Chapter 2 Literature Review

2.1 IT Assessment Views

Up to now, there is still no common view to explain the relationship between IT investment and firm performance. Hence, this research reviews three IT assessment views, including resource-, capability-, and contingency-oriented view, first and describes as follows.

2.1.1 Resource-oriented View

The resource-oriented view is a classic thought in the field of strategic management. It emphasizes heterogeneous company resources as a basis for competitive advantage (Melville, Kraemer, & Gurbaxani, 2004). This kind of company resource must have four attributes: value, rareness, inimitability, and non-substitutability (Barney, 1991). If a resource is valuable and rare, it will bring companies a temporary competitive advantage when they have access to it. If it is also inimitable, competitors won't know what factors guide the company's success and how to imitate it. At this moment, if the substitutes for this resource are also not easily available, this resource will give a company a sustained competitive advantage in implementing a value creating strategy without being copied by any current or potential competitors (Barney, 1991; Melville et al., 2004).

Therefore, if IT investment is regarded as a company resource, it should have several attributes such as uniqueness, rareness, and non-substitutability. In other words, when the IT that companies invest in is easily duplicated by competitors or it can't confer a sustained competitive advantage, the IT should be regarded as expenditure but not a company resource. In addition, IT investment also can be divided into two parts: IT assets and IT capability. IT assets include tangible assets (e.g. equipment and inventory), intangible assets (e.g. brand and goodwill), and human-related assets (e.g. skills and knowledge). IT capability results from the interaction and collaboration of the three IT assets and is value-added, rare and unique, as well as non-substitutable.

Ross, Beath & Goodhue (1996) proposed a framework to explain the value and inimitability of a company's IT capability, which mainly depends on the human, technology, and relationship assets, which are described as follows (see Figure 2.1).

- *Human Assets*

The defining characteristic of a valuable human asset is an IT staff that consistently solves business problems and addresses business opportunities through

information technology. There are three dimensions to this asset: technical skills, business understanding, and problem-solving orientation.

In the dimension of *technical skills*, the IT managers were applying their IT staff's technical skills to build bridge between old and new systems, to deliver data across locations and applications, and to recognize opportunities to apply new technologies as they become available. *Business understanding* results from frequent interaction with clients, including division managers and external customers. Close working relationships allowed IT staff to observe business processes in action and accumulate experience in solving business problems. This not only makes IT staff better understand business needs but sometimes also brings dramatic benefits. In the dimension of *problem-solving orientation*, companies with a valuable human asset distribute responsibility for *solving business problems* to every member of the IT staff. This differs from more traditional IT organizations in which staff members are responsible only for the completion of well-defined tasks.

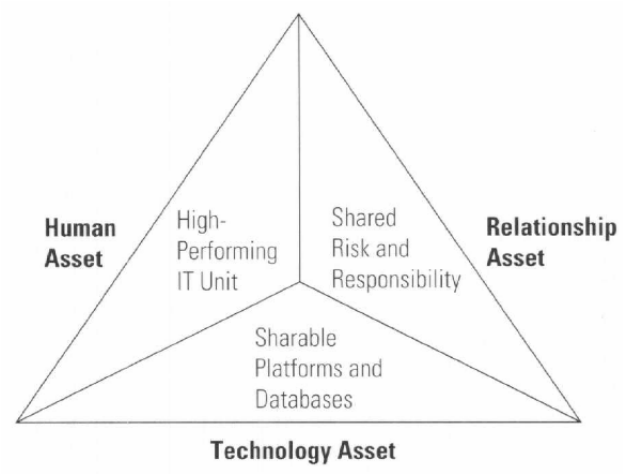

Figure 2.1 IT Assets
Source: Ross et al. (1996)

- *Technology Assets*

The technology asset consists of sharable technical platforms and databases. A valuable technology asset is an essential factor for integrating systems. It must make IT applications cost effective in their operations and support. It can be divided into two characteristics: (a) *a well-defined technology architecture* and (b) *data and platform standards*. If companies with a valuable technology asset are developing *an architecture*, this architecture will allow new systems to not only meet business needs but also be cost effective. *Standards* are one mechanism by which the company achieves its architectural vision. Standards limit the range of technologies that IT staff must support, enabling them to provide faster and more cost-effective support.

- *Relationship Assets*

In a valuable relationship asset, IT and a business unit must share the risk and responsibility for IT applications in a company. *Shared risk and responsibility* require trust and mutual respect between IT and clients, and an ability to communicate, coordinate, or negotiate quickly and effectively. The relationship asset includes: (1) business partner ownership of, and accountability for, all IT projects, and (2) top management leadership in establishing IT priorities.

Although Ross et al. (1996) made a differentiation between the three assets, they are still highly interdependent. Improvement in or neglect of one asset also influences the other two, that is, one might bolster or have a negative impact on the others. In addition to the above, Ross et al. (1996) also considered that IT assets would generate business value through their influence on IT planning, delivery, operations, and support processes. Figure 2.2 shows how a company generates and sustains competitive advantage through the interaction between the assets and IT processes.

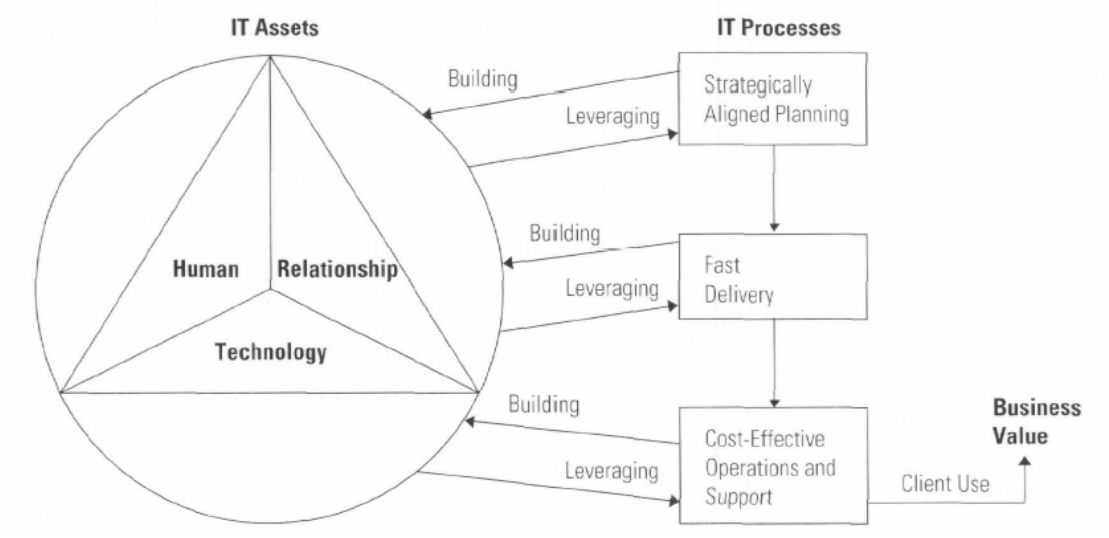

Figure 2.2 Delivering Business Value from Information Technology
Source: Ross et al. (1996)

2.1.2 Capability-oriented View

In the issue of "productivity paradox", many researches find that it is difficult to confirm the relationship between IT investment and firm performance. Most findings merely show that an indirect relationship or negative association exists between IT investment and firm performance. The main reason is that not all IT contributions can be seen immediately or be evaluated in the finance statement. In general, if the purpose of IT investment is to enhance the efficiency of business operation

(short-term benefit), traditional evaluation methods, such as traditional financial index, will be applicable. However, IT investment, which can create long-term benefits, may always be ignore or evaluated incorrectly in the traditional evaluation methods. Therefore, in order to take the future opportunities and benefits of IT investment into account, managers should consider the vision and their responsibility as key to select the suitable evaluation method.

Irani (2002) proposed the idea of "*concept justification*." If an investment in IT could immediately bring benefits in a short time, the companies can simply utilize traditional methods to evaluate its value. As most investment in IT is getting more and more complicated, however, the range involved also is becoming wider. Sometimes it is even necessary to integrate IT investment with external factors. Therefore, concept justification will be more important than traditional investment justifications such as financial approaches. This method requires identifying all people who are relevant to IT/IS, including the future ownership and stakeholders. It will list costs and benefits according to the purpose and demand of IT investment in the dimension of management. When using concept justification, it emphases that an alignment must exist within the planning of organization or IT, and the companies have to achieve the objectives listed in the organizational strategy. In addition, this method also emphasizes evaluation of an IT investment's benefits and future opportunities.

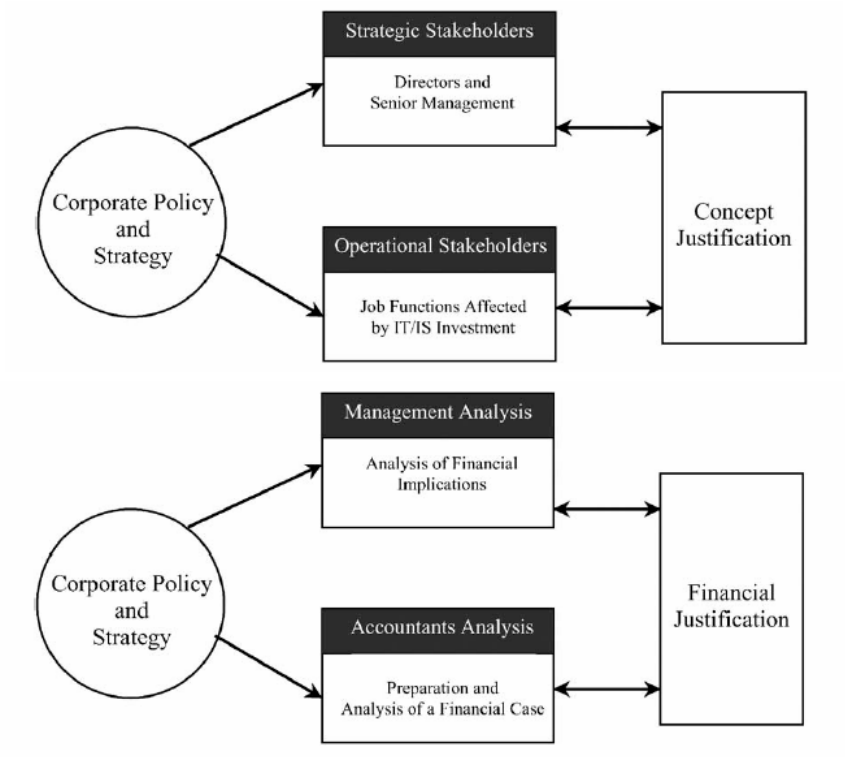

Figure 2.3 Concept and Financial Justification Stakeholders
Source: Irani (2002)

Figure 2.3 illustrates the conception of concept and financial justification. In general, companies adopt the quantified indicators from the financial justification to evaluate the costs and benefits of IT. For medium- and long-term or intangible indirect costs, companies might need to use the concept justification method, such as conceptual description and descriptive statements, to list the benefits and costs and then decide the approach for assessing the IT investment.

Irani (2002) take MRPII, which is the predecessor of ERP, as an example to illustrate how to use concept justification. As shown in Figure 2.4, the whole life cycle of MRPII benefits can be classified into strategic, tactical and operational benefits, with financial, non-financial and intangible natures. *Strategic benefits* include improved growth and success, leadership in new technology, improved market share, and enhanced competitive advantage. *Tactical benefits* include improved flexibility, increased productivity, reduced manufacturing lead-time, etc. *Operational benefits* include reduced raw material inventory, increased throughput, improved product tractability, etc.

Taxonomy of benefits considered as part of cost/benefit/value analysis

Classification of MRPII benefits	Financial	Non-financial	Partly/totally intangible
Strategic benefits			
Improved growth and success	✓	✓	✓
Leader in new technology			✓
Improved market share	✓		
Market leadership	✓	✓	✓
Enhanced competitive advantage	✓	✓	✓
Tactical benefits			
Improved flexibility	✓	✓	✓
Improved response to changes		✓	
Improved product quality	✓	✓	✓
Improved organizational teamwork			✓
Promotes concept of open culture			✓
Improved integration with other business functions			✓
Increased productivity	✓		
Increased plant efficiency	✓		
Reduced delivery lead-times		✓	
Reduced manufacturing lead-times		✓	
Improved capacity planning	✓	✓	✓
Improved stability of MPS		✓	
Improved data management		✓	✓
Improved manufacturing control		✓	✓
Improved accuracy of decisions	✓	✓	✓
Operational benefits			
Reduced raw material inventory	✓		
Reduced levels of WIP	✓		
Reduced labor costs	✓		
Reduced manufacturing costs	✓		
Increased throughput	✓		
Improved data availability and reporting structure			✓
Improved communication through 'on-line' order progressing			✓
Improved product tractability			✓
Formalized procedures with accountability and responsibility			✓
Improved schedule adherence	✓	✓	✓

Figure 2.4 The Benefits Analysis for MRPII
Source: Irani (2002)

In addition to the above, Irani (2002) also used this concept to explain indirect costs. He indicated that most indirect human and organizational costs exist in the financial area. Non-financial and intangible indirect costs means the sums that companies need to invest in human resources because of IT/IS. In general, employees always need to learn how to manipulate the new IT/IS. However, it is unknown whether it will bring employees new motivation and skills to work hard or result in a stouter resistance. In the area of organizational indirect costs, Irani also pointed out that if the IT has no capability to integrate the resources within the organization, it will lead business processes to be modified continuously or even be reengineered. It also might generate a loophole in security control because of the computerization. All of these need to pay great learning and implementation costs.

2.1.3 Contingency-oriented View

The study must include sufficient and appropriate variables so that it can understand whether IT brings tangible or intangible benefits or not. However, the independent variables are often inconsistent in most research. It always makes researchers confused. In addition, the time that IT influences on company performance is still a debatable point and is difficult to control. The interplay among IT, personnel, and an organization is also quite complex and difficult to determine.

Heo & Han (2003) regarded the contingency-oriented view as a start to study whether a contingent evaluation approach could assist organizations in assessing the influence of IS and the performance IS brought. In this research, the structure of IS is one of the most important factors in applying the contingent approaches, because it reflects the evolution of the computing environment. In addition, it can also be aligned with the business vision and strategies. Heo & Han mainly classified the structure of IS into four types: centralized, decentralized, centralized cooperative, and decentralized cooperative. They also examined the relationship between the four IS structure types and the adopted IS measures. The finding indicated that companies with different IT structures should have different IS measures that are more appropriate to them. In addition, if the contingent evaluation approach could add more contingent factors (e.g. environment and organizational culture), it would become a better and useful framework for future research.

As shown in Figure 2.5, Myers, Kappleman, & Prybutok (1997) proposed a comprehensive model for IT assessment selection (DeLone & McLean,1992; Saunders & Jones, 1992). In this model, the left side lists the existing performance indicators for IT investment and also takes intangible benefits into account, such as system quality, service quality, information quality, user satisfaction, as well as individual, work group, and organizational impact. The former is inclined to

operational benefits. The purpose is to understand the reliability, response time, user interface, content, and the error rate of systems. The latter places emphasis on tactical and strategic benefits, such as user satisfaction and the learning capacity of users. In the area of the work group, it emphasizes whether IT helps to improve participation, communication, cost savings, ability to respond to the market, and customer service.

In this model, there is an identified mechanism, called *mediated variables*. It also means selected contingency theory variables. It can be used to select additional dimensions and indicators for IT/IS assessment. After adjustment, the IT/IS assessment will better fit with organizational characteristics and the current industry environment. The mediated variables include two variables: external environmental variables and organizational variables. The former emphasizes culture, climate, economy, industry, and the current status of competitive environment. The latter includes the size, mission, and goals of organizations, maturity of IS function, top management support, IS budget size, organizational structure and culture, etc.

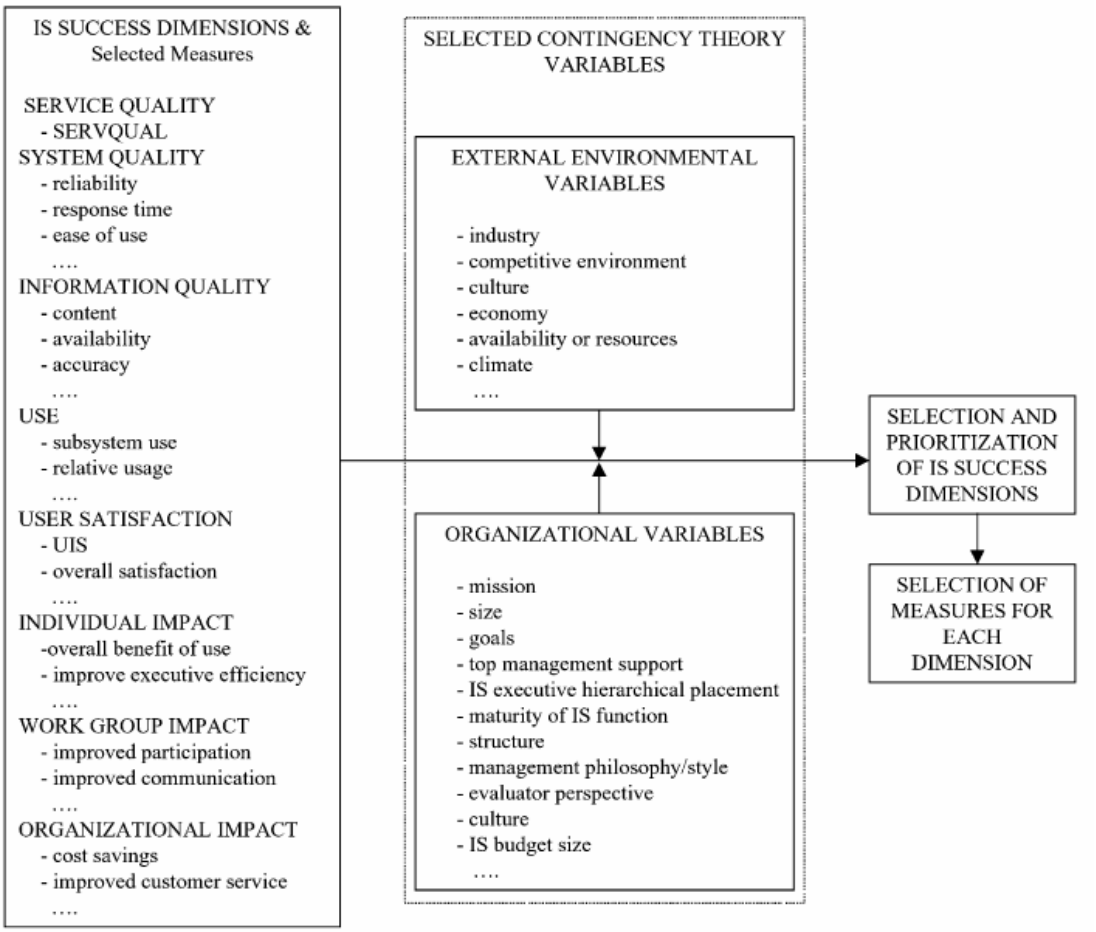

Figure 2.5 IS Assessment Selection Model
Source: Myers et al. (1997)

2.2 IT Investment and Firm Performance

The discussion on IT investment and firm performance is always popular in the field of IS and organizational management. Some researchers expected to prove the value of IT investment from all kinds of aspects such as organizational management. Some put emphasis on how to assess IT investment and study IT value accumulation and creation. In general, most people believe that IT can contribute to company performance. However, a review of the literature shows that studies examining the association between IT and organizational performance are very divergent (Melville, Kraemer, & Gurbaxani, 2004). Therefore, Melville et al. (2004) developed an IT business value model that integrated the various findings of previous research into a single framework. They used a resource- based view as a basis for this model. The findings indicated that IT is valuable, but the true extent and dimensions are dependent on internal and external factors, including complementary organizational resources, trading partners, and the competitive and macro environment.

As shown in Figure 2.6, the integrative model of IT business value comprises three domains: focal company, competitive environment, and macro environment. The purpose is to describe how phenomena resident within each domain shape the relationship between IT and organizational performance. The following will describe the three domains in detail (Melville et al., 2004).

1. Focal Firm

Focal firm means the organization that invests in and deploys IT resources. Within the focal firm, IT business value is generated by the deployment of IT and complementary organizational resources within business processes. The application of IT and complementary organizational resources may improve business processes or impact organizational performance. It comprises several parts:

- *IT Resources*. Sub-divided into *technological IT resource (TIR)*, which means a subset of physical capital resources comprising plant and equipment, geographic location, access to raw materials and physical technology, and *human IT resource (HIR)*, which is the firm's human capital referring to expertise and knowledge.
- *Complementary Organizational Resources*. Firm's resources complementary to IT, categories of which include non-IT physical resources, non-IT human resources, and organizational resources (Barney, 1991), including organizational structure, policies and rules, workplace practices, cultures, etc.
- *Business Processes*. Activities underlying the value generating processes (transforming inputs and outputs), such as inbound logistics, manufacturing, sales, distribution, customer services, etc.

- *Performance*. Divided into business process performance and organizational performance. *Business process performance* denotes operational efficiency of specific business processes, measures of which include customer service, flexibility, information sharing, and inventory management. *Organization performance* means aggregate IT-enabled performance impacts across all firm impacts such as cost reduction and competitive advantage.

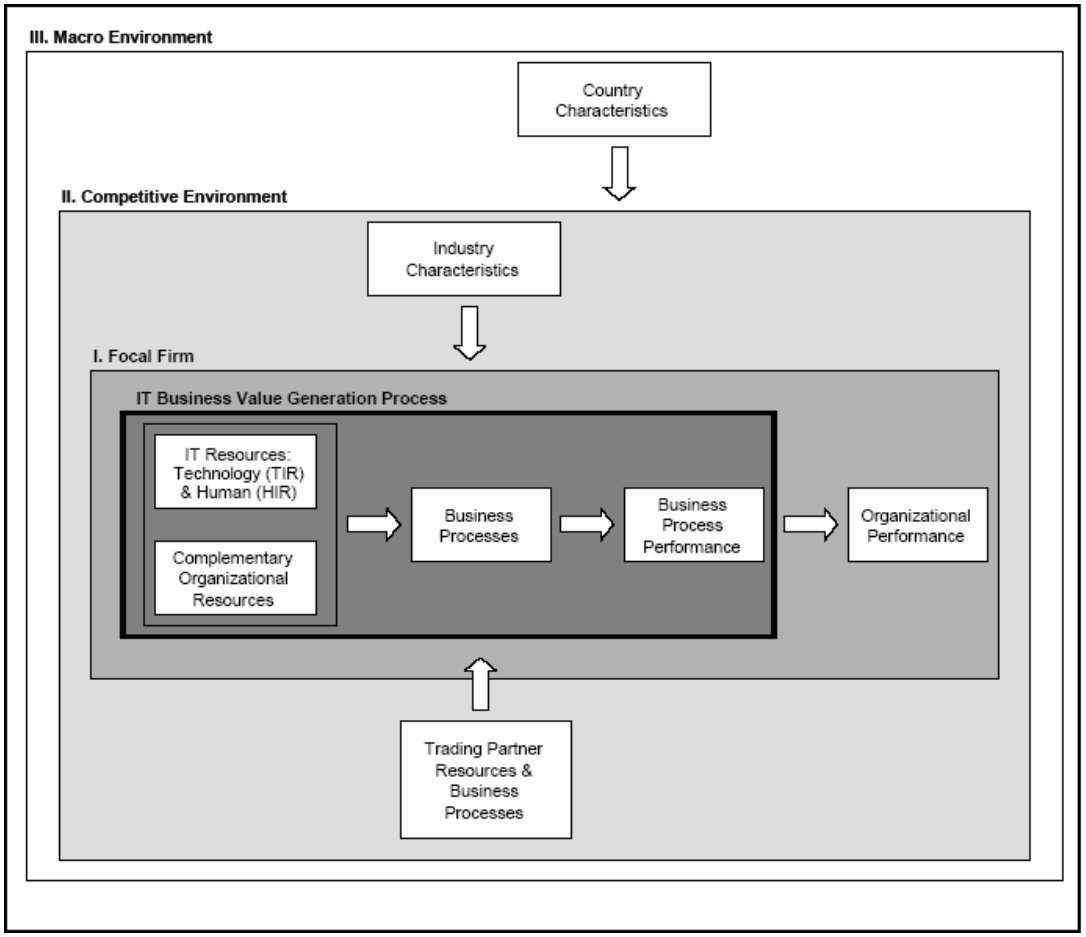

Figure 2.6 IT Business Value Model
Source: Melville et al. (2004)

- Competitive Environment

It is separated into two components: *industry characteristics* and *trading partner resources and business processes*.

- *Industry Characteristics*. Industry factors shaping the way in which IT is applied within the focal firm to generate business value, including competitiveness, regulations, etc.
- *Trading Partner Resources and Business Processes*. IT and non-IT resources and business processes of trading partners such as buyers and suppliers.

- Macro Environment

Macro factors shaping IT application and IT business value generation, including the level of development, basic infrastructure, education, research and development investment, population growth rate, culture, etc.

In addition to the above, the inability of traditional economic analysis to explain the intangible influences of IT also has led to seeking a more inclusive and comprehensive approach to measuring IT business value. Tallon, Kraemer, and Gurbaxani (2000) developed a process-oriented model, which is defined as the contribution of IT to firm performance, to assess the impacts of IT on critical business activities within the firm's value chain. The model incorporates corporate goals of IT and management practices as key determinants. They expected to determine whether there is a relationship among corporate goals for IT, management practices, and IT payoffs at the process level. In this research, Tallon et al. (2000) focused on the opinions of business executives about IT investment decisions.

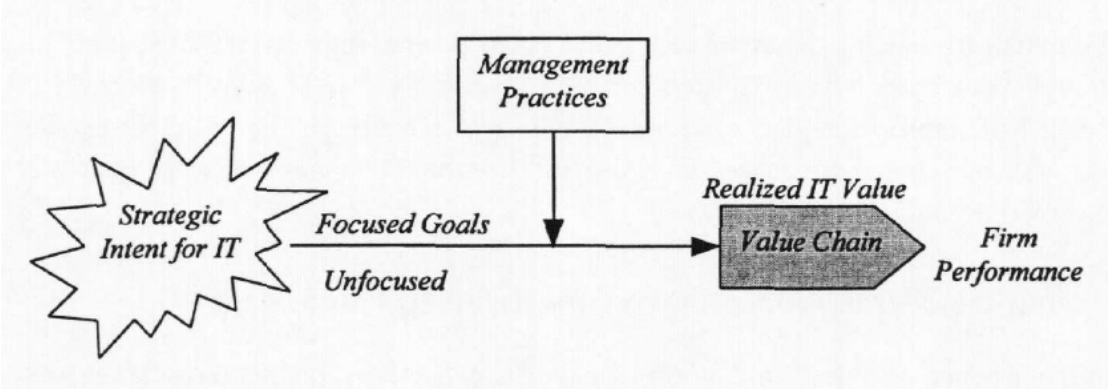

Figure 2.7 Conceptual Model of IT Business Value
Source: Tallon et al. (2000)

Figure 2.7 shows an overview of the conceptual model, showing the links between goals for IT, management practices, and realized IT impacts. From this, Tallon et al. derived the following research questions:

1. Do executives have different goals for IT?
2. Where in the value chain do executives perceive value from IT?
3. Where is the relationship between goals for IT and perceived IT payoffs?
4. To what extent can IT management practices improve the overall level of IT business value?

Porter (1996) suggests that corporations differentially focus on two key business objectives: operational effectiveness and strategic positioning. While both foci are necessary for "superior" firm performance, each works in unique ways.

- *Corporate goals for IT*

As shown in Table 2.1, Porter's distinction between operational effectiveness and strategic positioning can be translated directly into corresponding goals for IT. For example, efficiency is achieved by using IT to reduce operating costs or to improve productivity, while effectiveness comes from using IT to foster greater flexibility and responsiveness to changing market needs. Finally, research involved using IT to extend geographic research or customer access, while structure involves using IT to change industry or market practices.

Table 2.1 Linking Business Strategy with Corporate Goals for IT

Business strategy	**Goals for IT**
Operational effectives	*Internal*
Efficiency	Reduce costs, increase productivity and speed
Effectiveness	Enhance overall organizational effectiveness
Strategic positioning	*External*
Reach	Extend existing market and geographic reach
Structure	Change industry or market practices

Source: Tallon et al. (2000)

In Figure 2.8, Tallon et al. (2000) used the association between business strategy and goals for IT to develop an *a priori* classification of firms based on whether their goals for IT emphasize operational effectiveness, or strategic positioning, or both. Firms in the lower left quadrant are labeled "unfocused" since they have no clear goals for IT or are indifferent toward IT. They view IT spending as an expense to be minimized rather than an investment to be managed, and adopt a wait-and-see attitude to technology investment. "Operational-focus" firms in the upper left quadrant have clearly defined goal for IT centered on operational effectiveness. IT is primarily used to reduce operating costs and to enhance the overall effectiveness of business operations by focusing on quality, speed, flexibility, and time to market. In addition, they also believe that by using IT to gain greater control over their internal processes, they will be better able to respond to environmental uncertainty and the emergence of new competitors. "Market-focus" firms in the bottom right quadrant use IT to enhance their strategic positioning and to create or enhance a value proposition for their customers. Firms that embrace a "dual-focus" approach extend their use of IT beyond operational effectiveness to include market reach and new market creation. Their goals for IT contain both top-line (revenue growth) and bottom-line (productivity) elements.

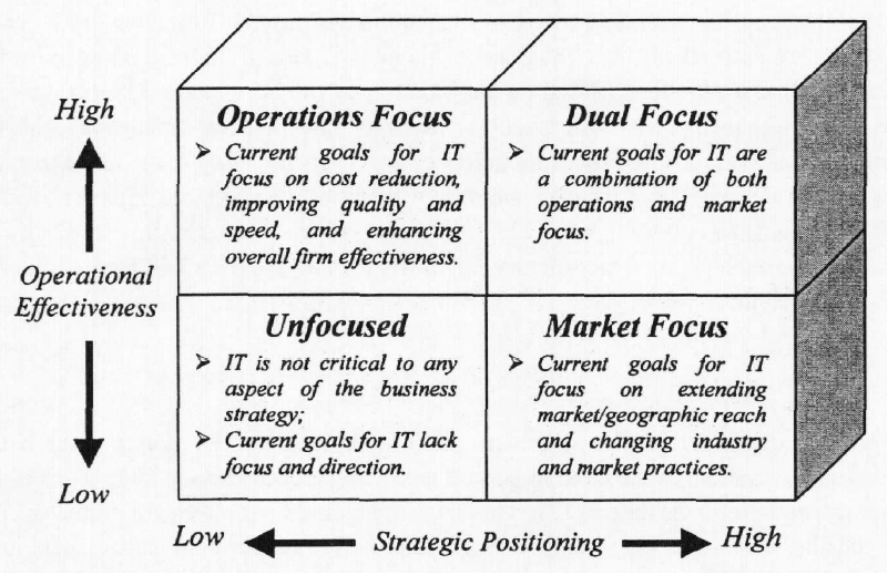

Figure 2.8 Corporate Goals for IT
Source: Tallon et al. (2000)

- *Management Practices*

Assessment of management practices is key to understanding how IT creates value for a firm. Based on their interviews with business and IS executives, Tallon et al. (2000) decided to focus on two prominent IT management practices: strategic alignment and IT investment evaluation. Strategic alignment means that it is used to adjust the alignment of IT based on the corporations' strategy and will be a critical impact on IT perceived value. For example, if payoffs from IT investment are a function of strategic alignment, then any attempt to increase IT business value must consider the extent to which IT is aligned with the business strategy. The audit of IT investment – including both pre-implementation and post-implementation reviews – is key to the success of those investments. Pre-implementation techniques are synonymous with IT planning and allow IT managers to differentiate between IT investments on the basis of implied net benefits. Post-implementation reviews can serve as a useful learning tool for IS managers.

With the empirical study, Tallon et al. (2000) found that corporate goals of IT can be classified into four types: unfocused, operations-focus, market-focus, and dual focus. In addition, the findings also indicated that executives in companies with more focused goals for IT perceive greater payoffs from IT across the value chain and that management practices such as strategic alignment and evaluation of IT investments contribute to higher perceived levels of IT business value.

2.3 IT Assessment in Financial Service Industry

Many previous studies have confirmed that IT will bring a great contribution to

company performance and business value. However, most of them either emphasize manufacturing and high-tech industry or pay attention all whole industry. In fact, the IT spending of the financial service industry is enormous. It is behind only that of manufacturing-related industries, such as the high-tech industry. For the financial service industry, the need to make a study on IT assessment is indeed there.

Shu and Strassmann (2003) found that IT in the service industry has not yet been seen to be more productive so far. In addition, the data that previous studies used either focused on specific industries or excluded financial industry data. Thus, the purpose of the research is to analyze IT productivity in the service sector. In the research, they focused on the banking industry and selected IT budget (I), non-interest expenses (N), interest expenses (IN), staff costs (L), and other operating costs (OE) as the input factors that they wanted to study. They used recent data that contained cross sectional and time series data ranging from the time period 1989 to 1997. In the research, they chose for analysis 12 banks covering a nine-year period. To eliminate possible estimation errors, they also applied a random effect model to analyze the panel data, which is called longitudinal data. The finding of the research shows that information spending has the highest marginal product among all the input variables and labor stands as the lowest productive input (see Figure 2.9).

Marginal product shows strong IT contribution

Variable	MP	Average
I	1.39	438,848
N	0.70	2,867,017
IN	0.33	3,610,242
L	0.18	1,451,163
OE	0.59	6,855,850

Figure 2.9 The Result of Marginal Product
Source: Shu & Strassmann (2003)

Zhu, Kraemer, Xu, & Dedrick (2004) developed a model based on the technology-organization-environment (TOE) framework for assessing the value of e-business at the company level. In this research, they chose technological readiness, company size, global scope, financial resources, intensity of competition, and the regulatory environment as factors that might influence e-business value and formulated six hypotheses for discussion (see Figure 2.10).

This research chose 612 companies across 10 countries in the financial services industry as research subjects from which to collect the data and then used the data to test their theoretical model. In addition, they compared two sub-samples from developed and developing countries to examine how e-business value is influenced by

the larger economic environment. The findings of this research are shown as follows (Zhu, Kraemer, Xu, & Dedrick, 2004).

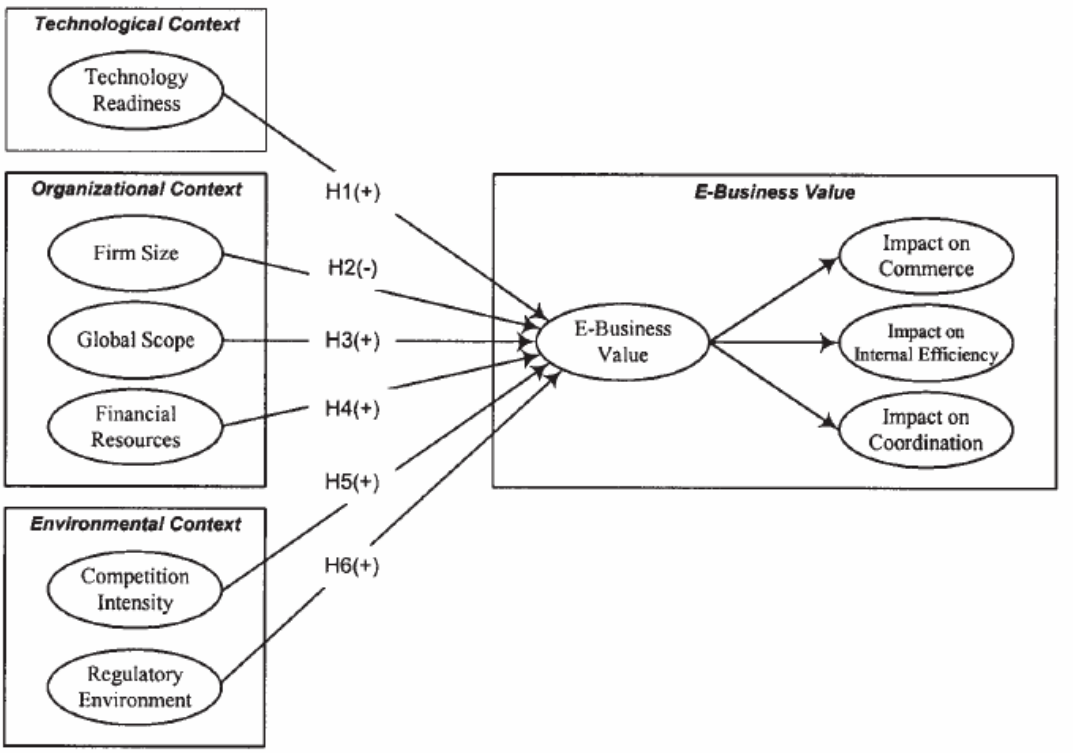

Figure 2.10 A Research Model for E-Business Value Based on the TOE Framework
Source: Zhu et al. (2004)

- Within the TOE framework, technological readiness emerges as the strongest factor for e-business value, while financial resources, global scope, and regulatory environment also significantly contribute to e-business value.
- Company size is negatively related to e-business value, suggesting that structural inertia associated with large companies tends to retard e-business value.
- Competitive pressure often drives companies to adopt e-business, but e-business value is associated more with internal organizational resources (e.g., technological readiness) than with external pressure to adopt.
- While financial resources are an important factor in developing countries, technological capabilities become far more important in developed countries. This suggests that as companies move into deeper stages of e-business transformation, the key determinant of e-business value shifts from monetary spending to higher dimensions of organizational capabilities.
- Government regulation plays a much more important role in developing countries than in developed countries. These findings indicate the usefulness of the proposed research model and theoretical framework for studying e-business value. They also provide insights for both business managers and policy-makers.