAM	ex-ante	cross-sectional	national/global	mixed, predominately quantitative	included	Support materials & guidelines	Spider diagram containing total scores for benefits & risks

7. Conclusion

This paper showed that IT plays a significant role in economy, based on the descriptive data analysis of IT spending. However, the literature review showed that the relationship between the IT and firms productivity remains unclear, more so in the public sector. This is explained by the evidence of so many different attempts, methods and models of measuring the returns on IT investment.

IT evaluation is a complex and multidisciplinary field of study. Thus, measuring return on IT investment can be tackled from different angles. Many IT investments fail to bring positive returns primarily due to failure to take into account different aspects of IT investments. Often IT decision makers fail to consider needs and capabilities of different stakeholders, particularly the end-users. Also, investment in IT is not an independent investment; it is dependent on other simultaneous investments including investment in upgrading personnel skills, investment in changing management styles and work processes, etc. What are the intended and unintended costs, benefits, and risks of IT investment? Equally important is the question of what are the intended and unintended costs, benefits and risks of not investing in IT?

Although a growing number of researchers are focusing on IT evaluation, both academicians and practitioners so far have not reached an agreement on the terminology and concepts used for defining IT evaluation and methodologies and models for measuring investments in IT. Instead, a range of models, techniques, tools, methodologies, and theoretical approaches for defining and describing IT evaluation has been growing rapidly. The next challenge is not to invent more concepts, models and methodologies for measuring returns from IT investment, but to make sense of all the existing ones, and to categorize them and provide guidance for future research in the evaluation of IT investment.

[4] Credit is given to Alexander Bratzler, Carsten Friedland, and Anthony Cresswell for developing public return on investment model comparison matrix.

8. Acknowledgements:

This project was supported by SAP http://www.sap.com/industries/publicsector/roi.epx.

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