A Process Based Framework for Assessing IT Value

Zaheeruddin Asif
Temple University, zasif@temple.edu

David Schuff
Temple University, david.schuff@temple.edu

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A process-based framework for assessing IT value

Zaheeruddin Asif
Fox School of Business and Management
Temple University, Philadelphia
zasif@temple.edu

David Schuff
Fox School of Business and Management
Temple University, Philadelphia
David.Schuff@temple.edu

ABSTRACT
The financial impact of IT involves both tangible and intangible social and technical costs. The problem of measuring “true” costs and benefits of IT investments is a complex problem and has caused researchers to focus on issues such as the productivity paradox, total cost of ownership, and cost taxonomies. This task becomes even more complicated when considering technologies that impact a variety of processes across the value chain. Therefore, a comprehensive approach designed for taking into account multiple aspects of IT value is desirable. In this paper we propose a model of IT cost that integrates socio-technical and process perspectives. Our model helps reveal which investments have the most return, and where that return is realized.

Keywords
IT evaluation, socio-technical systems theory, value chain model

INTRODUCTION
Global IT spending is expected to reach $2.1 trillion in 2004. However, productivity growth has slowed every decade since the 1960s [Atkinson and Court, 2004]. This seems to suggest an inverse relationship between investment in IT and productivity growth. Robert Solow recognized this “productivity paradox” when he said that computers can be seen everywhere “except in the productivity statistics.” [Bakos, 1998]

The financial impact of IT on a business involves both tangible as well as intangible social and technical costs. The problem of measuring “true” costs and benefits of IT investments is a notoriously complex problem [Brynjolfsson et al., 1998], and have caused researchers to focus on issues such as the productivity paradox, total cost of ownership, IT investment evaluation criteria, and IT cost taxonomies. This task becomes even more complicated when considering technologies, such as ERP systems, that impact a variety of processes across the value chain. Therefore, a comprehensive approach designed for taking a process perspective of IT value is desirable.

In this paper we propose a holistic model of information technology cost that integrates socio-technical and process perspectives. The model draws on socio-technical theory as well as the value chain framework in order to more accurately identify the social impacts of an information technology investment. Our model helps reveal not only which investments have the most return, but where they realize that return. Specifically, we expect to find that (and describe how) the value of an IT investment is made up of a series of individual impacts of the technology on the social structure of each process.

LITERATURE REVIEW
Productivity Paradox
The problem of measuring true costs and benefits of IT investments is a notoriously complex problem [Brynjolfsson et al., 1998]. Although it has now become generally accepted that IT does improve productivity [Devaraj and Kohli, 2000], conclusive evidence that IT investments result in higher productivity has been difficult to produce. Brynjolfsson [1993] argued that the cause of this paradox can be attributed to areas such as measurement error of outputs and inputs, lags due to learning and adjustments (benefits from IT can take several years to show results on the bottom line), redistribution and dissipation of profits, and mismanagement of information and technology. More recently, studies using larger data sets and more refined research methods that were able to show IT does increase productivity [Lichtenberg, 1995; Schreyer, 1999; Devaraj et al., 2000].
Total Cost of Ownership

Total Cost of Ownership (TCO) takes a holistic view of IT costs by considering both direct and indirect costs [David, Schuff and St.Louis, 2002]. There are several models available for calculating TCO. However, the cost components for different models frequently vary, representing a mix of direct, indirect, tangible and intangible costs. IS researchers have proposed various reasons for and methods of overcoming the problem of imprecise measurements. While some have highlighted the importance of including indirect and intangible costs, others emphasize including social subsystem costs [Irani and Love, 2000; Ryan and Harrison, 2000], yet others advocate taking a process-oriented view of technology [Mooney, Gurbaxani and Kraemer, 1996].

Indirect and Intangible factors

Irani and Love [2000] point out that the justification for IT expenditures remains difficult because there is still no generally accepted framework that takes indirect, intangible, or soft benefits and costs into account. They highlight the need to incorporate indirect human and organizational costs and benefits in IT investment decisions as they believe that the traditional criteria for judging IT project success are not sufficient. They developed a taxonomy of direct and indirect factors along a “financial/non-financial” dimension.

Similarly, Irani, Ezingeard, Grieve, and Race [1999] hold that true IT costs comprise both direct and indirect costs, where indirect costs can be divided into human and organizational project costs. Direct costs include components such as management time, employee time, salary change and turnover, indirect costs contain elements such as losses in productivity, strains on resources, and resistance.

Socio-technical systems theory

Classical socio-technical systems theory was originally developed to study the problem of work design. This approach views an organization as made up of two distinct but interacting subsystems; the technical subsystem made up of equipment and machinery and the social subsystem made up people and their interrelationships. The two subsystems interact and influence each other. A number of information systems researchers have also utilized this approach in various contexts, including information systems design [Mumford, 1993], knowledge management [Pan and Scarborough, 1999], and IS implementation [Margulies and Colflesh, 1982; Kavan, O'Hara, Patterson and Bostrom, 1999].

Ryan and Harrison [2000] maintain that traditional analyses of IT value are incomplete because they fail to include “hidden” costs associated with changes in social subsystems brought about by a new technology. They assert that IT investment decisions have traditionally focused on financial or technical issues. However, there are hidden costs and benefits resulting from disruption in the social subsystem brought about by the introduction of IT. This “disruption” is defined as a combination of the type of innovation and the degree of change in workflow.

Value chain analysis

Value chain analysis has been used extensively to study the optimal organization for various activities that convert raw inputs into finished goods [Robinson, 2002]. It views an organization as consisting of primary activities and support activities that contribute to the value of the final product. This concept has been applied for various purposes, including classifying and organizing knowledge management activities [Pan et al., 1999] as well as information management [Cisco and Strong, 1999].

Tallon, Kraemer, and Gurbaxani [2000] developed a process-oriented model to assess the impacts of IT on critical business activities within the value chain. They found that impact of IT is context dependent; executives’ perceived value of IT (as a proxy for true value) varies across stages in the value chain. Mooney et al. [1996] also proposed a process-oriented framework for assessing business value of an IT investment, highlighting the automational, informational, and transformational effects of IT.

RESEARCH MODEL

Research for measuring the value of IT has been conducted at different levels, including economy, industry and firm [Strassmann, 1990; Kraemer and Dedrick, 1994; Oliner and Sichel, 1994]. The trend that emerges from these studies suggests that the likelihood of detecting positive or negative impact of IT increases with increased level of detail. It is also noted that at lower levels, the process approach is more useful in studying causal linkages and contexts of IT investment [Kohli and Devaraj, 2003]. It has been argued that the adoption and use of information technology should be conceptualized as a form of organizational change [Orlikowski, 1993]. This organizational change results in disruption of both the technical and social subsystems of an organization. From a business process perspective, IT changes the value chain through a modification or
replacement of old processes, or a resequencing of existing processes. It stands to reason that the value of IT is dependent on its context within the value chain and that its value will be dependent upon the process being disrupted. Our research model is summarized in Figure 1:

![Research Model: Context View of IT value](image)

**Figure 1. Research Model**

**HYPOTHESES**

We argue that the value of IT depends on its context within the value chain, because different processes may realize different levels of social disruption for a particular IT artifact. Since social disruption leads to additional hidden costs due to change in the workflow (and associated factors such as resistance and loss of productivity during the learning curve), it follows that the anticipated payoff from the introduction of IT will be lower in contexts that involve higher social disruption. This leads us to the following hypothesis:

**H1:** The value of an IT artifact will be lower in contexts where it causes more social disruption.

Some processes are more dependent on social elements like employees’ connections and social capital – which accrues to employees by virtue of their developing social networks as a part of their job. These networks may involve peers, supervisors, subordinates, customers, suppliers and/or other persons. When such processes are automated, it may cause social disruption by damaging the social networks, resulting in a loss of social capital. This leads us to our second hypothesis:

**H2:** Social disruption is highest along the value chain where social contact is necessary.

The processes in a value chain may depend upon the use of tacit knowledge by the human operators involved. This tacit knowledge constitutes a form of social capital and is usually obtained through social networks and processes such as socialization, and grows with experience. Tacit knowledge helps workers solve problems and make decisions in uncertain and novel situations.

When IT is introduced in such processes without regard to the intangible components of the task, the payoff can be adversely affected. Absence of trust, good will, or tacit knowledge may lead to a loss of efficiency and productivity. Accordingly, our third hypothesis is:

**H3:** Social disruption will be higher in the value chain contexts where tacit knowledge is required.

Not all processes will incur similar social costs or accrue similar social benefits as a result of IT introduction. This is so because these costs and benefits depend upon the nature of social structures such as groups, communication channels and reporting relationships that embed these processes. Whenever one or more of these or similar factors appear they add indirect and intangible costs to the IT system and consequently lower its perceived value. From this, we formulate our fourth hypothesis:
H4: Information technologies that force new social structures along the value chain will increase social disruption.

METHODOLOGY

We plan to empirically test the above hypotheses through a survey of IT executives. Since it is difficult to get objective measures of IT value, we decided to use executives’ perceptions as our dependent variable. Executives’ perceptions have been shown to serve as a surrogate for more objective measures of value [Tallon et al., 2000]. The respondents will be asked to recall a recent technology initiative in their own organizations. Based on this initiative, the executives will be given a list of “typical” value chain processes and asked to indicate which processes the artifact will effect. The respondents will then be asked to describe the characteristics (operationalizations of the variable indicated in the hypotheses section, such as tacit knowledge or social contact) of the processes affected by the artifact. For control purposes, the characteristics of the IT artifact (such as size of the project and cost) and the organization itself will be collected.

RESULTS

We expect to find a relationship between processes having different socio-technical attributes such as dependence on human operator’s tacit knowledge or social network, the level of social disruption brought about by the introduction of an IT artifact and the perceived value of that artifact. We speculate that the contexts that suffer greater social disruption should negatively affect the value of an IT artifact. Equipped with knowledge of which processes along the value chain an IT artifact can realize the greatest value, IT managers will be in a better position to foresee and plan for social consequences of IT introduction.

REFERENCES


