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## A framework for investigating the impact of IT capability and organisational capability on firm performance in the late industrialising context

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**Abstract:** From the viewpoint of the whole organisation, the capabilities of a firm can be classified into *technological capability* and *organisational capability*. Nowadays, how to accelerate the rate of building up and accumulating technological capabilities is of vital importance to the latecomer companies in order to catch up with technological frontier companies. Technological capability encompasses the Information Technology (IT) capability and other technical but non-IT capabilities. In this paper we focus on the IT capability and its effect on a firm's performance and propose an integrated framework that provides the latecomer firms with a roadmap to build up their capabilities and improve their performance. The purpose is to advance an understanding of the relationship among IT capability, organisational capability, and firm performance.

**Keywords:** technological capability; IT capability; dynamic capability; organisational capability; information synergy; innovativeness; firm performance.

**Reference** to this paper should be made as follows: Li, E.Y., Chen, J-S. and Huang, Y-H. (2006) 'A framework for investigating the impact of IT capability and organisational capability on firm performance in the late industrialising context', *Int. J. Technology Management*, Vol. 36, Nos. 1/2/3, pp.209–229.

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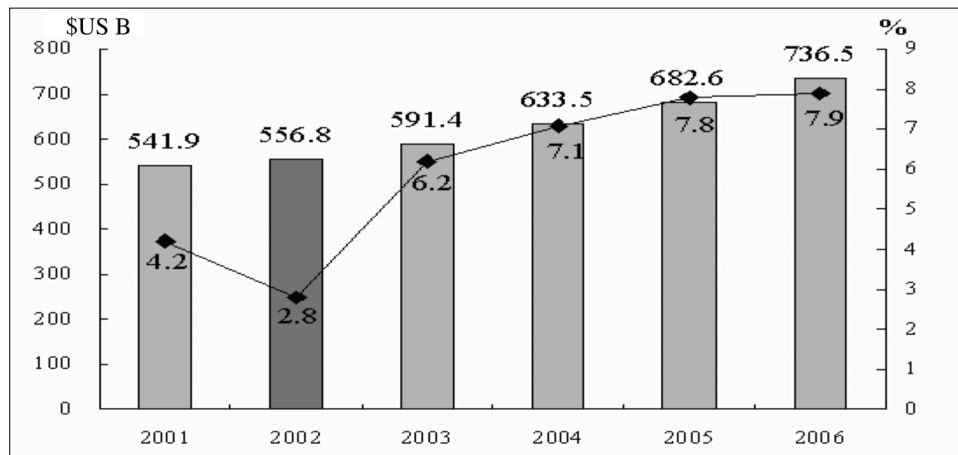
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## 1 Introduction

The market growth rate of the IT services industry continues to increase according to the report of Gartner Group (see Figure 1). The CAGR (Compound Annual Growth Rate) is 7.2% from 2002 to 2006. This implies that not only the IT services industry would be prosperous, but also that companies would invest more in IT-related applications. In the digital age, the role of IT is moving from an auxiliary to an active character that generates sustained competitive advantage for a company. For example, in the financial services sector, e-brokerage, such as Schwab.com and E-trade.com, has become a new business

model that makes IT services an important strategic business unit in companies. Compared with the conventional financial service company, Schwab has created additional competitive advantages such as low prices, innovative products, and superior services (Rayport and Jaworski, 2001). Furthermore, we are facing a paradigm shift from the transitions of industrial economy toward the information economy. The assumption of diminishing returns in the industrial age has transformed into that of increasing returns in the information age (Arthur, 1996). Nowadays, the studies of knowledge-conversion process (Nonaka and Takeuchi, 1995) and the way to accumulate technological capability (Figueiredo, 2003) are increasingly important. Especially for the latecomer companies, which have to catch up with technological frontier companies, how to accelerate the rate of building up and accumulating technological capabilities is a vital issue. Taiwan is known as one of the East Asian latecomers compared to European (and US) forerunners. Although Taiwan's high-technology industry consists of a cluster of Small- and Medium-Sized Enterprises (SMEs) that lack technological and financial resources, these SMEs still can demonstrate powerful innovative capabilities (Dedrick and Kraemer, 1998).

**Figure 1** 2001–2006 worldwide market volume and growth rate of IT services sector



From the viewpoint of the whole organisation, the capabilities of a firm can be classified into *technological capability* (Bell and Pavitt, 1995) and *organisational capability* (Ulrich and Lake, 1990; Bell and Pavitt, 1995). Technological capability encompasses the IT capability and other technical but non-IT capabilities. Undoubtedly, IT has become the most efficient instrument that generates enormously invisible capability in the modern era of knowledge economy. Its capability has been known to influence significantly a firm's performance. In this study, we examine the technological capability in another perspective via examining the role of IT in building up a firm's performance.

Many prior studies (Sircar *et al.*, 2000; Thatcher and Oliver, 2001) use IT investment as a measure of IT value. This approach underestimates some complex issues, such as the ever-decreasing prices of hardware and related equipment. Furthermore, IT expenses might include some idle and obsolete equipment, which provides no productivity due to the fast-changing IT specifications. Thus, instead of viewing IT expense as the measurement of IT capability, we should focus on the intangible issues of IT capability.

Notwithstanding, we regard IT as a core competence of firms, but the use of IT is not a panacea. Brynjolfsson (1993) provides four possible explanations for the IT productivity paradox, which includes mismeasurement of inputs and outputs, lags due to learning and adjustment, redistribution and dissipation of profits and mismanagement of information and technology. The inconsistency phenomenon exists between the service and manufacturing industries; while there is positive impact on output and productivity of IT adoption in the manufacturing sector, there are insignificant results in the service sector. This is because the intangibles, such as better responsiveness to customers and increased coordination with suppliers, are hard to measure and do not always increase the amount of output, *e.g.*, firm's Return on Investment (ROI) or Return on Assets (ROA). Nevertheless, these help to retain customers and improve coordination, which in turn sustain the level of returns.

Collaboration is known to engender information synergies in a company. Information synergies, refer to the state of a company in which individuals, or subunits, pool their resources and collaborate across roles or subunit boundaries via information technologies (Dewett and Jones, 2001). The more collaboration in companies, the more information synergy will be generated. Subsequently, the level of synergy will influence firm performance. For example, Taiwan Semiconductor Manufacturing Company (TSMC) Ltd., a leading Taiwanese semiconductor company, collaborated with a number of 'critical' customers and these customers set their own different requirements and, in turn, provided Taiwan Semiconductor Manufacturing Company (TSMC) Ltd. opportunities to experiment with new process technologies. This suggests that firms have to be open to their customers, suppliers, and partners to discuss and negotiate the possible paths of product development (Saxenian and Hsu, 2001). Therefore, information synergy is one way that firms build up and accumulate their capability in the late industrialised countries. In addition, innovativeness can be regarded as a preperformance resource and an intermediate factor for financial performance (Tuominen *et al.*, 2003). Therefore, we raise two mediators, information synergy and innovativeness, as our antecedents before firm performance. That is, instead of finding the direct effect of IT on firm performance, we try to find the indirect effect via information synergy and innovativeness.

In order to reveal the value of IT, the capability of IT must support business strategy flexibly. Consequently, how to build organisational capability to help make a right decision on IT adoption is crucial to firms. McAfee (2003) identified five pitfalls of IT implementation: inertia, resistance, mis-specification, misuse, and nonuse. He mentioned that typical checklist items cannot differentiate one process-enabling implementation from another. Some companies might adopt the same ERP system, *e.g.*, SAP, but not all of them will be successful after implementing the 'best practice' system. Despite the fact that IT system itself is easy to copy, a successful implementation process is difficult to replicate. Furthermore, even if a company adopts the same implementation process as another successful company, it could still fail because it might encounter inner and outer environments, which are different from the successful company. Therefore, firms with higher flexible managerial capability can enhance the IT capability. In this paper, we shall explore the relationship between IT capability and organisational capability based on the existing literature.

The purpose of this study is to advance an understanding of the relationship among IT capability, organisational capability, and firm performance. The framework proposed by this study can provide the latecomer firms with a roadmap to build up their capabilities and improve their performance. Specifically, the objectives of the research are:

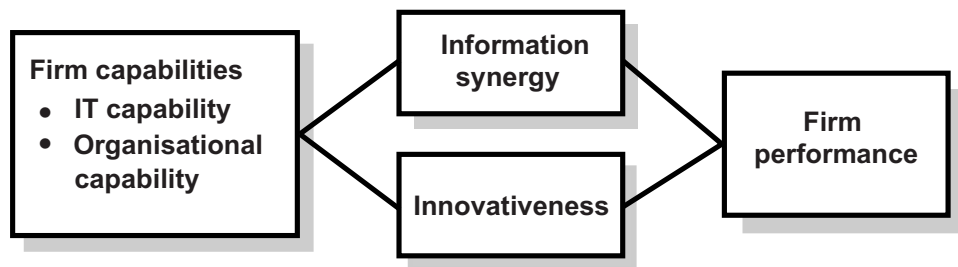
- to examine the interactions between IT capability and organisational capability
- to explore possible relations among information synergy, innovativeness, and firm performance
- to develop and present a framework that depicts the dynamics of firm performance.

In the remaining sections, we first propose a research framework of this study. Then, we present literature reviews and the propositions based on the existing literature. Next, we present a full conceptual framework of the dynamics of firm performance. Finally, conclusions and implications derived from this study are described.

## 2 The research framework

Electronic commerce has become a new business model that makes IT services an important strategic business unit in companies. In this context, we categorise the firm capabilities into two dimensions: IT capability and the non-IT capability, that is, organisational capability. Studies have shown that stronger firm capabilities do not guarantee higher firm performance (Brynjolfsson, 1993; Slotegraaf and Dickson, 2004). There must be some intervening factors that affect a firm's performance. Therefore, we introduce two mediators in this study, information synergy and innovativeness, to make the linkage between firm capability and performance more feasible. These two mediators are known to affect firm performance (Subramanian and Nilakanta, 1996; Menon *et al.*, 1997; Song *et al.*, 1997). Although innovativeness might be considered as a part of the organisational capability, it has been treated as a mediator that affects the firm performance (Song *et al.*, 1997). In this study, we also consider it as a pre-performance factor.

**Figure 2** The research framework



## 3 Literature reviews and propositions

In the following section, we describe the variables of the research framework in more detail. These include IT capability, organisational capability, information synergy, innovativeness, and firm performance.

### 3.1 IT capability

Recent studies examine the IT capability with a resource-based perspective (Bharadwaj, 2000; Tippins and Sohi, 2003). The resource-based perspective focuses on advantages stemming from internal organisational resources that are heterogeneous, unique, and difficult to imitate (Barney, 1991; Prahalad and Hamel, 1990). Following the resource-based perspective, several scholars provide the definitions of IT capability. Bharadwaj (2000) defined IT capability as “a firm’s ability to mobilise and deploy IT-based resources in combination or co-present with other resources and capabilities”. Tippins and Sohi (2003) conceptualise IT capability as ‘the extent to which a firm is knowledgeable about and effectively utilises IT to manage information within the firm’. Ross *et al.* (1996) defined IT capability as “the ability to control IT-related costs, deliver systems when needed, and effect business objectives through IT implementations”. From this point of view, a firm was successful not because it implemented a leading-edge IT application, but because it has developed a capability for applying IT to changing business opportunities. Brown and Sambamurthy (1999), based on the theory of Hamel and Prahalad (1994), define capability as “the distinctive organisational skills for combining available resources and sustaining superior performance”. In summary, IT capability refers to the distinctive assets, competencies, knowledge, processes, and relationships that enable firms to effectively acquire, deploy, and manage IT products and services in shaping innovations and business strategies (Sambamurthy and Zmud, 1997; Feeny and Wilcocks, 1998). Several literature explore different aspects of IT capability, such as IS/Line partnering and knowledge work leverage (Ross *et al.*, 1996; Feeny and Wilcocks, 1998; Brown and Sambamurthy, 1999), IT-enabled business platform (Weill and Broadbent, 1998), solutions delivery (Prahalad and Hamel, 1990; Clark *et al.*, 1997; Bharadwaj *et al.*, 1999; Bharadwaj, 2000), value innovation (McKenney, 1995; Clark *et al.*, 1997; Powell and Dent-Micallef, 1997; Sambamurthy and Zmud, 1997; Feeny and Wilcocks, 1998; Brown and Sambamurthy, 1999), value-chain extension (Brown and Sambamurthy, 1999), and process adaptiveness (Sambamurthy and Zmud, 1997; Weill and Broadbent, 1998; Bharadwaj *et al.*, 1999). All these aspects emphasise the unique characteristics of IT capability. In contrast, some scholars try to group the elements of IT capability into categories. Among them, Bharadwaj (2000) divides IT-based resources into three categories: IT infrastructure, human IT, and IT-enabled intangibles. This taxonomy does not reveal the importance of process-adaptive elements. Tippins and Sohi (2003) classify IT capability into three dimensions: IT knowledge, IT operations, and IT objects. This classification not only encompasses the tangible and intangible elements of IT capability, but also introduces the IT operations and knowledge work leverage (Ross *et al.*, 1996; Feeny and Wilcocks, 1998; Brown and Sambamurthy, 1999). Therefore, we adopt Tippins’ classification of IT capability. Each IT capability dimension is defined as follows:

- *IT knowledge* is the extent to which a firm owns a body of technical knowledge about objects such as computer-based systems.
- *IT operations* are the extent to which a firm utilises IT to manage market and customer information.
- *IT objects* include computer-based hardware, software, and support personnel.

Tippins' classification is consistent with the concept commonly accepted by most scholars of which IT is necessary but not sufficient (Carr, 2003; Goldratt *et al.*, 2000); the value of IT can only be revealed when IT capability is consistent with business strategy and is utilised in an incremental innovative way (Brown and Hagel, 2003). This, in turn, raises different perspectives of organisational issues, which focus on organisational capability related to IT.

### 3.2 Organisational capability

The dimensions of organisational capability are adapted from Teece *et al.* (1997) and Sambamurthy *et al.* (2003). Teece *et al.* followed resource-based theory which emphasises the scarcity of resources and regards the competitive advantage within firms as heterogeneous, unique, and difficult to imitate (Prahalad and Hamel, 1990; Barney, 1991). In addition, they proposed the concept of 'dynamic capability'. The term 'dynamic' refers to the capacity of renewing competences to achieve congruence with the changing business environment. The rate of technological change is rapid, and the nature of future competition and markets is difficult to determine; thus, certain innovative responses are required when time-to-market and timing are critical. Furthermore, they define the term 'capability' as the ability of management in appropriately adapting, integrating, and reconfiguring internal and external organisational skills, resources, and functional competences to match the requirements of a changing environment. In sum, the 'dynamic capability' approach emphasises that the resources can be renewed and the core competences can be changed dynamically. It integrates the research areas such as the management of R&D, product and process development, technology transfer, intellectual property, manufacturing, and organisational learning.

Teece *et al.* (1997) further provide three dimensions, namely, process, position, and path, which can help to determine a firm's distinctive competence and dynamic capability. The term 'process' refers to the way things are done in firms such as routines, or patterns of current practice and learning. The term 'position' refers to the firms' current specific endowments, such as technological assets, complementary assets, reputational assets, financial assets, structural assets, and market assets. Finally, the term 'path' indicates that firms must follow a certain trajectory or path of competence development. Generally speaking, the competitive advantages of firms lie with its organisational processes, shaped by its specific asset position, and the paths available to it.

Following Teece *et al.* (1997), Sambamurthy *et al.* (2003) proposed a theoretical perspective to highlight three dimensions of dynamic capability: process capitals, agility, and entrepreneurial alertness. These three dimensions are consistent with process and path dimensions of Teece *et al.* It does not include the position dimension, which refers to various assets of an organisation. In this study, we adopt three dimensions from Sambamurthy *et al.* and the position dimension of Teece *et al.*; the latter is referred to as 'positional assets'. Below is a table contrasting organisational and IT capability of three studies adapted by this study, followed by the detailed description of each research variable in this study.

**Table 1** The categorisation of capability in four studies

<i>Teece's dynamic capability</i>	<i>Tippin's IT capability</i>	<i>Sambamurthy's organisational capability</i>	<i>This study</i>
Process	IT operation	Process reach	Process reach
		Process richness	Process richness
		Agility	Agility
Position	IT object	n/a	Positional assets
Path	IT knowledge	Knowledge reach	Knowledge reach
		Knowledge richness	Knowledge richness
		Entrepreneurial alertness	Entrepreneurial alertness

### 3.2.1 Positional assets

We refer to Teece's position dimension as 'positional assets'. Positional assets are those specific assets which firms possess at the moment. These include technological assets (*i.e.*, the technological know-how within firms), complementary assets (*i.e.*, the related assets when delivering products or services), financial assets (*i.e.*, cash position and degree of leverage), reputational assets (which often summarise a good deal of information about firms and shape the responses of customers, suppliers, and competitors), structural assets (*i.e.*, the formal and informal structure of organisations, the degree of hierarchy and the level of vertical and lateral integration), institutional assets (*i.e.*, the public policies and regulatory systems within nations and organisations which affect the intellectual property regimes, tort laws, anti-trust laws, *etc.*), market assets (*i.e.*, product market position matters, such as market share), organisational boundaries (*i.e.*, the location of a firm's boundaries, the degree of vertical, lateral and horizontal integration) (Teece *et al.*, 1997).

### 3.2.2 Process capitals

Process capitals are described as a set of IT-enabled capability in the form of digitised enterprise work processes and knowledge systems. Therefore, process capitals are very essential to dynamic capability. A firm's position lies with its present portfolios of assets, while its trajectory might be a lead to guide the process. Sambamurthy *et al.* (2003) combine the dimensions of reach and richness (Evans and Wurster, 1999) to specify the extent of process capitals, which include four layers: digitised process reach (*i.e.*, the extent to which a firm applies integrated IT-enabled processes), digitised process richness (*i.e.*, the quality of information about transactions in the processes), digitised knowledge reach (*i.e.*, the comprehensiveness and accessibility of codified knowledge), and digitised knowledge richness (*i.e.*, the system of interactions among organisations members to develop tacit knowledge). The organisational capability comes from the aforementioned four layers. Companies who own the process capitals and apply them in a dynamic perspective will gain competitive advantages, similar to the online auction website of eBay, which encompasses the payment process (*e.g.*, Paypal) and the shipping process (*e.g.*, FedEx).



### 3.2.3 Agility

According to Eisenhardt and Martin (2000), dynamic capability consists of three essences. First, though dynamic capability is idiosyncratic in its details, it has significant commonality across firms, such as best practice. Second, there is no long-term competitive advantage in a high-velocity market; the key point is time and flexibility. Third, the strategic necessity is not leverage, but change. Therefore, it is very important for firms to know three aspects of change: what to change, to what to change, and how to cause the change? After all, there is no sustained competitive advantage that firms can own because of the rapidly changing environment. Agility becomes a vital issue to meet the changing business need. The term 'agility' refers to the ability to catch opportunities for innovation and a competitive market by assembling essential assets, knowledge, and relationships with speed and surprise (D'Aveni, 1994; Goldman *et al.*, 1995). One can categorise agility into three aspects: customer, partnering, and operational agilities (Sambamurthy *et al.*, 2003). Highly agile firms are prone to adjust to dynamic outer environments. Since the customers' preferences change all the time, firms should have the ability to capture the changing customers' needs at the right time in order to catch the business opportunities. In addition, firms can no longer survive only by strengthening their own specific ability; they must consolidate partners to form a more competitive virtual team. Therefore, agilities and flexibilities are key factors of organisational capability.

### 3.2.4 Entrepreneurial alertness

In addition to process capitals and agility, the capabilities to discover its marketplace, identify areas of marketplace ignorance, and verify opportunities for action are also vital to a firm. This is the essence of entrepreneurial alertness. Sambamurthy *et al.* (2003) define entrepreneurial alertness as the abilities of strategic foresight and systemic insight. Strategic foresight is the ability to anticipate discontinuities in the business environment, the threats and opportunities in the extended enterprise chain, and the impeding disruptive moves by competitors. Systemic insight is the ability to visualise connections between digital options, agility capabilities, and rising market opportunities in building competitive actions. However, successful firms do not always adopt the newest technology; they need to know all the newest information and make a choice of what they need instead of using useless technology. For example, General Electric Lighting's financial system still relies on SAP, R/2, an ERP package with a version almost ten-years-old, because their financial system is stable. Companies need not always implement the latest solutions unless their information is changing all the time. For example, human-resources applications in manufacturing companies are more stable than those in the hospitality business or educational institutions as the latter has higher employee turnover than the former business.

In summary, to improve organisational capability, one must improve one's positional assets, process capitals, agility, and entrepreneurial alertness. Many IT systems such as asset management systems, enterprise management systems (*e.g.*, Enterprise Resource Planning (ERP)/Customer Relationship Management (CRM)/Supply Chain Management (SCM) systems), data mining software, *etc.*, can help us attain this purpose. For example, Baxter International Inc. is a global healthcare company. Initially, Baxter viewed IT as a resource used to solve a localised client's problem. Through IT capability, Baxter can get

customers' response immediately and give them feedback in real-time. This seamless operation enabled by the IT application is a vital element of a firm's organisational capability. It helps Baxter to develop strategic potential that is valuable and difficult to imitate, particularly by some of its competitors (Andreu and Ciborra, 1996). Hence, we propose the following:

*Proposition 1 Higher level of IT capability will facilitate the extent of organisational capability.*

### 3.3 Information synergy

The term 'synergetics' is composed of two Greek words  $\sigma\upsilon\nu$  (joint, combined) and  $\epsilon\rho\gamma\omicron\nu$  (work, actions); it literally means joint action or co-action. Therefore, synergy means the combined action of two or more organisms to achieve an effect in which each is individually incapable (Bushev, 1994). Information synergy is the performance gains that result when IT allows two or more individuals, or subunits, to pool their resources and collaborate across roles or subunit boundaries. It is a between-person or between-group effect (Dewett and Jones, 2001). Competitive advantages allied with synergy are less likely to be imitated, as they are often attained under a distinctive set of circumstances and on the basis of firm-specific resources (Bharadwaj *et al.*, 1993).

In this study, we define information synergy in three dimensions: information dissemination, information responsiveness and shared interpretation:

- 1 *Information dissemination* is the extent to which the information obtained by an organisation is shared between its functional units via formal or informal channels (Maltz and Kohli, 1996). This is the first step toward information synergy.
- 2 *Information responsiveness* is the ability of a company to gather information from its environment and within the organisation, and to detect and anticipate changes. If people in a company respond to others' information inquiry quickly, it gives the inquirers an impression that the respondents have the skills and competences to be able to exchange accurate and helpful information. This might increase the inquirers' intentions to cooperate (Gefen and Ridings, 2002).
- 3 *Shared interpretation* is the consensus among organisational members as regard to the meaning of information (Slater and Narver, 1995). Once there is a consensus between different groups' opinions, organisational members can take a joint action in a concerted manner. The study of Figueiredo (2003) examined two large steel companies in Brazil and found that the rates of technological capability accumulation can be expedited if deliberate and effective efforts on knowledge-acquisition and knowledge-conversion processes (including both knowledge socialisation and knowledge codification processes) are made within the company. The latter processes facilitate the spread of knowledge across the company.

#### 3.3.1 Information synergy and IT capability

The use of IT is not a panacea. Without the human factor, IT is just equipment. Therefore, Davenport (1994) promotes the importance of a human-centred approach to information management. He suggests that an enterprise system should impose its own logic on a company's strategy, culture and organisation (Davenport, 1998). If an

information system is designed for the community, all members in the organisation would be more willing to utilise the IT platform. On the contrary, the worst thing a firm can do is to make a decision about a system based on technical criteria instead of human concerns. Even in a firm adopting the newest IT, people might be reluctant to use the information system. Therefore, information synergy advocates that one combines human factor and IT application and then transforms static enterprise data into dynamic information so as to generate a synergistic effect in the organisation. In addition, IT can create the environment of a virtual community, which facilitates and enhances the activities of the community in a way that could benefit its members as a whole (Marshall, 2000). Coordination theory suggests that managerial judgments and actions across the enterprise can be linked through the use of a variety of coordination mechanisms (Galbraith, 1974). IT can be a good platform to use as a coordination mechanism, such as the enterprise information portal, document management system, knowledge community, collaboration system, e-learning system, *etc.* The implementation and use of these mechanisms can promote values of coordination and partnering. This, in turn, facilitates the extent to information synergies. Moreover, Tippins and Sohi (2003) reported that IT knowledge, IT operations, and IT objects are significantly related with information dissemination and shared interpretation at  $p = 0.01$  level, supporting the relationship between IT capability and information synergy. Hence, we make the following proposition:

*Proposition 2 Higher level of IT capability will facilitate the extent of information synergy.*

### 3.3.2 Information synergy and organisational capability

As firms integrate IT in their operations by reengineering their intraorganisational and interorganisational business processes, a rich communication and synergy must develop between business partners (Raymond and Blili, 2000–2001). Rowley (2002) also raises the essential issue of synergy by viewing the extent of integration between the functions and multiple channels. Therefore, the organisational capability is a vital issue in collaborative effect between groups. The higher organisational capability that firms own, the higher agility firms can acquire. These agilities, in turn, help to promote information synergy between external (customers, partners) and internal (departments, divisions) business units of an organisation. As West and Anderson (1996) stated, the possible benefits of dynamic organisational capability can go beyond economic returns and might include improved group cohesiveness and better interpersonal communication. Thus, we make the following proposition:

*Proposition 3 Higher level of organisational capability will facilitate the extent of information synergy.*

### 3.4 Innovativeness

Myers and Marquis (1996) define innovation as “a complex activity which proceeds from the conceptualisation of a new idea to a solution of the problem and then to the actual utilisation of economic or social value”. Innovation represents the commercialisation of

new technologies or technological change (Utterback and Abernathy, 1975). Garcia and Calantone (2002) provide a definition which captures the essence of innovation from an overall perspective:

“Innovation is an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention.”

It is obvious that different scholars have different viewpoints; therefore, the inconsistencies make the operationalisations of innovation hard to define.

Innovativeness is most frequently used as a measure of the degree of ‘newness’ of an innovation (Garcia and Calantone, 2002). Subramanian and Nilakanta (1996) regard innovativeness as ‘an enduring organisational trait’. Ettl *et al.* (1984) defined organisational innovativeness as the propensity for a firm to innovate or develop new products. R&D investments are traditionally regarded as an indicator of innovativeness. Based on the existing literature, we have derived a construct of innovativeness with five distinct dimensions: product, process, personnel, service and technology. We not only refer to the tangible part of innovativeness (*i.e.*, product, technology), but also highlight the intangible aspects, such as process, personnel, and services. The definitions of these five dimensions follow:

- 1 *Product innovativeness* is about the improvement of product or the creation of a new product. It is about the newness of the product. A highly innovative product can be regarded as having a high degree of innovativeness. All outputs from an organisation can be considered as products.
- 2 *Process innovativeness* is about decreasing lead time, stabilising financial activities, and increasing cash flow. If firms have the ability to incorporate innovativeness into their business process, they might gain benefits since they open a new perspective to reengineer the inert process. Subramanian and Nilakanta (1996) also point out the importance of a consistently high level of innovativeness over time instead of assessing innovativeness at one point in time. Therefore, we also emphasise the importance of continuous improvement in innovativeness.
- 3 *Personnel innovativeness* is about improving work design to generate staff’s creative thinking and new way of working. Undoubtedly, the human resources are the most important assets in the companies; they are the sources of innovation. Personnel innovativeness helps companies to adopt innovations earlier than others. It is of most benefit to employee relations (Totterdell *et al.*, 2002).
- 4 *Service innovativeness* is about the improvement of services and new way of providing services. For example, an auction is not a new way of business transactions, but eBay transforms the traditional form of auction, it creates a new form, which is an online auction. Service innovations are of most benefit to customers (Totterdell *et al.*, 2002).
- 5 *Technology innovativeness* is about introducing the new instrument and facilities that expedite firms operation, such as machinery, communication systems, *etc.* (Totterdell *et al.*, 2002).

### 3.4.1 Innovativeness and information synergy

Many past studies have demonstrated the positive effects of cross-functional integration on new product development success (Menon *et al.*, 1997; Song *et al.*, 1997). The research of Olson *et al.* (2001) further manifests the importance of cooperation among marketing, operations, and R&D departments given various time points and innovativeness levels. The result shows that high project innovativeness is significantly related at  $p < 0.01$  level with late-stage cooperation among marketing, operation, and R&D departments. Therefore, we make the following proposition:

*Proposition 4 Higher level of information synergy will facilitate the extent of innovativeness.*

### 3.4.2 Innovativeness and IT capability

The time issue in the innovation process becomes the most challenging parameter in the competitive market. The sooner a new product is developed, the more competitive advantage will be gained. Therefore, a Rapid Product Development (RPD) technique should be applied in an R&D department. RPD requires team-oriented communication systems, which open up new ways of cooperation. By utilising IT capability within an R&D organisation effectively, the product development time can be reduced effectively (Bullinger *et al.*, 2000). That is, IT is a good instrument to build up a collaborated environment, such as an electronic bulletin board, a knowledge-sharing portal. These environments can bring about creative thinking and expedite the efficiency and effectiveness of an innovation process. Hence, we make the following proposition:

*Proposition 5 Higher level of IT capabilities will facilitate the extent of innovativeness.*

### 3.4.3 Innovativeness and organisational capability

Since innovativeness is defined as ‘an enduring organisational trait’ (Subramanian and Nilakanta, 1996), it is highly correlated with organisational capability, specifically, entrepreneurial alertness. Therefore, truly innovative organisations will exhibit innovative behaviour consistently over time. For example, Morris Chang, Chairman of the TSMC (the largest semiconductor manufacturer in Taiwan) speaks to his staff: “To succeed in the new environment, we need to add to our existing core competencies. We need our people to be more innovative, to take more initiatives on their own and to operate effectively in a fluid organisation”.

In addition, innovativeness is considered to be an integral dimension of organisational strategy. For example, New Product Development (NPD) is viewed as the organisational capability to regenerate resources, improve quality or work life, attain a high degree of system flexibility that allows for continuous change and development of human, technological, and work processes. It can improve business processes and outcomes. Olin and Shani (2003) promote the concept of applying the dynamic capability and an actionable knowledge-creation process to the NPD so as to create the sustainability of the NPD. Because NPD is both process and product innovativeness, we make the following proposition:

*Proposition 6 Higher level of organisational capability will facilitate the extent of innovativeness.*

### 3.5 Firm performance

Many researchers use financial performance indices (e.g., Return on Investment (ROI), Return on Assets (ROA)) to measure a firm's performance. However, the financial indices recorded in public databases are usually outdated; they cannot represent the current performance of a firm. Unfortunately, most firms are hesitant to report their current performance information. Therefore, in this study we use an indirect approach to measure the performance adapted from Tippins and Sohi (2003). We ask the respondents to compare with their competitors the following indices: customer retention, sales growth, profitability, and return on investment.

#### 3.5.1 Firm performance and information synergy

Since information synergy is the synergistic effect from collaborations between groups or individuals, the performance generated from teamwork is usually better than one person's work. In addition, many researchers try to explore the cross-functional integration within firms; all the results show the positive effect in facilitating a successful new product development (Menon *et al.*, 1997; Song *et al.*, 1997). While introducing new products can satisfy customers' capricious need, new products can also improve customer retention, one of the indices of firm's performance. Hence, we make the following proposition:

*Proposition 7 Higher level of information synergy will facilitate the extent of firm performance.*

#### 3.5.2 Firm performance and innovativeness

A firm having higher innovativeness might have higher organisational performance (Subramanian and Nilakanta, 1996). For example, 3M is a well-known innovative company all over the world; its culture has fostered creativity and given employees the freedom to take risks and try new ideas. This culture has led to a steady stream of new products. Therefore, 3M's products can meet the changing customers' demand and, in turn, facilitate the profit growth. Another example is Samsung, the leading electronics company, its 3P's (Personnel, Process, Product) innovation programme keeps Samsung's advantage in maintaining top performance in that industry. Hence, we make the following proposition:

*Proposition 8 Higher level of innovativeness will facilitate the extent of firm performance.*

### 3.6 Information synergy and innovativeness as mediators

Several researches show that IT does not necessary promote a firm's performance in every industry. This is the phenomenon of productivity paradox (Brynjolfsson, 1993; Lucas, 1999). Therefore, we expect that IT impact on a firm's performance cannot be measured directly; it can only be assessed by examining the indirect effect on some intermediate firm characteristics. IT capability could influence the extent of both information synergy and innovativeness according to Proposition 2 and Proposition 5. According to Proposition 7, higher information synergy will facilitate higher firm performance. Meanwhile, innovativeness can be regarded as a pre-performance resource and an intermediate factor for financial performance (Tuominen *et al.*, 2003) according to Proposition 8. As the empirical research of Tippins and Sohi (2003) shows that information dissemination and share interpretation are significant mediators (Comparative fit index = 0.972) between IT competency and firm performance, innovativeness and information synergy could be the intermediate variables between IT capability and firm's performance. Hence, we make the following proposition:

*Proposition 9 The relationship between IT capabilities and firm performance is mediated by information synergy and innovativeness.*

An organisational capability is the foundation of firm performance. A firm with higher capability tends to gain more profits (Sambamurthy *et al.*, 2003). From our previous propositions, organisational capability has an effect on information synergy and innovativeness; furthermore, information synergy and innovativeness can influence firm performance. Hence, we make the following proposition:

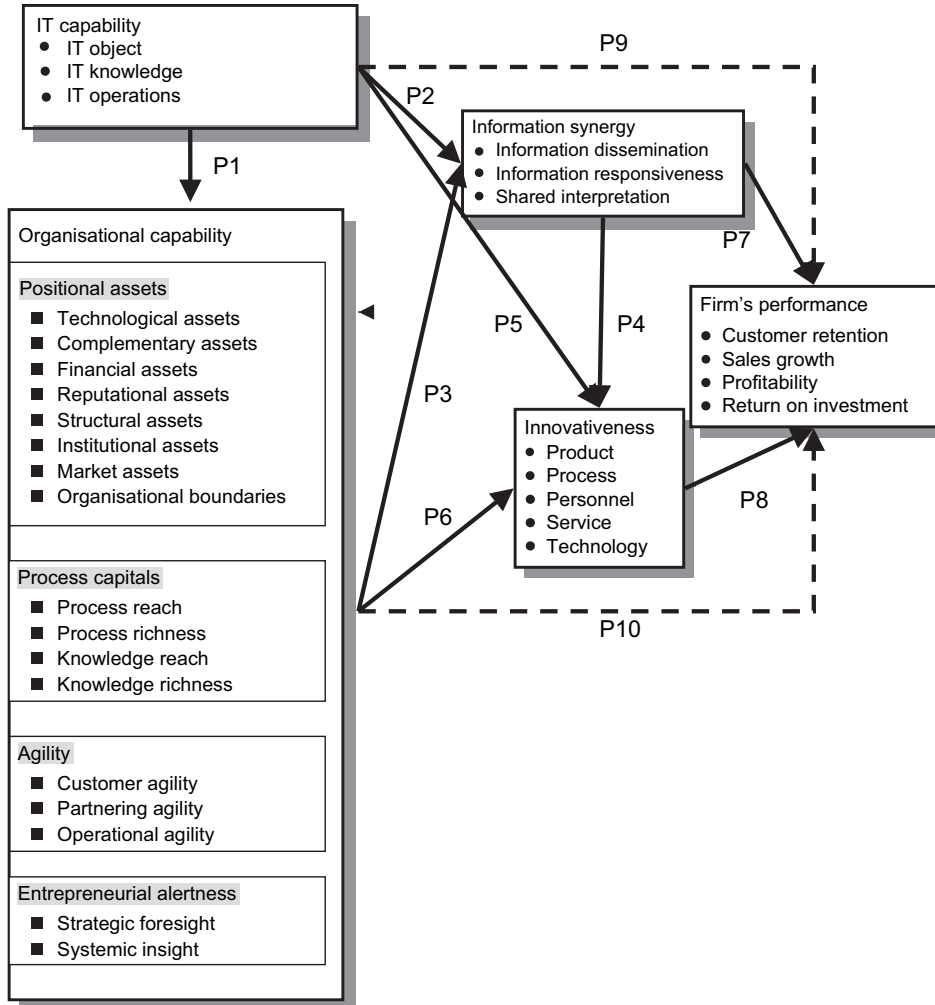
*Proposition 10 The relationship between organisational capability and firm performance is mediated by information synergy and innovativeness.*

## 4 The full conceptual framework

Based on the existing literature, which has been reviewed in the previous section, we present a research framework as depicted in Figure 3. This framework shows the individual elements of each research construct. According to this framework, the outcome of firm's performance is the combined result of information synergies and innovativeness. The latter are, in turn, influenced by IT capability and organisational capability.

In this framework, we attempt to provide an integrated model that explicitly links IT capability and organisational capability to the dynamics of firm performance. Though IT itself is tangible, it can generate enormously intangible return if it is properly used. The degree of properly used technology is affected by several organisational characteristics. In this study, we have identified organisational capability, information synergy, and innovativeness as three important organisational characteristics. We try to view IT capability and organisational capability as two critical factors that affect a firm's performance via two mediators: information synergy and innovativeness. Moreover, the effect of IT capability is mediated by organisational capability.

**Figure 3** The conceptual framework



## 5 Conclusions and implications

The dynamics of firm performance is very complex and many factors might be involved. In this paper, we attempt to identify the critical factors of firm performance dynamics and group them into different constructs to delineate the relations of these constructs. Through an extensive review of the literature, we identify various factors and group them into four constructs: IT capability, organisational capability, information synergy, and innovativeness. Based on the literature, we also reveal that IT capability and organisational capability do not necessarily have significant direct effect on firm performance; they must be mediated by other factor constructs such as information synergy and innovativeness. The latter two mediators are supported by the literature as discussed in the previous sections. In addition to the conceptual framework of firm performance dynamics, this study makes several contributions to the literature.



First, Sambamurthy proposed process capitals, agility, and entrepreneurial alertness as three components of organisational capability. However, these three components are insufficient. We further proposed one additional component, positional asset, to fill the void.

Second, we identified information synergy as a factor influencing organisational performance. The components of this factor are information dissemination, information responsiveness, and shared interpretation. These components were adapted from Maltz and Kohli (1996), Gefen and Ridings (2002), and Slater and Narver (1995), respectively.

Third, innovativeness is known to influence firm performance (Subramanian and Nilakanta, 1996; Tuominen *et al.*, 2003). In this study, we adapted the types of innovation from Totterdell *et al.* (2002) and proposed five types of innovativeness: product innovativeness, process innovativeness, personnel innovativeness, service innovativeness, and technology innovativeness.

Fourth, we adopted a dynamic capability perspective to present a theoretical model to examine the relationship between IT capability and organisational capability. This model so far is the most comprehensive framework of organisational dynamics in the literature. It includes not only tangible components but also intangible ones. It also considers the dynamic issues of firm performance.

Fifth, we brought out information synergy and innovativeness as the antecedents of a successful firm's performance. These two factors, in turn, are the mediators between the two capabilities (IT capability and organisational capability) and firm performance.

In summary, the proposed conceptual framework is much more comprehensive than the extant models in the literature. This framework is based on the extensive experiences of various researchers from industrialised countries. Therefore, the framework will be very helpful for managers and policymakers in late industrialising countries in evaluating and prioritising the elements of each factor in the framework and allocating appropriate resources accordingly in order to improve firm performance.

From a practical and managerial standpoint, many insights could be gained from this research:

- IT capability and organisational capability must have consonance with a firm's business strategy. The elucidation of our research might help managers recognise that the benefits of IT cannot be attained until IT is applied in an innovative and productive way.
- From our above explication, managers shall facilitate information synergy and innovativeness when implementing IT. Many IT implementation failures were due to intangible organisational factors. Information synergy and innovativeness are two vital intangible factors, besides the process capitals, agility, and entrepreneurial alertness in organisational capability, and the IT knowledge and IT operations in IT capability. Firm managers should not overlook these intangible components.
- The conceptual framework of this study enumerates the components of IT and organisational capabilities and depicts the relationship among the factors affecting firm performance. This framework could serve as a roadmap to capability building and accumulation for latecomer firms in both industrialised and nonindustrialised contexts.

Based on the above discussion, we strongly recommend that managers should put an emphasis on IT capability among technological capabilities, which is helpful for latecomer companies to expedite their rates of building up and accumulating technological capabilities. In addition, IT capability must coincide with organisational capability and both capabilities should be mediated by information synergy and innovativeness. This, in turn, allows technological capability to play an effective and constructive role in promoting a latecomer firm's performance.

In the future, an empirical research is needed to test the propositions arising from our conceptual framework. We recognise that this may be a difficult task since most of the constructs involved are unobservable. Particularly, we put much emphasis on intangible issues. Nevertheless, we also try to delineate each construct into several dimensions; it is helpful in operationalising these research variables for further investigation. These empirical findings might help companies make a wise decision about IT adoption and the way to utilise IT. With the ability to manage IT in the digital era, a firm's capability will be greatly strengthened. Consequently, this study provides a profound theoretical foundation on investigating the value of IT.

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