

# IT Investment Strategy And IT Infrastructure Services

Hsin-Ginn Hwang, E-mail: [mishgh@ccunix.ccu.edu.tw](mailto:mishgh@ccunix.ccu.edu.tw), National Chung Cheng University, Taiwan

Robert Yeh, E-mail: [mishgh@ccunix.ccu.edu.tw](mailto:mishgh@ccunix.ccu.edu.tw), National Chung Cheng University, Taiwan

Houn-Gee Chen, E-mail: [hgchen@mx.nthu.edu.tw](mailto:hgchen@mx.nthu.edu.tw), National Tsing Hwa University, Taiwan

James J. Jiang, E-mail: [james.jiang@bus.ucf.edu](mailto:james.jiang@bus.ucf.edu), University of Central Florida

Gary Klein, E-mail: [james.jiang@bus.ucf.edu](mailto:james.jiang@bus.ucf.edu), University of Colorado at Colorado Springs

## Abstract

*Organizations invest in information technology infrastructure for a variety of reasons. One dimension describing the investment strategy is the intention of achieving cost savings versus the intention to remain flexible and responsive to the marketplace. Of interest is the relationship between this cost-flexibility dimension and the extent to which services are provided as part of the firmwide infrastructure. A survey of CIOs reveals that organizations emphasizing cost tend to have less investment in firmwide infrastructure across a breadth of service types than those promoting flexibility. This implies that organizations pursuing a flexible strategy will provide a broader base of services that are common to all groups within the organization. Firms using a cost-based strategy tend to provide less infrastructure leaving many of the services incomplete or up to individual business units within the organization.*

## Introduction

The rapid evolution of information technology (IT) has dramatically reshaped the competitive environment of businesses. Many firms have undergone tremendous stress as they attempt to keep competitive amidst the constantly changing stream of technologies (Markus and Soh, 1993). Organizations, large and small, are taking the advantage of technology initiatives to drive changes and improve operations, productivity, as well as bottom-line performance. The perspective reflecting this change is that IT not only exists to support the enterprise but also must be integrated into the organization (Stratopoulos and Dehning, 2000). Therefore, businesses nowadays allocate a great proportion of resources and revenues to IT expenditures (Weill and Broadbent, 1998). In fact, IT investment has been the single largest capital expense in many organizations and it has reached hundreds of billion dollars per year with the expectation of positive financial impact.

Top management responsible for the decisions about IT investment frequently encounter a dilemma deciding whether IT capabilities resulting from the IT expenditures can meet the business needs of the firm. Much of the decision involves the amount of infrastructure required to provide to all of the individual business units and how much discretion to leave up to the individual units. The many options for configuring IT investments are often presented in technical terms, which result in managers delegating decisions to IT professionals. IT executives have also found decisions about IT investment difficult and equivocal - more than 60% of these managers use their "gut instinct" as a decision system (Marion, 1992).

As IT investment is one key to competitive advantage, IS researchers argue IT investment should be well grounded in strategy (McFarlan, 1984; Li and Ye, 1999). Weill and Broadbent (1998) describe IT investment strategy as the justification for firmwide IT infrastructure, ranging from a focus on cost saving to one of providing

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flexibility. The actual investment in IT infrastructure is portrayed as a portfolio shared throughout the firm in the form of reliable services that provide a foundation to enable present and future business applications (Niederman, Brancheau and Wetherbe, 1991; Weill and Broadbent, 1998). Organizations range from a cost saving approach to an enabling approach to IT investment for increasing strategic options. These different views affect an organization's justification of IT investment and the amount of investment made at the corporate level versus the amount left up to the individual business units in the organization.

An organization's IT infrastructure consists of the aggregation of its overall IT investment. Recently, investment postures have been identified as the main concern for IT managers. These IT infrastructure investments are often captured as services defined on a set of shared IT resources. These services provide the base foundation for business applications. Firms in general take different views of IT investment approaches to arrive at different IT infrastructure service capabilities, which can underpin the competitive position of their business by enabling initiatives such as cycle time improvement and cross-selling opportunities (Sambamurthy and Zmud, 1999).

The alignment of IT infrastructure to business plans is considered to be critical in achieving flexibility, where flexibility is the ability to respond rapidly and effectively to emergent needs of business opportunities (Duncan, 1995). While researchers have argued the relationship between IT infrastructure flexibility and business strategic advantages (Henderson and Venkatraman, 1993), few works have taken the notion of IT infrastructure as their central focus. The focus of this study is to examine the relationship between an organization's IT investment strategy and its firmwide IT infrastructure service capability. Specifically, in this study, we examine the following questions: 1. Which dimensions of IT Infrastructure are the core services provided by firms? 2. Which dimensions of IT Infrastructure services are more likely to be established by firms taking a "flexibility" IT investment strategy?

## **Background**

Information technology potentially creates sustained competitive advantages for firms (Clemons and Row, 1991; Feeny and Ives, 1990). IT evolved from its traditional "back office" role to a "strategic" role with the potential to not only support the existing business strategies but also shape new business strategies (Keen, 1991). Based on the fact that IT can serve as a critical enabler of business transformation with its capabilities to deliver firm-level advantages, it is then imperative for the firms to pay attention to IT plans and its alignment with business objectives. As a consequence, the significance of the alignment between IT plans and organizational strategy and objectives has been among the top concerns for business executives as well as researchers.

Lucas and Turner (1982) suggested that IT could be used to achieve corporate strategy in ways that assist firms in obtaining efficiencies in operations, improving the planning process, and opening new markets. The strategy of IT was also suggested from the perspective of the entailing advantages from IT, such as innovation, growth, and alliance advantages. Moreover, corporate strategy should be taken into consideration in the IT planning stage because IT plays an important role in the implementation of corporate strategy (McFarlan, 1984). In other words, the strategic use of IT is far more significant than the IT itself. Contrary to simply applying IT, it should be regarded as an integral component of corporate strategy and identified as a strategic resource that can further utilize its function in support of overall business strategy.

IT infrastructure has been repeatedly listed among the top concerns in IS research. It includes a set of shared, tangible resources that provide the firmwide foundation for business applications. So IT infrastructure is a set of shared IT services that enable the effective long-term use of IT in the firmwide level. In this paper, the IT infrastructure is defined as the base foundation for building business applications, which is shared throughout the firm as reliable services.

Weill and Broadbent proposed an IT infrastructure with various elements as a pyramid of services. At the base of the IT pyramid are the technology tangibles, such as computers, database software packages, operating systems, and communication technologies. These components are largely commodities and readily available in the marketplace. The second layer is composed of a set of shared IT services such as telecommunications network services, provision of electronic data interchange, and management of large-scale processing utilities. The human IT

infrastructure between the layer “IT Components” and layer “Shared IT Services”, which is composed of knowledge, skills and experience, binds the commodity components into reliable services that form the overall IT infrastructure.

The services provided by the IT infrastructure throughout the firm are usually stable over time because critical services remain relatively constant, with gradual improvements over time to take advantage of new technologies. In contrast, the IT required for business processes changes frequently as businesses take on new business processes to cope with competition. By separating these two, the IT infrastructure services provide a foundation necessary for the IT to achieve the new business processes or promote applications when the environment changes. Taking the service view of the IT infrastructure will then significantly reduce the time and cost required to adjust and keep up with the various new technology developments. Therefore, the service notion of IT infrastructure is very powerful when firms have to deal with the ever-changing need for the new IT applications. Weill and Broadbent (1998) classified these services into 8 management clusters. Table 1 shows the specifics of this classification.

**Table 1**  
**Information Technology Infrastructure Services**

	<u>Mean</u>	<u>Rank</u>
<i>Communications Management: (category mean = 4.31, category rank = 1)</i>		
1. Manage firmwide communications network services	4.21	[6]
2. Manage groupwide or firmwide messaging services	4.34	[2]
3. Manage firmwide or business-unit workstation networks (e.g., LANs, POS)	4.38	[1]
<i>Standards Management (mean = 4.12, rank = 2)</i>		
1. Enforce IT architecture and standards	4.01	[8]
2. Recommend standards for one component of IT architecture (e.g., hardware, operating systems, data, communications)	4.23	[3]
<i>Security: (mean = 3.99, rank = 4)</i>		
1. Implement security, disaster planning, and recovery for business units	3.97	[12]
2. Provide security, disaster planning, and business recovery services for firmwide installations and applications	4.00	[9]
<i>IT Education (mean = 3.65, rank = 5)</i>		
1. Provide technology advice and support services	3.94	[14]
2. Provide technology education services (e.g., training)	3.36	[24]
<i>Service Management: (mean = 4.03, rank = 3)</i>		
1. Manage, maintain, and support large-scale data-processing facilities	4.23	[3]
2. Perform IS project management	4.23	[3]
3. Perform IS planning for business units	3.78	[15]
4. Manage and negotiate with suppliers and outsourcers	3.97	[12]
5. Provide firmwide Intranet capability (e.g., information access, multiple system access)	3.99	[10]
<i>Applications Management: (mean = 3.61, rank = 7)</i>		
1. Manage firmwide or business-unit applications and databases	4.21	[6]
2. Provide management information electronically (e.g., EIS)	3.71	[16]
3. Manage business-unit-specific applications	3.99	[10]
4. Develop and manage electronic linkages to suppliers or customers	3.51	[23]
5. Develop a common systems development environment	3.62	[17]
6. Provide multimedia operations and development (e.g., video conferencing)	2.66	[25]
7. Provide firmwide support for groups (e.g., Lotus Notes)	3.58	[21]

**Table 1 (continued)**

	<u>Mean</u>	<u>Rank</u>
8. Develop business-unit-specific applications (usually on a charge-back or contractual basis)	3.57	[22]
<i>Data Management: (mean = 3.60, rank = 8)</i>		
1. Provide data management advice and consultancy service	3.60	[20]
2. Manage firmwide or business-unit data, including standards	3.62	[17]
<i>IT R&amp;D: (mean = 3.62, rank = 6)</i>		
1. Identify and test new technologies for business purposes	3.62	[17]

Providing IT infrastructure services is one of the most critical issues facing IS executives and managers. IT investment involves difficult decisions for IS executives and managers. They are usually large-scale investments in accordance with the long-term objectives and strategy of the businesses. As IT infrastructure is gradually seen as a fundamental factor that differentiates the competitive performance of firms, IT investment is then equally significant for the businesses. Firms in general take different approaches to IT infrastructure investment in order to accomplish different types of infrastructure capabilities, which underpin the competitive position and advantages of a firm by facilitating such initiatives as cycle time improvement.

Weill and Broadbent identified four approaches along a flexibility dimension termed as *views*. The four views of IT infrastructure investment are the “None”, “Utility”, “Dependent” and “Enabling” views, each of which serves its own specific purposes under particular conditions and represents increasing flexibility requirements for the infrastructure. A “None” view implies that a firm has no firmwide IT infrastructure. A firm with a “Utility” view focuses on achieving cost savings and does not view IT infrastructure as a strategic resource. A firm with a “Dependent” view invests in IT infrastructure as a response to well-articulated business strategies. An “Enabling” view organization regards IT infrastructure as a business investment to achieve agility and enable new business strategies.

While some firms may take the utility view to focus on achieving cost savings, others may take the enabling view to focus on providing an extensive set of infrastructure services and flexibility according to their own specific strategic context. These different views affect an organization’s justification of IT investment. In turn, as organizations take flexibility as their IT infrastructure strategy, a greater IT infrastructure service capability is provided. However, limited empirical work has been attempted to demonstrate the above argument. Furthermore, Broadbent, Weill and St. Clair (1999) argued that firms need to provide a minimum set of IT infrastructure services as the foundation for their business applications.

This study will examine the issue from the dimensions the firms are most likely to establish as their core IT infrastructure services. In addition, as firms may take different views to arrive at different IT infrastructure capabilities, we will examine the IT infrastructure service differences between firms taking a flexibility investment strategy and those taking a utility IT investment strategy. Specifically we investigate the following two questions in this study:

- What are the firms’ core IT infrastructure services?
- What are the significant differences in the dimensions of IT infrastructure services between firms with a “flexibility” investment strategy and those adopting a “utility” investment strategy?

**Research Methodology**

***Sample***

*Questionnaires were mailed to Chief Information Officers in the U.S. CIOs were selected because respondents needed an overall picture of IT investments to complete the survey. Addresses and CIO names were obtained from the Compact Disclosure database. Firms were randomly selected. 1,000 instruments were mailed. Postage paid envelopes for each questionnaire were enclosed.*

*All the respondents were assured that their responses would be kept confidential. 123 questionnaires were returned. About 85 percent of the respondents were male. Over 76 percent of the respondents were 41 years/old or above. Just under 25 percent worked in companies which had 100 IS employees or less. In addition, the respondents had a high level of education (more than 50 percent had graduate degrees).*

**Metrics**

*IT Infrastructure Investment Strategy*

Weill and Broadbent (1998) describe IT investment strategy as the justification for firmwide IT infrastructure investment, ranging from a focus on cost saving to one of providing flexibility. The items associated with this dichotomy are listed in Table 2. The instrument asked participants to consider the last two years of IT infrastructure investment cases put to senior management and the subsequent discussions among participating managers. Each item was scored using a five-point scale. All items were presented such that the greater the score, the greater the extent the condition defined was met.

**Table 2**  
**Strategic Reasons for Information Technology Investment (Factor Loadings)**

<u>Item</u>	<u>Cost</u>	<u>Flexibility</u>
1. IT infrastructure is primarily viewed as a utility providing the base IT service at minimum cost.	.53	.38
2. The main reason for investing in IT infrastructure is to reduce the total IT costs of the firm.	.72	.14
3. In justifying IT infrastructure investment, each project must show clear cost savings.	.79	.00
4. In meetings between senior IT managers and senior business unit managers, the most important topic is the cost and quality of IT service.	.49	.45
5. In forming business strategies, the business units consider the capabilities of the IT infrastructure.	.26	.69
6. Senior managers of the firm perceive a flexible IT infrastructure as providing a competitive advantage.	.17	.69
7. In meetings between senior IT manager and senior business unit managers, the most important topic is the capabilities of IT to enable new business strategies.	.09	.52

A principal components analysis (PCA) was conducted on the items in the table to determine if the factor structure supports the expectations of the scale. An initial PCA indicated two eigenvalues greater than one, indicating that two factors were likely present in the data. A subsequent factor analysis with varimax rotation resulted in the factor loadings presented in Table 2. Based on this analysis, items one through three were retained as indicators of the cost dimension and items five through seven for the indicators of the flexibility dimension. An overall flexibility score was computed by reversing the cost scales and taking an average of the remaining six items.

External validity refers to the extent to which the findings can be generalized across times, persons, and settings. The external validity of the findings is threatened if the sample is systematically biased – for example, if the responses were generally from organizations taking flexibility as their justifications for IT infrastructure investment. The responses had good distribution since the IT infrastructure investment strategy means (3.19) and medians (3.29) were similar, skewness (= -.12) was less than 2, and kurtosis (= -.47) was less than 5 (Ghiselli, Campbell and Zedeck, 1981). Threats to external validity also result from a sample biased in terms of demographics. An ANOVA was conducted by using IT infrastructure investment strategy (as the dependent variable) against demographic categories including organization size and personal traits (independent variables). Results did not indicate any significant relationship.

**IT Infrastructure Services**

IT infrastructure generally has been described as a set of IT services, including communication management, standard management, security, IT education, service management, applications management, data management, and IT R&D. We used this service view as a representation of IT investment. The IT infrastructure services list has been used in other IT infrastructure studies. Each item was scored using a five-point scale. All items were presented such that the greater the score, the greater the extent the service was provided by the firm’s IT infrastructure. A higher number of services in a firm indicates a higher level of firmwide IT infrastructure capability. The ranks of the services, especially the top ranks, are similar to those found in the earlier studies identified. Category scores were computed as the average of all items in the category. External validity for the category scores was assured using the same principles as for the strategy scale.

**Results**

To answer the first question, what are the core IT infrastructure services, the means for the IT infrastructure services are provided in Table 1 for each item and for each category. In general, the presence of communications management, standards management, security and services management all are implemented to a level of four (out of five) or higher. The remaining four categories tend to run around a 3.6 out of five, indicating a lower level of providing these services to the organization as a whole. This may be because applications and data may be more critical strictly to individual units within the organization and the backbone providing the ability to run the applications is more tightly controlled. In short, the results have identified communications management, standards management and service management as the 3 core IT infrastructure services categories.

To examine the differences in dimensions of IT infrastructure services between firms with different IT investment strategies, an Ordinary Least Squares regression was conducted for each category of IT service. In each case, the IT services category was the dependent variable and the cost-flexibility measure was the independent variable. The regression results are shown in Table 3. The results show that overall IT infrastructure services were significantly associated with IT investment strategy. Also, the positive coefficients between IT investment strategies and IT infrastructure indicated that the more firms take the flexibility investment strategy, the more IT infrastructure services will be provided. Of the individual categories, only security and IT education did not relate significantly to the cost-flexibility measure.

**Table 3  
Regression Results**

<u>Dependent Variable</u>	<u>Independent Variables</u>	<u>Coefficients</u>	<u>P-value</u>
<i>IT Infrastructure (Overall)</i>	IT Investment Strategies	.41	.00*
1. Communications Management	IT Investment Strategies	.36	.01*
2. Standards Management	IT Investment Strategies	.59	.00*
3. Security	IT Investment Strategies	.26	.07
4. IT Education	IT Investment Strategies	.21	.11
5. Services Management	IT Investment Strategies	.36	.00*
6. Applications Management	IT Investment Strategies	.43	.00*
7. Data Management	IT Investment Strategies	.37	.02*
8. IT R&D	IT Investment Strategies	.48	.00*

*\*significant at p-value < .05 level.*

To gain more insight into this difference, the means for the eight categories of IT infrastructure services between firms taking flexibility and utilities strategies are provided in Table 4. As depicted in Table 4, firms with flexibility as their IT investment strategy provided a more extensive set of IT infrastructure services except security and IT education. As for the priorities, communications management, security and service management are the 3 highest services established by firms with utility investment strategy while communications management, standards man-

agement and service management are the higher priorities for firms with a flexibility investment strategy. Interestingly, communications management received the most attention regardless of IT investment strategies.

**Table 4**  
**Comparison of Means for Firms with Flexibility/Utility Investment Strategy**

<u>IT Infrastructure</u>	<i>IT Investment Strategy</i>	
	<u>Utility</u>	<u>Flexibility</u>
Communications Management	4.01 [1]	4.54 [1]
Standards Management	3.68 [4]	4.47 [2]
Security	3.77 [2]	4.14 [4]
IT Education	3.48 [5]	3.77 [8]
Service Management	3.74 [3]	4.29 [3]
Applications Management	3.26 [6]	3.91 [7]
Data Management	3.17 [8]	3.96 [5]
IT R&D	3.24 [7]	3.94 [6]
<b>Total</b>	<b>3.55</b>	<b>4.14</b>

*Note: The mean of IT investment strategy (3.24) is used as the criteria to divide flexibility from utility for the IT investment strategy.*

**Discussion**

The study found that organizations invest more heavily in IT infrastructure services when they take a flexibility approach to IT strategy as opposed to a cost savings approach. The distinction is important as investments made in infrastructure amount to a large portion of the IT budget. Decisions must always be made whether services should be offered as part of a common, central scheme, or whether they should be developed at the level of the individual business units. In the case of the IT infrastructure, most services have increasing investment at the firm level as flexibility is promoted. This may not be intuitive as flexibility could be interpreted to send as much responsibility to the local business units in order to respond more rapidly to the conditions faced at the market interface rather than at the firmwide level.

Superior financial performance will accrue to organizations who can quickly and successfully develop the new technology applications that create new business opportunities (Porter and Millar, 1985). This is evidenced by a recent study that found a positive impact of IT investment on financial performance when their IT projects were developed timely and/or integrated with their organizational strategies to respond their competitive environments (Li and Ye, 1999). But the evidence is not conclusive as other studies have not found the relation to hold (Stratopoulos and Dehning, 2000). With this study, however IT investment should consider the firmwide IT infrastructure services in organizations to allow new IT applications to be developed successfully.

The analysis of the study takes place within the strategic levels of the organization. This is where policy is made and heavy investment is contemplated. Though no causality can be implied, clearly there is a link between the level of firmwide IT investment and the strategic intent to utilize IT for flexibility as opposed to achieving cost advantages over the competition. From this view, it is not surprising that organizations provide a cadre of services that the individual business units can build upon, as an infrastructure designed for rapid response allows planners at local levels to leverage the infrastructure to meet local conditions. In essence, the firm is empowering individual business units to respond quickly to market changes by having a guaranteed set of valuable services already in place.

The flexibility in this case is in the ability to capitalize on a solid firmwide infrastructure rather than requiring local units to build out capabilities as required. Only wholly unique needs of the units must be developed and launched at the local levels, allowing the units to be more responsive in terms of applications by building on an existing framework. This may have been demonstrated by the data that shows a higher implementation of infrastructure categories dealing with communications, standards, security and service management as opposed to applications and data management that may need to be more specifically designed to the units that require them.

The data is also historical in the sense that a snapshot of the infrastructure categories may be very relevant at the time of the survey, but may change as the market forces change. A firm needs to examine their IT infrastructure portfolio on a regular basis to determine which services can be standardized for the firm so that units can build and respond quickly. A good place to start, going by the data, is in the communications management arena of providing the technology needed for an organization to disseminate data and knowledge. Security also should be handled as part of the firmwide services and enforcing a set of broad standards allows for the local business units to develop systems within a set of constraints that provide direction and allow for flexibility.

### **Suggestions For Future Research**

The IT services structure opens the possibility for a number of studies aimed at determining the value of IT investments. Previous studies have not had much success in establishing a link between IT investments and firm performance. Much of this may be due to the presence of risky IT projects that consume a large portion of the budgets (Weill and Broadbent, 1998). The use of IT services, however, could serve as good indicators of the extent of IT within an organization while searching for the value links thought to be present. In addition, the categories of services provide the means to look at the extent of various services provided in the support of different strategic initiatives, such as the pursuit of globalization or knowledge management. Lastly, services can be aligned to the strategic intent of an organization as viewed by different stakeholders. In this fashion we can study the viewpoints of different groups in their pursuit of firm success. The contingencies that may be found could provide a good indicator of the differences between information professionals and general management. 📖

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Notes