Assessing the Value of Investments in Government Interoperability

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ABSTRACT:

Government investments in enhancing the interoperability of ICT systems have the potential to improve services and help governments respond to the diverse and often incompatible needs and interests of individual citizens, organizations, and society at large. These diverse needs and interests encompass a broad range of value propositions and demands that can seldom be met by single programs or assessed by simple metrics. The diversity of stakeholder needs and the complexity inherent in interoperable systems for connected government require an architecture that is up to the task. Such an architecture must include the reference models and components that can accommodate and integrate large portfolios of applications and support multiple kinds of performance assessments. The value propositions that underlie the architecture's performance assessment or reference model are fundamental. The propositions must be broad enough to span the full scope of the government program's goals, a substantial challenge. In recognition of that challenge, this chapter puts forward two perspectives for assessing the value of interoperable ICT investments, incorporating outcomes beyond financial metrics. The first is the network value approach to assessment of investments in interoperable ICT systems for government. The second

is the public value framework developed by the Center for Technology in Government, which expands on the network value approach to include a broader range of public value outcomes. These approaches are illustrated in two case studies: the I-Choose project designed to produce interoperable government and private sector data about a specific agricultural market and the government of Colombia's interoperability efforts with expanded metrics based on the expansion of interoperability networks.

Keywords: *interoperability, public value, ICT investment*

INTRODUCTION

Assessing the value expected from increased interoperability in government presents policy makers, managers, and analysts with a difficult and multifaceted problem. The high level goal of increasing government interoperability is to better serve the citizens and society at large. The demands and interests of citizens are diverse and often incompatible, reflecting the complexity of modern societies. Thus there is no simple value proposition. Methods to assess returns on investments in ICT interoperability should therefore incorporate a broad sense of public value that goes well beyond the traditional financial or program performance metrics. Such a broad value proposition is necessary to direct decision makers' attention to the full range of benefits possible from increased interoperability, and thereby improve the design and implementation of enhanced interoperability into existing and new systems.

This chapter presents a perspective on assessing the value of interoperability that includes a broad public value proposition. Such a value proposition reflects the complexity of an enterprise architecture that encompasses the range of applications needed for interoperability in a connected government context. This chapter outlines strategies and recommendations for policy makers to enhance the assessment of government investments in ICTs to include returns to both the direct and indirect beneficiaries of government activities, and to society at large through such outcomes as gains in per capita GDP.

The chapter presents two approaches to assessing value that go beyond traditional return on investment (ROI) analyses. The first is an analysis of societal-level economic returns from expanding government network interoperability based on a review of a white paper, "The Economic Impact of Interoperability" (Madrid, 2008). The second, based on the public value framework developed by the Center for Technology in Government (CTG), looks at a broad set of values that governments can potentially deliver through interoperable ICT investments to include financial, political, social, strategic, ideological, quality of life, and stewardship. With these examples, this chapter illustrates how a more comprehensive understanding of the values of interoperable ICT investment can yield more comprehensive and effective justification to support large portfolios of applications and investments in connected government.

The value of increased interoperability can accrue from a great variety of ICT investments and government programs. The chapter briefly addresses the general idea of interoperability to set the context for the specific cases and assessment approaches to be presented. This context setting discussion includes some attention to current shortcomings and inadequacies of the typical financial ROI measurement for assessing the value of government interoperability-related ICT projects. The discussion includes particular attention to the more macroeconomic returns on government ICT investments in terms of increases in economic activity as reflected in national gross domestic product (GDP). Section 4 describes the public value framework for assessing government interoperability projects that consider broader stakeholders' perspectives. Finally, section 5 illustrates the application of these approaches to two cases. The first is a proposed data interoperability framework to support the provision of a wide range of information for sustainable agricultural products, initially focused on fair trade coffee. This initiative, known as I-Choose, will aggregate information on fair trade certification above the national level in the areas of product classifications and government standards, government labeling schemes, and third party certification systems. The second case will focus on government ICTs in Colombia, where the government has been able to provide data on the economic impact of government interoperability efforts.

BACKGROUND

The Development of ICT Investment in the Public Sector

Government services continue to evolve along with the ongoing development and increasing availability of ICT systems. Increasing familiarity with ICT resources has encouraged citizens to pressure government agencies to accelerate the offering of online services (Madrid, 2008). In addition, the development of government ICT investments and new projects internal to government drive change within agencies. However the transformation of government services and operations through ICT and interoperability projects is typically a gradual process rather than a revolutionary one (West, 2004). The adoption of a more sophisticated design develops over time as government program managers and developers gains more experience (Ho, 2002).

One line of research on e-government development in US cities and municipalities represents e-government capabilities as developing through a series of stages (Moon, 2002; West, 2004). There are various studies proposing e-government development in terms of stages or maturity models (Karokola & Yngstrom, 2009). This chapter is based in part on this approach: the UN1 (2002) and Gartner2 e-government maturity models (Baum & Di Maio, 2000). Both of these models propose a four or five-stage progression of increasing capability to describe and rank how countries compare on e-government services deployment. Stages one and two in the UN model both refer to the "web presence stage." The sequence of e-government progression in both the UN and Gartner models is based on similar stages or phases: the web presence/emerging phase, the interaction/enhanced phase, the transaction/interactive phase, and the standardization/transactional phase (United Nations, 2001; Baum & Di Maio, 2000).

The idea of progressive stages of maturity in e-government systems should be taken as a metaphor to describe variations in capability across settings, not as a literal description of development that follows a fixed sequence of events. At any time, different governments will display varying levels of capability that can be described as more or less mature. However, two governments that display similar levels of capability have not necessarily achieved those levels through the same sequence of development. According to the United Nations (2002):

The stages are a method for quantifying progress. They are representative of the governments level of development based primarily on the content and deliverable services available through official websites. This is not to suggest, however, that in order to achieve immediate success, a country must follow this linear path, but rather reflects the type of analysis and standards used in 2001. (p. 11)

The main differences among the stages are based on the interdependence of action and systems integration. In the first and second stages, agencies take action independently, without connecting or integrating efforts with other agencies. In the third stage, the transaction/interactive phase, actors begin to recognize the need to have an integrated system between agencies. This phase signifies the first

[1] The UN utilizes this model to publish its e-*Government Readiness Index.*

[2] Gartner group (www.gartner.com):

recognition by agencies of the need for interoperable systems. In practice, many government agencies initially overlook the need for interoperability and instead develop their separate systems and solutions independently (Madrid, 2008). The development of interoperability, i.e., the effort to integrate various applications among different agencies, emerges as a necessity in the last stage: standardization/transactional. In this last phase, government agencies integrate separate information systems across organizational boundaries, jurisdictions, and levels. Hence, the interoperability of information systems in government is a natural expansion of efforts to add value and improve performance from the point of view of their stakeholders (Pardo & Burke, 2009).

The interoperable government information system will simplify the transactions and relationships between government and their stakeholders (Madrid, 2008). The interoperable system also allows for identification and reduction of redundant and non-value added activities. A number of studies argue that as a result, interoperability will generate an overall increase in productivity and improvement of data and information quality (Madrid, 2008; Pardo & Burke, 2009). The task is not simple. Generating new levels of interoperability across the boundaries of government agencies, across different levels, and with other non-governmental institutions requires sustained effort at coordination and collaboration (Pardo & Burke, 2009). These coordination and collaboration efforts must account for and overcome differences in systems, procedures, information sharing mechanism, and stakeholder interests across different agencies, levels, and non-governmental entities.

Interoperability and Enterprise Architecture (EA) in Connected Government

A number of studies argue that the adoption of an enterprise architecture model for IT development and operation as a strategy for interoperability provides better planning and coordination in government (Hjort-Madsen, 2009). Enterprise architecture in this sense is a rigorous model or description of an organization that includes the business components and how they are linked to each other and to the other components of the organization's IT systems and infrastructure components. In their research, Pardo and Burke (2009) pointed at the emergence of a new governance model where autonomous government agencies and non-governmental institutions need to work as coherent network to accommodate the needs of their constituents and to deliver value (Pardo & Burke, 2009). The United Nations coined this as "connected government," in which agencies transcend the functional, organizational, and jurisdictional boundaries to provide value for their constituents (Saha, 2010). This governance model includes sustained effort for coordination and collaboration to mitigate the complexity of the networked system (Pardo & Burke, 2009). The implementation and achievement of these tasks are challenging and complicated. Saha (2010) calls for the use of enterprise architecture as a necessary strategy to mitigate the complexity of interoperable systems in the connected government. Enterprise architecture is regarded as a useful tool for transformational government (Hjort-Madsen, 2009, Hjort-Madsen & Pries-Heje, 2009) and effective for

facilitating interoperability and handling interoperability conflict (Schekkerman, 2006; Janssen & Kuk, 2006).

Saha (2010) further argues the importance of a close fit between interoperability, connected government, and enterprise architecture. An enterprise architecture model can enable effective strategic planning to improve interoperability and connections among government agencies (Saha, 2010). Enterprise architecture as an organizing and structuring framework has higher potential to yield more efficient coordination and extend interoperability among government agencies, particularly in the higher levels such as federal agencies (Guijarro, 2007). Saha (2010) also points out the possible correlation between the maturity levels of e-government and the implementation of enterprise architecture methods. Each level of the e-government maturity index correlates positively with an enterprise architecture maturity level. For instance, the transformational and connected e-government level that promotes interoperability correlates with levels 3 and 4 of enterprise architecture--namely, rationalized data and modular architecture (Saha, 2010). Rationalized data architecture refers to the standardization of data and process in the architecture, while modular architecture provides flexible modules that incorporate and enable both global standards and local differences (Ross, 2003). Arguably, successful government service delivery in a network of connected agencies and interoperability requires an IT infrastructure that facilitates, at the very least, standardization of data and processes or a more flexible modular architecture.

However, the adoption and implementation of enterprise architecture to support interoperable IT investment in government are contingent on at least two conditions: 1) EA is embedded within contextual elements (Janssen & Hjort-Mardsen, 2007; Hjort-Mardsen, 2009) and 2) EA is influenced by the social interactions and diverse needs of the stakeholders (Janssen, 2011). The culture, history, and standard practices of government agencies and the national government determine the adoption of enterprise architecture in public sector (Hjort-Mardsen, 2009). The implementation of enterprise architecture also needs to account for the interactions and social interdependencies among constituents or stakeholders (Janssen, 2011). As a result, effective adoption and implementation of enterprise architecture in the public sector demands understanding and reengineering of the public sector structure (Janssen & Cresswell, 2005).

Evaluating the effectiveness of network government is very complex and has been mostly neglected in the public administration literature (Provan & Milward, 2001). In a similar manner, the complexity of enterprise architecture has led to a challenge in understanding the value of enterprise architecture applications (Tamm, Seddon, Shanks, and Reynolds, 2011). Tamm et al. (2011) point to the fragmented and incomplete explanations on the value of enterprise architecture adoption and implementation. They call for future research to advance the understanding of the value of enterprise architecture. The subject of the Tamm et al (2011) study was private institutions. Applying the value assessment in the public sector context will add additional challenges.

Government, as opposed to private institutions, has more diverse stakeholders and constituents, such as individual citizens, organizations, and society at large. These constituents might have varied and often discordant and conflicting needs and interests (Creswell et al, 2006). Diversity of needs and interests makes the assessment of stakeholder commitments and involvements a crucial determinant for successful enterprise architecture implementation (Janssen & Cresswell, 2005). This chapter argues that for such a wide transformation in assessing the value of interoperable projects in a connected government, the typical financial ROI methods for assessing overall value are inadequate. Instead, this chapter proposes and outlines two approaches that recognize a much broader range of values as potential returns from interoperable systems. These are 1) the network values on economic productivity approach and 2) the public value framework to assess interoperable government ICT investment projects.

The Shortcomings of Traditional Return on Investment (ROI) Analysis

In the simplest definition of return on investment (ROI) in public sector accounting terms, the return is the simple ratio of excess profit to investment, in terms of either past performance or future expectations (McNulty & Tharenou, 2005; Purser, 2004; Schachner, 1973). This basic idea is typically the way ROI is considered in ICT projects, with a consistent focus on the financial returns, though the financial metrics may differ in the public sector where profit accounting does not apply. However, some analysts argue that ROI in interoperability-related ICT projects is more complicated (Carrata, et al., 2006) because of the variety of their purpose and the nature of information technology investment (Rastrick & Corner, 2010). As result, a single measurement might not be adequate (Rastrick & Corner, 2010; Weill & Olson, 1989). The typical financial ROI measurement has been extensively criticized for its inadequacy (Richard, Devinney, Yip, & Johnson, 2009) due to distortion through accounting policies, human error, and deception (Jacobson, 1987), especially in relation to government ICT projects (Dadayan, 2006; Cresswell, 2010). Building on the literature in economics, public administration, and information science, this chapter will describe specific shortcomings of the narrow, financial approaches to ROI analysis for investments to enhance government interoperability.

Discussions of these shortcomings by Dadayan (2006) and Markov (2006) point to three limitations of the financial ROI model for ICT: 1) the inaccuracy of the model to predict the actual return due to complexity in ICT investment; 2) the assumption of a high degree of certainty of the cost and benefit measures in traditional ROI; 3) the exclusion of political dynamics underlying ICT investment decisions. Similar criticisms and objections to the validity of strictly financial ROI measurement have a long standing in economics and finance analysis (Jacobson, 1987). The critiques by Fisher and McGowan (1983) on the misuse of ROI measurement pointed to the inaccuracy of the model for predicting financial performance. The measurement of ROI by relating profit fractions to capitalization of investment is also prone to error (Fisher & McGowan, 1983; Moorthy & Polley, 2010). The ratio does not necessarily properly link profit generation to the characteristics and performance of the investment (Fisher & McGowan, 1983; Fisher,

1984; Jacobson, 1987; Richard, et al., 2009). The ratio may be further misleading because the profits as a numerator signify a result of past performance, while the denominator (capitalization of investments) reflects both past and potential future revenue/profit streams (Fisher & McGowan, 1983; Fisher, 1984; Jacobson, 1987; Richard, et al., 2009). Further problems result from the possibility of accounting measurement error affecting both the numerator and denominator (Salamon, 1985).

These criticisms of the validity of financial ROI, specifically in term of proper measurement of the returns in relation to costs and risks, also apply to public sector ICT investments (Cresswell, 2004, 2010; Cresswell et al., 2006). A study by Cresswell et al. (2006) indicates three significant shortcomings of the existing methods and models of public returns assessment for government ICT and interoperability projects. First is the narrow scope in defining the returns, which leads to incomplete analysis of public value and fails to incorporate the way political factors can affect the returns (Keefer & Knack, 2007). A second shortcoming relates to the lack of systematic attention to public perspectives when identifying value from government investments (Lamore, Link, & Blackmond, 2006). A third shortcoming is the inadequacy or unavailability of methods to fit the public ROI assessment to the specificity of government ICT investments, both in terms of context and goals (Cresswell et al., 2006). In sum, the first two shortcomings can be combined into a more general critique of financial ROI: financial-only calculations ignore the importance of non-financial returns and their differential impacts across a variety of stakeholders (Epstein & Mealem, 2009). In addition, ROI does not typically take into account the important influences of specific ICT investment contexts.

The first flaw reflects an underestimation of the significant influence from the political process, the functioning of government organizations, and the diversity of goals in ICT investment projects in the public sector. ICT initiatives in government can vary from system-wide transformations to narrowly defined projects focused on a single program or service (Cresswell et al., 2006). The time span of complex government ICT and interoperability projects could challenge the capability of classic evaluation approaches such as ROI (Markov, 2006). The stakeholders of government are varied and potential returns to the stakeholders can be direct and easily observable or indirect, obscure, and extended over long time periods (Dadayan, 2006; Cresswell et al., 2006). Project goals and related returns may shift over the life of a project because highly complex government ICT and interoperability projects can be much more vulnerable to political dynamics. Government failure related to any ICT project can lead to serious political consequences for both sponsors and developers (Cresswell, 2010).

The second flaw relates to the problems of measuring the public value of ICT and interoperability projects. Cresswell et al. (2006) argue that the measurement of returns in public sector investments should consider financial and non-financial returns to direct and indirect beneficiaries and also to the society at large (Cresswell et al., 2006). Building on this argument, this chapter will show two approaches to measuring returns from interoperable ICT investment projects. The first examines the network value of

interoperable ICT investment and how it can influence economic productivity of the society at large. The second approach, the public value framework (Cresswell et al., 2006), expands the network value approach to include additional variables that reflect a broader public perspective. The next section will describe and outline the network value approach and illustrate the impact of government investments in interoperability-related ICT projects on the economic returns to the society at large based on Madrid's (2008) white paper, "The Economic Impact of Interoperability."

MAIN FOCUS OF THE CHAPTER

The Network Value Approach: Economic Returns on Government Investments in Interoperability-related ICT Projects

A number of studies point at the significant impact of ICT investment on a country's economic development. An ongoing study by WITSA3 has always found that ICT expenditure is a critically important element of the global economy. Their study found that the ICT industry is among the most significant drivers of the global economy, accounting for US $1.8 trillion in spending in 1997, approximately 6 percent of the global GDP (WITSA, 1999). Their study also suggests that national GDP grows when ICT spending increases. In addition, the productivity gains will increase subsequent to the investment in digital technology (Bernasek, 2002). Research by Waverman et al. (2005) found a significant GDP growth rate of 0.59 percentage points annually with an increase of 10 mobile phones per 100 people from 1996 to 2003 (Waverman et al., 2005). These studies provide strong indications of the economic impact of ICT investment, particularly in GDP development.

A study by Madrid (2008) points to the duality of citizen needs for government service provision. Citizens, as the major stakeholder of government, have vertical needs as well as horizontal needs (Madrid, 2008). Vertical need refers to the reliance of citizens on separate services provided by single

[3] http://www.witsa.org/

agencies. Madrid (2008) further argues that these vertical needs shape the basic design of conventional government ICT projects. For these projects, the initial goal of e-government is usually to find and develop customized solutions to address specific internal government agency workflows to provide better services, agency by agency, to fulfill specific citizen needs. This stand-alone design of e-government development is referred to here as the vertical approach (Madrid, 2008). As a result of this vertical approach, each government system is disconnected from one another, which results in independent legacy systems. The vertical approach to systems may work well for some internal agency process issues, but it can overlook public value returns that are indirect or collateral with the nominal goals of the program or service and may ignore significant stakeholders.

Citizens also have horizontal needs. These are needs met by services that cross agency boundaries and involve inter-agency processes, such as passport applications that may involve multiple agencies. However, the vertical orientation of most e-government development has forced citizens to transact and interact with independent and non-integrated processes in separate government agencies. These multiple transactions not only inconvenience citizens, but also add costs and affect overall economic productivity. This section presents a network value approach to show how integrated and interoperable government information systems could provide value to the society at large in terms of economic productivity.

The Network Value Impact of Interoperability

The last stage of many e-government maturity models point to the standardization/transactional phase, which provides the setting for a great variety of transactions to be integrated. Such a level of interconnection and integration of information systems among government agencies will result in highly networked systems. In line with Metcalfe's network effect law (Shapiro & Varian, 1998), Madrid's (2008) study revealed that increasing the integration of e-government system networks could produce a huge impact in improving the economic productivity of a country. Metcalfe's Law asserts that networks become more valuable as they reach more users. Hence, when government systems become more interoperable and better connected with one another, the resulting systems will provide higher overall value for the society.

The potential magnitude of the added value of a more integrated network can be measured or correlated to the number of possible connections with other actors in the network. Allee (2003) proposed that "the value and capability of a network expands with the numbers of connections…when a certain level of connectivity is reached in a complex system, the capabilities that are being unleashed may be far greater than the sum of the parts (Allee, 2003, p.78)." Similarly, as pointed at in Metcalfe's Law, the number of unique connections in the network of n number of actors is equal to $n(n-1)/2$ (Shapiro & Varian, 1998). Hence, leveraging the network effect, the value of interoperable (networked) government information

systems can also be estimated mathematically as a function of the number of connected transactions (Madrid, 2008). In his study, Madrid (2008) represented this function as:

$$value = \sum_{i=1}^{m} \lambda^{i} \left(\frac{t!1}{(t-n)!n!} \right)$$

Where:

t is the total number of transactions to interoperate

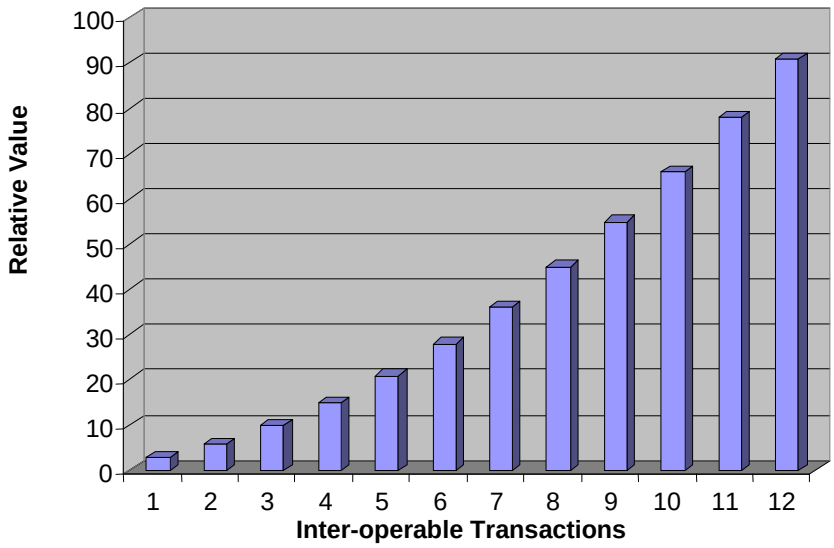
n is the number of transactions that need to be combined to complete a process

m is the number of sub-systems

λ is the correlation factor

The formula indicates that an increased number of connections in the network will also increase the efficiency of the system and value. The following illustration for N=2 shows how significant the increase is on the network value as we increase the number of transactions that interconnect or interoperate. Mathematically speaking, this is a factorial progression (Figure 1 below).

Figure 1. Network Value of Interoperability



Source: adapted from Madrid, L. (2008)

Network Value and Economic Productivity

Considering the potentially significant impact of the network's value, the adoption of a fully interoperable government system can create enormous returns. For instance, applying this logic to economic growth, greater interoperability of government information systems can result in a huge increase in economic productivity overtime. The analysis presented here builds on Madrid's (2008) white paper on "The Economic Impact of Interoperability." To provide a better understanding of the network value of interoperability, this chapter will apply the logic of network value impacts on productivity in terms of GDP. Consider the condition where a citizen needs to wait in line for a government service due to disconnected government systems. Time wasted while waiting in line is reduced opportunity to produce economic value. The longer the time a citizen needs to wait in line or to travel to different agencies, the greater the potential for the loss of that citizen's opportunity to work productively and produce economic benefits.

To apply this logic, first we need to measure the contribution of one working hour to increase economic productivity in terms of GDP. The citizen's contribution to GDP per working hour can be calculated by

dividing a country's GDP in one year by the population by annual working hours. This function can be represented as:

$$GDP_{/\,workinghours} = \left[\frac{\left(GDP_{t_i} / Population_{t_i} \right)}{Workinghours_{t_i}} \right]$$

Assuming that the citizen waiting on line is employed and in a country with a developed or emerging economy, he or she will average 2,000 working hours per year. GDP per working hour can then be calculated by dividing GDP by the product of the number in a country's full time labor force, multiplied by 2,000 working hours per year. Table 1 represents the working hours of citizens for the year of 2006 in developed and emerging economy countries.

Table 1 - GDP per Working Hour

Country	GDP (millions of USD)	Population	GDP / cap	GDP / Working Hour
World	48,244,879	6,671,226,000	7,232	3.62
Australia	768,178	20,850,000	36,843	18.42
Belgium	392,001	10,457,000	37,487	18.74
Brazil	1,067,962	186,500,000	5,726	2.86
Canada	1,251,463	32,990,000	37,935	18.97
China	2,668,071	1,319,000,000	2,023	1.01
France	2,230,721	64,102,140	34,799	17.40
Germany	2,906,681	82,310,000	35,314	17.66
India	906,268	1,169,016,000	775	0.39
Italy	1,844,749	58,883,958	31,329	15.66

Japan	4,340,133	127,720,000	33,982	16.99
Mexico	839,182	103,263,388	8,127	4.06
Netherlands	657,590	16,390,000	40,121	20.06
Russia	986,940	142,499,000	6,926	3.46
South Korea	888,024	48,224,000	18,415	9.21
Spain	1,223,988	44,708,964	27,377	13.69
Sweden	384,927	9,150,000	42,069	21.03
Switzerland	379,758	7,484,000	50,743	25.37
Turkey	402,710	74,877,000	5,378	2.69
United Kingdom	2,345,015	60,209,500	38,948	19.47
United States	13,201,819	301,950,000	43,722	21.86

Source: Adapted from Madrid, L. (2008)

Based on Table 1, presumably, if a citizen of the United States is wasting time available for paid work while waiting in line or traveling to different agencies, this citizen will lose the opportunity to contribute to GDP by $21.86 per hour.

The variation in the number of possible time-wasting activities and how long they will take can have a major effect on the results of this kind of calculation. To account for some of these variations, the original study included a sensitivity analysis. This sensitivity analysis is used to adjust for the impact on the analysis of variation in type of activities and time to accomplish them. Table 2 shows that increased variations in the disconnected number of activities and in the times require to fulfill each activity have an inverse relation with the effects on GDP (refer to Table 2 below). Arguably, this finding provides suggestive evidence about the influence of an interoperable system on the economic productivity of a country in terms of GDP.

Table 2. Normalized Impact on GDP

Number of activities per year										
10	15	20	25	30	35	40	45	50	55	60
0.04%	0.06%	0.08%	0.10%	0.13%	0.15%	0.17%	0.19%	0.21%	0.23%	0.25%
0.08%	0.13%	0.17%	0.21%	0.25%	0.29%	0.33%	0.38%	0.42%	0.46%	0.50%
0.13%	0.19%	0.25%	0.31%	0.38%	0.44%	0.50%	0.56%	0.63%	0.69%	0.75%
0.17%	0.25%	0.33%	0.42%	0.50%	0.58%	0.67%	0.75%	0.83%	0.92%	1.00%
0.21%	0.31%	0.42%	0.52%	0.63%	0.73%	0.83%	0.94%	1.04%	1.15%	1.25%
0.25%	0.38%	0.50%	0.63%	0.75%	0.88%	1.00%	1.13%	1.25%	1.38%	1.50%
0.29%	0.44%	0.58%	0.73%	0.88%	1.02%	1.17%	1.31%	1.46%	1.60%	1.75%
0.33%	0.50%	0.67%	0.83%	1.00%	1.17%	1.33%	1.50%	1.67%	1.83%	2.00%
0.38%	0.56%	0.75%	0.94%	1.13%	1.31%	1.50%	1.69%	1.88%	2.06%	2.25%
0.42%	0.63%	0.83%	1.04%	1.25%	1.46%	1.67%	1.88%	2.08%	2.29%	2.50%
0.46%	0.69%	0.92%	1.15%	1.38%	1.60%	1.83%	2.06%	2.29%	2.52%	2.75%
0.50%	0.75%	1.00%	1.25%	1.50%	1.75%	2.00%	2.25%	2.50%	2.75%	3.00%

Source: Analysis result

It seems clear that government investments in interoperability-related ICT projects have the potential to provide value beyond internal agency efficiencies or other financial returns. E-government initiatives that work primarily on diminishing the time to process each transaction (vertical approach) overlook the larger potential of network values in providing greater value to the public (Madrid, 2008). Those e-government initiatives that integrate various disparate government information systems have an impact value similar to the network effect perspective. This network effect of interoperability-related ICT projects could generate enormous returns and value to the society. As previously demonstrated, the network combinatorial effect of interoperable government systems translates into a positive-leverage impact on GDP growth.

ROI in interoperability-related ICT projects can be enlarged, including more diverse values than the financial (GDP) results shown above. Cresswell et al. (2006) point out that measuring the returns on public sector investments should consider the value to direct and indirect beneficiaries and also to the society at large. These returns encompass both tangible and non-tangible outcomes. Furthermore, Cresswell et al. (2006, 2010) posit two ways in which government ICT investments generate value: 1) by improving the intrinsic value of government as an asset to the community and 2) by providing direct specific benefits to stakeholders (persons, groups, or organizations). The first is value resulting from internal improvements to government for the benefit of the society at large. The second one manifest in multiple forms: a combination of financial, political, and social returns. Positive economic advantage is part of the social returns on government ICT projects (Cresswell et al., 2006). The next section will

outline the public value framework as an alternative for government ICT project assessment that expands the network value approach and incorporates broader public value perspectives at large.

The Public Value Approach: An Assessment Framework

This section extends the discussion by presenting a framework for incorporating a wider public value perspective in the analysis of returns on government ICT investments. That framework shows how to assess interoperability-related ICT projects in terms of delivering value4 to citizens and to the society as a whole. To do so, the framework illustrates how to answer basic assessment questions, such as what is the nature of the value produced? who are the beneficiaries? what is the value generating mechanism? What are the necessary conditions for value generation? A full description of the framework and its use is too long for this section, but can be found in the public value framework report from the Center for Technology in Government (Cresswell, 2006).

The Concept and Application of the Public Value Framework

The CTG framework (Cresswell, 2006, 2010) defines public value in terms of how an investment in government information technology can affect the individual, collective, or societal interests of stakeholders. Such an investment can produce results that have either a positive or negative impact on one or more stakeholder groups. This general definition of public value emphasizes the variety of interests to be accounted for in describing public value. This approach is in direct contrast with the utilitarian view that considers value in the aggregate—the greatest good for the greatest number—in ways that can obscure important variations in the distribution of results in a society.

In this regard, a framework to assess the public value of government interoperability-related ICT investments must acknowledge and provide ways to deal with diverse stakeholder interests. Cresswell et al.(2006) emphasize the three main elements in a public value assessment: the nature of the technology investment, the related interests of stakeholders, and the government programs and operations affected by

[4] Cresswell et al. (2006) use the term “value” in contrast to “return” to emphasize the broader scope of returns in government ICT investment.

the investment. Public value is located in the intersection of these three elements (**Error! Reference source not found.** below). Identifying and documenting public value necessitates examination of the interactions among these three elements. The methods presented for public value assessment depend on understanding and specifying the relationships among these elements.

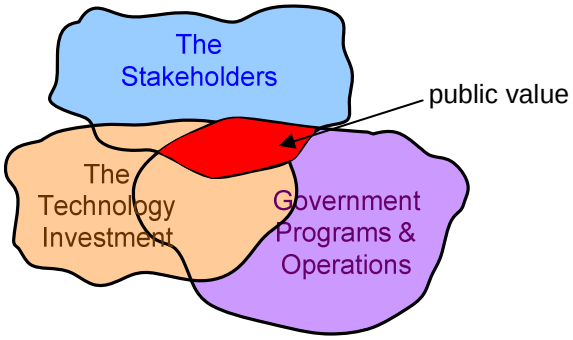


Figure 2. The Basic Elements in the Public Value Framework

That is, the public value assessment treats value creation as a result of complex nonlinear interactions among the operation of government programs and operations, the technology investment, and how that affects stakeholders. The effects include both positive and negative impacts on stakeholder interests, along with their support for and trust in the government generally (Cresswell et al., 2006).

A simplified description of those relationships is represented in Figure 3 below. This schematic shows the connections between changes in the business process and goals in government agencies with regard to the

new ICT investment (on the left) and the impact on the stakeholders (on the right).5 The activities in the left side of the framework connect the goals of government ICT and interoperability projects with the related business processes and how they generate public value. These activities have consequences for stakeholders' interests and risks on the right side of the framework.

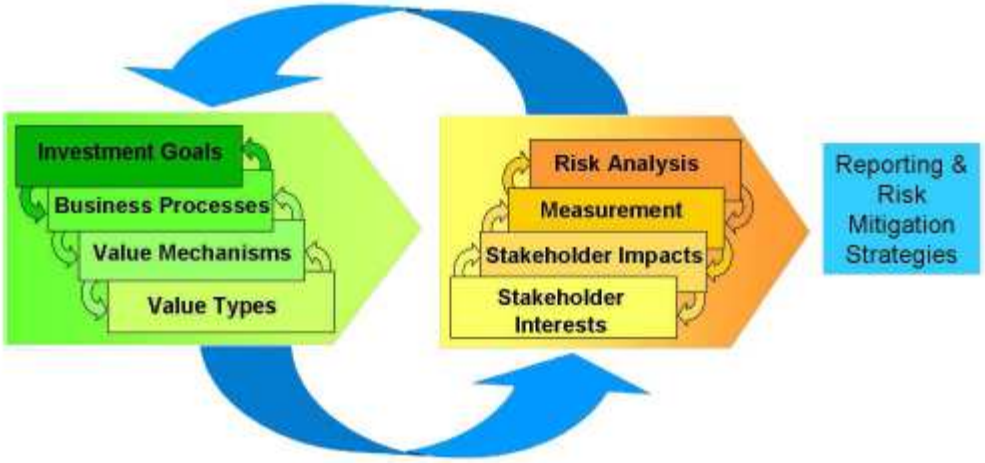


Figure 3. The Public Value Framework

This analysis is not conceived as a linear process, but rather one that allows for learning and adjustments at each step, with possible returns to preceding steps with new information or insights. Therefore the

[5] A more complete description of the Public Value Framework and how it can be used can be found in "Advancing Return on Investment Analysis for Government IT: A Public Value Framework" (http://www.ctg.albany.edu/publications/reports/advancing_roi)

arrows in Figure 3 represent the flow of results from one step to another and possibly looping back to preceding steps as needed. When the assessment is finished, the report of results can be combined with risk analysis and mitigation strategies.

The Public Value Generators and Impact

Each mechanism in the public value framework could generate more than one kind of public value depending on the nature of the ICT investment. To allow for this kind of variability, the framework identifies four basic public value generators that can apply to a wide range of particular ICT initiatives. Each of these generators entails different measurements and implications for assessment. The four public value generators are:

- Increase in Efficiency – gaining higher output or other goals using same amount of resources or consuming less resources to maintaining existing level of output or goals.
- Increase in Effectiveness – improving the quality or quantity of a desirable outcome (e.g., service transaction, policy, etc.).
- Intrinsic Enhancement – changing the environment or circumstances of a stakeholder in ways that the stakeholder values for their own sake.
- Enablement – providing means or allowing otherwise infeasible or prohibited desired activity, or preventing or reducing undesirable events or outcomes.

For any given ICT investment, these four public value generators can act independently or in consort to influence the overall return to the stakeholders. An interoperability-related ICT project can incorporate, in principle, all four generators: 1) interoperability increases efficiency by reducing the redundant activities across government agencies, 2) interoperability improves the quality of government service delivery to the stakeholders, 3) interoperability changes the environment in which citizens interact with government that led to improve economic productivity, and 4) interoperability increases citizens' convenience in interacting with or in requesting government services by enabling integrated services across agencies boundaries and levels.

Likewise, considering that investments in interoperability-related government ICT projects involve various stakeholders, each of these value generators can be linked to a variety of interests. This public value framework employs seven basic types of value as a way to analyze how the investments may affect stakeholder interests. The basic public value types are:

- **Financial** – impacts on current or anticipated income, asset values, liabilities, entitlements, and other aspects of wealth or risks to any of the above.

- **Political** – impacts on personal or corporate influence on government actions or policy, role in political affairs, or influence in political parties or prospects for current of future public office.
- **Social** - impacts on family or community relationships, social mobility, status, and identity.
- **Strategic** – impacts on person's or groups economic or political advantage or opportunities, goals, and resources for innovation or planning.
- **Quality of Life**- impacts on individual and household health, security, satisfaction, and general well-being.
- **Ideological** – impacts on beliefs, moral or ethical commitments, alignment of government actions or policies or social outcomes with beliefs, or moral or ethical positions.
- **Stewardship** – impacts on the public's view of government officials as faithful stewards or guardians of the value of the government in terms of public trust, integrity, and legitimacy.

This way of describing public value is intended as an extension of the current method used by governments to assess the internal efficiency gains or savings returns on particular investments or performance evaluations (Cresswell et al., 2006). In this way, the framework can serve to supplement the current internally focused assessment method by uncovering broader potential values of government ICT investment.

The Stakeholders of Government Interoperability-related ICT Investments

As depicted in Figure 3, assessments employing this public value framework require identification of government programs, business processes, and the associated stakeholders. The process to identify those who have an interest in the value generation of a government ICT investment project is half of the public value framework process. Cresswell et al. (2006) describe this stakeholder analysis as consisting of three parts:

- Identifying the individuals or groups who have interest in the investment project.
- Identifying the specific interests of the stakeholders.
- Assessing the role and potential influence of the stakeholders in the delivery of public value.

A thorough and systematic stakeholder analysis is important to identify the linkages that connect the ICT investment with business processes and value creation for various stakeholders. Identification of stakeholders should include those internal to the ICT project, those in related government agencies across different levels, and possible external parties affected by or who have an interest in this project.

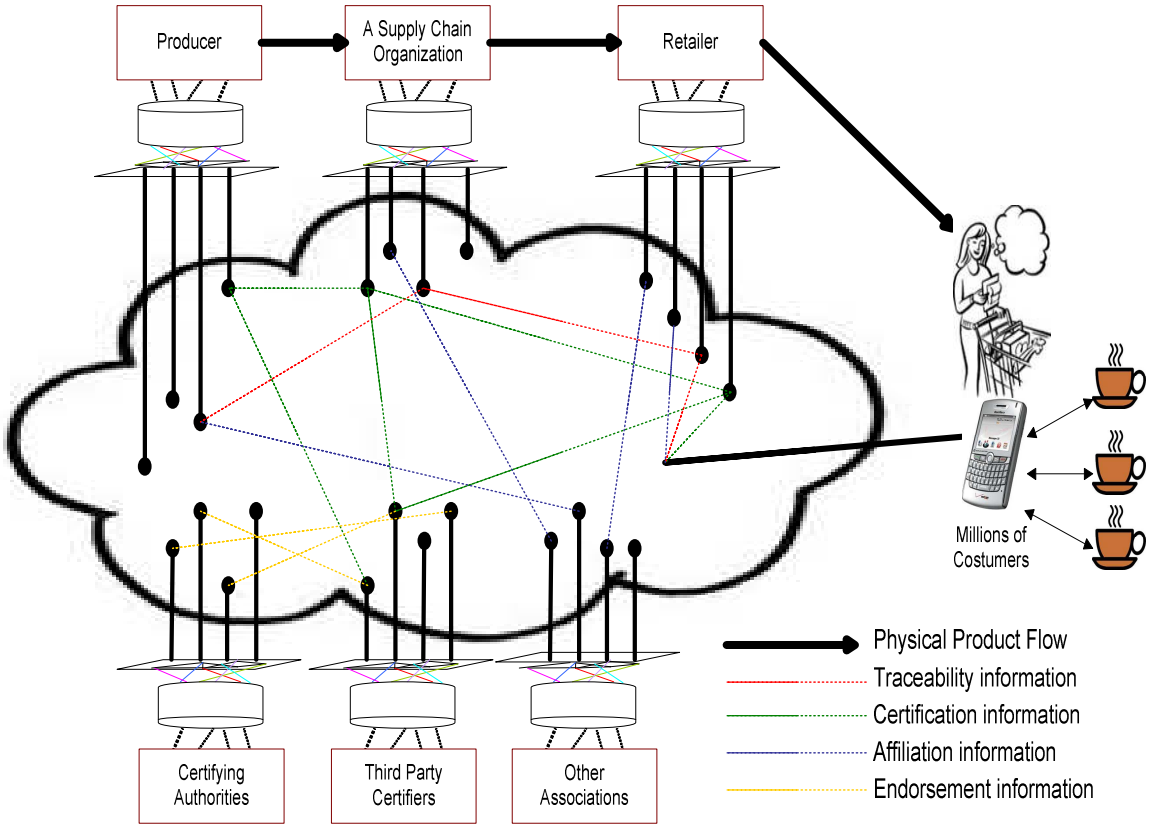
There are no rigid formulas for this form of stakeholder analysis, dependent as it is on the context of the ICT project and the agencies involved. In this sense, the crucial resource for effective stakeholder identification is in-depth knowledge of the operational and broader context of the ICT investment. To assemble this knowledge, stakeholder analysis generally engages a group of participants with extensive knowledge of the political and organizational setting of the investment. Despite much room for variation, there are four common consistencies found among different methods of stakeholder analysis:

- Involvement of multiple analysts with in-depth knowledge of the stakeholder environment.
- Use of brainstorming or other related method to identify all possible relevant stakeholders in the broader perspectives.
- Identification of multiple stakeholder roles, internal and external to the organization setting.
- Identification of potential stakeholder expectations, influence potential, past and future participation possibilities, and level of interest.

Cross referencing the stakeholders with the potential value identifies impacts on interests and the kinds of evidence that can reveal value outcomes. For a more detailed discussion on the application of the framework, refer to the Center for Technology in Government (CTG) white paper on the public value framework (Cresswell et al., 2006). The next section describes two instances of interoperable ICT investment and how they relate to public value assessment. The main focus is on stakeholder identification and the value impacts of the interoperable ICT investment.

I-Choose: An Interoperable Data Architecture to Support Full Information Product Pricing

The I-Choose project, a current activity at the Center for Technology in Government (funded by the US National Science Foundation), can provide useful illustrations of how the framework can support a public value assessment. The goal of this project is to develop and test a data sharing architecture to provide a wide range of trusted product information to assist consumer choices in purchasing food products, in particular sustainable coffee that is “Fair Trade” certified. The project, known as “Building Information Sharing Networks to Support Consumer Choice (I-Choose),” will focus on the development of an information architecture for interoperability among stakeholders for coffee grown in Mexico and distributed and consumed in Canada and the United States. I-Choose will use emerging Semantic Web technologies to create a new generation of “linked data” mash ups connecting actors who have interests linked to the fair-trade coffee product supply-chain. To achieve their vision, a collaborative network of international researchers from three countries in North America will focus on developing an interoperable data architecture of full product information necessary for a sustainable coffee supply chain.



Source: Jarman et al, 2011

Figure 4. The Envision Application Leveraging on I-Choose Infrastructure

The I-Choose Vision

The I-Choose interoperable data architecture will facilitate consumer queries submitted through an application on the consumer's mobile device (smartphones). When in use, the consumer will be able to employ the I-Choose application to find more information on a coffee product in the sustainable coffee supply chain. The consumer can simply scan the product's UPC code (or other type of barcode) readable by camera phones. The information will come from supply chain operators and third party certifiers who will create and maintain interoperable data networks through their compliance with the I-Choose RDF-based specialty coffee supply chain ontology. As shown in Figure 4 above, once the consumer scans the

UPC code (or other type of barcode), the application will start composing information about the sustainable supply chain. For instance, the consumer could discover that the coffee was shade grown at the Velasquez Coffee Cooperative in Mexico that has been certified by the United Fair Trade Association (UFTA), and is well-rated by the Consumer Value Institute. Thus, consumers can make purchasing decisions that better reflect their personal commitments to environment sustainability.

The I-Choose application will provide additional information on particular coffee products to assist the consumer in making buying decisions and checking the trustworthiness of the information (Figure 4). The I-Choose approach to developing an interoperable data architecture begins with a network of diverse communities in the supply chain. The members of these communities will collaborate in creating an ontology of the necessary terms and concepts, then develop a hierarchical taxonomy of domains in the supply-chain. These will be the foundation of an interoperable data architecture.

Identification of Stakeholders and Network Formation

Building this interoperable data architecture will consist of a multi-stage iterative process of consensus building activities with actors from the supply-chain communities. The process begins with developing the network of diverse communities in the supply chain. The network acknowledges the roles of each stakeholder affected or having an interest in the I-Choose framework. The network will include various communities and stakeholders involved in the product supply-chains and external stakeholders with interests in the supply-chain. The stakeholder identification process in I-Choose incorporates brainstorming among actors with in-depth knowledge of the stakeholder environment. The group includes researchers from three countries, gathered in two sets of different meetings (team and network meeting), in a two-stage process.

The first brainstorming session is to identify the impacted stakeholders, based on the researchers' background knowledge and experience in their previous collaborative project. The stakeholders identified in this first step are then invited to the second stage for more in-depth brainstorming with the research team to help expand the network further. In addition to the face-to-face meetings, regular online forums will be conducted through a variety of media (e.g., email, SharePoint, Skype, and teleconferences). These mechanisms are designed to ensure the involvement of all relevant stakeholders to ensure that the interoperable architecture will improve the quality of the deliverables.

Value Impact of I-Choose Interoperable Data Architecture

The I-Choose data architecture, incorporating network interoperability among the actors across the supply chain, is expected to produce value returns for all seven types of public value identified in the framework.

- **Financial returns** – One interoperability goal for I-Choose is to create value in improving the current and anticipated income of suppliers and distributers involved in fair-trade coffee produced in Mexico

and consumed in the United States and Canada. Some early evidence suggests that this is a likely outcome. A fair-trade coffee producer member of the CESMACH cooperative in Chiapas, Raul Gutierrez expects positive results. In an email to a roaster in Canada, Raul said that support for fair-trade will improve the economic condition of his family and his community. Having I-Choose to provide trusted information to the United States and Canadian consumers that Raul is a real grower and that the coffee is indeed a fair-trade product could stimulate consumption and increase income for Raul and other growers like him. This can substantially improve the economic conditions of the region. Increasing the growers' income will arguably increase income tax revenue for the government to support development.

- **Political** – I-Choose's introduction of non-price product information that moves beyond a description of product features can alter how policy makers conceptualize trade and trade regulations. The public may increase pressure for environmentally friendly, socially responsible, and safer products. Current efforts to force compliance with legal standards to address environmental and labor issues lack the potential added force of consumer participation. The I-Choose interoperable architecture can open new venues for citizen participation in policy making on environmental issues.
- **Social** – In the example of Raul, I-Choose provides validation for his community, the Campesinos Ecologicos de la Sierra Madre de Chiappas (CESMACH), can help attract new members, and encourage the formation of similar co-ops.
- **Quality of Life** – Consumers will appreciate that I-Choose will allow them to create their own value profile so that product ratings provided by I-Choose can reflect their personal preferences. This creates a price-value rating that can be tailored to meet a consumer's budgets and enhance the consumer's satisfaction.
- **Strategic** – The ability of I-Choose to connect consumer preferences to actors in the supply chain will create economic advantage or opportunities for them, such as allowing retailers to tailor their products to consumer preferences, which could potentially increase their sale or expand their market share.
- **Ideological** – I-Choose acknowledges and supports individuals with strong values and beliefs about the importance of environmental stewardship and avoiding the economic exploitation of coffee growers by choosing their consumption pattern accordingly.

If fully implemented to support trusted and full information interoperability, the I-Choose data architecture can generate a diverse mix of public values. These values affect stakeholders differently. In this regard, assessment of interoperable ICT investment should and could incorporate broader values than financial metrics. As the I-Choose case illustrates, focusing only on internal efficiency, savings, or other financial metrics alone will overlook other significant potential values to different stakeholders. The next

section provides another case about the successful effort of the government of Colombia to provide metrics for measuring the impact of an interoperable project based on GDP.

Interoperable ICT in Colombia

Gobierno en Linea, or Government Online in Colombia, started with the enactment of Decree 1151 of 2008. This decree serves as the guideline for the implementation of an online government strategy (Murcia et al., 2010). Maria Isabel Meija Jaramillo, the Chief Director for the Connectivity Agenda Agency, asserted in 2010 that "government on-line is a national Colombian Strategy, leaded by the Ministry of Communications, to build a more transparent and efficient Government to provide better services to the citizens and business through the use of ICT" (Meija-Jaramillo, 2010). The key message to be delivered to the citizens is, "Making easier your relationship with the Government" (Meija-Jaramillo, 2010).

The objectives of the Colombian Online Government strategies include rendering better services by saving money and time and also promoting citizen access to multiple channels (Murcia et al., 2009). A major challenge that Maria Isabel Meija pointed out is the massive number of services that the Colombian public administration offered to the citizens. There are more than two thousand services in Colombia, which makes it impractical to offer each of them online (Meija-Jaramillo, 2010). Meija pointed out that the government of Colombia has attempted three transformation efforts. First, to provide services and organize the procedures around user needs. Second is developing a "cluster service model" by organizing the procedures based on the user needs. Finally, the government identifies, prioritizes, and optimizes clusters of procedures prior to the introduction of the new technology (Meija-Jaramillo, 2010).

Three examples within the Gobierno en Linea strategy are outlined in this section: the certificado judicial en linea, the Procuraduria General de la Nacion, and the Movil Social en Accion. The certificado judicial en linea, or online judicial certificate, is the certificate to record criminal records based on the data collected and reported by the judicial branch. In the online system, the patron only need to go through two steps, enter the application online, follow the instructions, and make an appointment by phone for the next day between 7:00 am and 4:00 pm to complete their transaction. The processes for the other two examples are basically similar. This interoperable gateway that the Colombian government is offering to their citizens results in increased public value.

- **Financial return**. The portal of Gobierno en Linea (http://www.gobiernoenlinea.gov.co) provides an interoperable gateway where citizens can find various government services in one place. This service provision results in time and money savings for citizens and public agencies. The certificado judicial en linea processes 371,079 certificates from November 2008 through August 2009, reducing the transaction time from two hours to ten minutes, saving US $ 4.54 in indirect costs for users/citizens.

The Procuraduria General de la Nacion processed 3,407,047 certificates from November 2008 to August 2009, reducing the transaction time from 1.3 hours to five minutes and saving the users/citizens US $ 3.48 in indirect costs. Finally, the Movil Social en Accion was used by 960,487 people from October 2008 to August 2009, reducing the transaction time from four hours to fifteen minutes and saving the public agency US $ 2.02 in delivery costs.

- **Political**. The Gobierno en Linea portal also encourages citizen participation through wikis, blogs, and forums. This portal enables a novel form of citizen participation that could influence government actions or policies for citizen services.
- **Social**. One example of the social impact of Gobierno en Linea is the recognition and balancing of national identity and multiculturalism. The basic language of Gobierno en Linea is Spanish, as their national identity. However, this portal also provides English as an alternative presentation. This bilingual offering serves to preserve the national identity of Columbia and at the same time provides broader service offerings to others with different nationalities.
- **Quality of Life**. The Gobierno en Linea provides total convenience to the citizens. This portal allows citizens the freedom to access government on their own time by liberating or lessening the obligation and hassle of getting public services, which also contributes to quality of life.
- **Strategic value** refers to the condition of improved opportunity beyond what is immediately available. The Gobierno en Linea provides various features that stimulate citizen creativity and innovation. For instance: the opinion survey in the Gobierno en Linea website indicates that 63% of citizens will seek help from the website either through email, chat, or the contact mailbox. Citizens also indicate that 46% will check online if they have subpoenas or traffic fines. These are two examples of improved opportunity through the offering of an interoperability gateway.
- **Ideological value** results when government actions or policies align with stakeholder beliefs, morals, or ethical positions. The Gobierno en Linea provides a forum where citizens and users can present and discuss social issues for the consideration of the Colombian government. The feedback loop enables citizens to raise issues pertaining to their ideology, beliefs, or moral values. For instance, in January of 2010, one citizen raised the issue of regulation applicable to bikers and called for change in the National Traffic Code.
- **Stewardship**. The Gobierno en Linea has the potential to improve citizen trust, and enhance the integrity, accountability, and legitimacy of the Colombian government. Citizens could directly measure the performance of government through this online offering. In addition, the citizen participation feature afforded by this portal could induce increased public trust in the government as an effective steward of the society.

The Colombian case demonstrate the combination of the network value effect and the public value framework. The time and money savings generated from the Gobierno en linea project clearly illustrate the network value effect of interoperable ICT investment. At the same time, this case also demonstrates the diverse public values from interoperable government ICT investment.

FUTURE DIRECTIONS

Finding the best ways to build and improve government IT systems will depend more and more on being able to assess the performance of interoperable systems, especially where government agencies and non-government institutions need to work as an effective network. In an interoperable system for connected government, supported with architecture that encompasses a large portfolio of applications, complex and multiple assessment approaches are necessary. This study provides alternative methods and frameworks that complement the usual financial metrics employed in assessing the value of government IT investments, in particular by incorporating a broader perspective in term of public and network value. In this way, this study shows a path for validation and development in future research on value assessment. Future studies could ascertain the generalizability of the propositions outlined here to other contexts and cases. As a preliminary study of the value assessment framework for interoperable IT investment, this research also provides a foundation for further empirical testing.

CONCLUSION

This chapter addresses the challenge of expanding the definition of value for ICT projects, particularly those dealing with government interoperability. The chapter argues for a broader public value proposition as the basis for assessment, a value proposition that goes beyond the usual financial metrics used to examine return on investment. This chapter shows specifically that investing in interoperable government ICT systems has the potential to provide value beyond internal agency efficiencies and other financial returns. That value includes returns to both the direct and indirect beneficiaries of interoperable ICT systems, i.e., stakeholders, and returns to the society at large.

The value returns for enhanced interoperability are largely a result of network effects. We therefore employed the network value approach to show ways interoperable ICT systems create interrelated service offerings. The value of a network will be manifested in an increased number of connections. The returns are a result of how an expanded network can yield combinatorial effects that generate large returns, as in the example of a substantial boost to GDP growth. Similarly, the case of Gobierno en Linea in Colombia shows the significant amount of money and time savings and improvement in quality of life that emerge from an interoperable e-government investment.

In the second approach, this chapter has shown that the ROI in interoperability-related government ICT projects includes a diverse set of benefits. The public value framework acknowledges the diversity and incompatibility of the demands and interests of multiple stakeholder groups. This framework employs an iterative process of assessing the mechanisms and results of value generation based on an analysis of government stakeholders. The framework treats public value in terms of seven value types that can result from e-government investments. These seven public value types are financial, political, social, ideological, stewardship, strategic, and quality of life. The assessment framework provides a way to link the characteristics of an interoperability-related ICT project to the value types of interest to stakeholders. By expanding the value proposition beyond financial metrics, this approach provides a more robust way to justify and evaluate investments in government interoperability.

Applications of the public value framework to two case studies illustrate the kinds of results that can be produced. Through the cases, the chapter shows the diverse values that can result from interoperable e-government investment initiatives. These examples are offered to assist public officials and policy makers in considering the full range of benefits possible from increased interoperability efforts, and thereby improve the overall design strategies for ICT investment and interoperability implementation.

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KEY TERMS & DEFINITIONS:

Public value framework: framework for assessing the value of broad range of government IT investment that takes into account the diverse needs and interests of government constituents (individual citizen, organization and society at large).

Interoperability: condition where the diverse and disconnected systems in organizations are able to inter-operate or work together.

Return on investment: profit, or gain or benefit derived from investment, usually in the form of simple ratio of excess profit to investment.

Value assessment: the approach for evaluating the worth and significance of investment that emphasize on broader scope.

Network value framework: framework for assessing the value of government IT investment that takes into account the number of connections in the network of n numbers of actors.

Networked government: situation where autonomous government agencies and non-governmental institutions need to work as coherent network and inter-connected to one another to accommodate the needs of their constituents and to deliver values.

Network effects: the multiplying impact as result of connectivity among actors in a particular network.

Economic productivity: increase in economic output and/or production of a nations due to the reduction in unnecessary costs.