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Information synergy as the catalyst between information technology capability and innovativeness: empirical evidence from the financial service sector

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Abstract

Introduction. Previous studies about the effect of information technology (IT) on firm performance have presented no conclusive evidence. In this study, we examine the effect of IT on a firm's innovativeness and introduce information synergy as the catalyst between them. Information synergy is the state of a company in which individuals pool their resources and collaborate across roles or boundaries through information technologies
Method. A research framework and the associated hypotheses are proposed. An empirical survey was conducted and questionnaires were mailed to 400 financial firms in Taiwan.
Analysis. A total of 76 valid observations was collected and analysed using structural equation modelling technique with partial least square analysis.
Results. The empirical result shows that IT capability does not have a direct effect on innovativeness; it has an indirect effect through information synergy and accounts for 32.3% of the variance in information synergy, while IT capability and information synergy account for 74% of the variance in innovativeness underlying the structural model.
Conclusions. Information synergy is the key to improving a firm's performance as represented by the level of innovativeness. Regardless of how large the size of IT investment is, what really matters is how well the IT is being used for sharing timely information and making the right business decisions.

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Introduction

In today's business environment, information technology (IT) is playing an active role in creating competitive advantage for financial service companies. For example, 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. (Rayport and Jaworski 2001). Recently, the emerging platforms of social networking sites, such as Facebook and MySpace, allow people to make friends, connect with each other to share music and photos, and build a global village in cyberspace. Because of the popularity of Facebook, Standard Chartered Bank is piloting the use of Facebook for internal use, attempting to improve productivity and communications (Charman-Anderson 2008).

Studies of IT in services reveal that standardized performance measures are hard to establish and the relationship between IT investment and firm performance is not conclusive (Brynjolfsson 1993; Harris and Katz 1989). Many previous studies (e.g., Dehning *et al.* 2005; Sircar *et al.* 2000; Thatcher and Oliver 2001) have tried to find the relationship between IT investment and firm performance and productivity. Another study (Shu and Strassmann 2005) shows that IT investment yields the highest profit margin in the banking industry. These studies underestimate some complex issues, such as obsolescence and idleness of IT resources which consume much of the investment without contributing any value. Thus, rather than exploring the effect derived from IT investment, we focus on the value-creating intangible issues of IT capability, such as process effectiveness, IT experience and value innovation.

When studying firm performance in the service sector, it is difficult to find a perfect measure. For example, Subramanian and Nilakanta (1996) define firm performance as the share of deposits and the return on assets. They reveal that a firm having higher innovativeness tends to have higher organizational performance, using 350 banks in the mid-west region of the United States. Bank of America defined customer satisfaction and revenues as the performance measures. It created an 'innovation market' within the bank's existing network and ran a series of formal experiments aimed at creating new service concepts for retail banking. The project was able to meet the final goal of improving the two performance measures (Thomke 2003). Tuominen *et al.* (2003) proposed a contingency model assessing innovativeness through organizational adaptability. They regarded innovativeness as a pre-performance resource and an intermediate factor for financial performance. Recently, an empirical study conducted in east Germany has confirmed a positive relationship between the innovativeness and firm performance in high-technology manufacturers (Eickelpasch *et al.* 2007). Based on these studies, we propose adopting the level of innovativeness as a plausible predictor of various performance outcomes, tangible or intangible.

Similar to the relationship between IT investment and firm performance, it is difficult to study the direct effect of IT capability on firm innovativeness in the service sector; for example, in financial service companies. The reason might be that there are other mediating effects between IT capability and firm innovativeness. One source of such mediating effects might come from information synergy in the company (Li, Chen and Huang 2006). By information synergy, we mean the state of a company in which individuals or subunits pool their resources and collaborate across roles or subunit boundaries through information technologies (Dewett and Jones 2001). In this study, we shall investigate this mediating effect between IT capability and firm innovativeness.

In summary, the purpose of this study is to advance understanding of the relationship among IT capability, information synergy and innovativeness in the financial service sector and conduct the empirical data analysis to a verified partial framework proposed by Li *et al.* (2006). Specifically, the research has three purposes: 1) to identify and

develop the constructs of IT capability, information synergy and innovativeness; 2) to explore possible relations among the three constructs; 3) to develop and test a model that depicts the effect of IT capability on innovativeness and the mediating effect of information synergy. In the remaining sections we first present literature reviews and the hypotheses based on the existing literature. Second, we propose a research model of this study. Third, we describe the development of the three constructs and validate them using data collected from financial service companies. Fourth, we test the model using structural equation modelling and discuss the results. Finally, we present implications, limitations and future research.

Literature review and research model

In the following section, we review the pertinent literature and propose a research model with formative indicators. We also identify components for each construct in the research model and posit three hypotheses regarding the relationships among IT capability, information synergy and innovativeness.

Information technology capability

Li, Chen and Huang (2006) have conducted a thorough discussion about the essence of information technology capability (Bharadwaj 2000; Ross, Beath and Goodhue 1996), which is also known as 'IT competency' (Tippins and Sohi 2003). In this study, we adopt the term 'IT capability'.

According to the model proposed by Peppard and Ward (2004), three levels linking information systems capability with competencies and resources are: resource level, organizing level and enterprise level. The resource level indicates the main resource components that compose the competencies. The organizing level is about how these resources are organized to create competencies. The enterprise level is how the capability demonstrates itself and is conceived in the performance of the organization. In this study, we adopt the enterprise level to denote our information technology construct, therefore, we apply IT capability as our main concept.

Tippins and Sohi (2003) proposed three dimensions of IT capability, which are knowledge, operations and objects. This classification not only encompasses the tangible and intangible elements (the objects) of IT capability, but also introduces the operations and knowledge work. Therefore, we adopt these three dimensions as our main components of IT capability. These three dimensions demonstrate co-specialized resources that firms cannot utilize the information technology objects effectively without sufficient knowledge and operations.

Information Synergy

Li *et al.* (2006) have elucidated the terms 'synergy' and 'information synergy'. In this study, we define information synergy as 'an environment where corporate members tend to disseminate and share information willingly and collaborate with each other across subunit boundaries, forming a harmonious organizational climate to generate synergy through the power of unity'. According to this definition, we view information synergy as a formative construct with three sub-constructs: information dissemination, information responsiveness and shared interpretation. These sub-constructs were discussed in Li *et al.* (2006).

Innovativeness

Although Li *et al.* (2006) have presented several definitions of innovation, different scholars have inconsistent viewpoints, making the operationalization of the term hard to proceed with. Therefore, instead of directly adopting the concept of innovation which emphasizes the tangible outcome, we use the concept of innovativeness in this study. In this study, we view innovativeness as 'the innovative climate existing in a firm and the tendency to develop new products or services'. We consider innovativeness as a pre-performance factor and regard it as the most important indicator of future performance, be it tangible or intangible. Instead of using financial firm performance indices, such as return on investments and return on assets, we believe that innovativeness can tell us more about a firm's potential success.

Based on the existing literature, we have derived a reflective construct of innovativeness with four sub-constructs: product, process, personnel and service. The definitions of these four sub-constructs are defined in Li *et al.* (2006). In contrast to that study, we did not adopt the sub-construct of technology innovativeness because there are very few technologies other than information technology adopted in financial service sector.

Information technology capability and information synergy

Information technology platforms can be a good coordination mechanism; for example, the enterprise information portal, document management system, knowledge community, collaboration system, or e-learning system. The implementation and use of these mechanisms can promote values of coordination and partnering (Li *et al.* 2006). This, in turn, facilitates the creation of information synergies. For example, InsynQ Inc., a provider of online software applications and services to financial organizations, introduces online accounting systems that allow users to share files and screens over the Web. Using these systems, financial service companies can enhance their technology capability and gain the advantage to pass money, save time and improve services to clients, thereby attracting more business (Camp 2005). Another example is the use of multiple integrated channels to ensure the success of e-banking adoption by a UK bank, The Woolwich. (Sah and Siddiqui 2006). Tippins and Sohi (2003) reveal that IT knowledge, operations and objects are significantly related to information dissemination and shared interpretation. All this evidence supports the relationship between IT capability and information synergy. Hence, we propose the following hypothesis which is consistent with the second proposition in Li *et al.* (2006).

> Hypothesis 1: IT capability is positively related to information synergy.

Information synergy and innovativeness

The essential issue of synergy can be examined by the extent of integration between functional areas and multiple information channels (Rowley 2002). In this examination, coordination is a vital element of synergy between groups. The more the firms coordinate, the higher information synergy the firms can acquire, which, in turn, helps to promote innovativeness between external (customers, partners) and internal (departments, divisions) business units of an organization. Furthermore, Canada's best bankers demonstrated that synergy between banker and client, owner and employees is crucial (Hatter 1995). Therefore, we propose the following hypothesis which is consistent with the fourth proposition in Li *et al.* (2006).

> Hypothesis 2: Information synergy has a positive effect on innovativeness.

Information technology capability and innovativeness

As firms integrate IT in their operations by re-engineering their intra-organizational and inter-organizational business processes, a rich communication and synergy will develop between business partners (Raymond and Blili 2000-2001). Only after the effect of information synergy is brought into these collaborative environments can one bring about creative thinking, efficiency and effectiveness in an innovation process. In his recent book, Friedman declared that 'the world is flat', because IT, as a powerful 'flattener', has made everything of value connected and 'created a flat world: a global, web-enabled platform for multiple forms of sharing knowledge and work, irrespective of time, distance, geography and increasingly, language' (Friedman 2005: 48-172). In this flattened world, common software platforms and open source code enable global collaboration and give rise to outsourcing, offshoring, supply chaining and insourcing. Therefore, China and India become the outposts of financial services innovation

(Sraeel 2006). This phenomenon is a metaphor of information synergy of a service company wherein every piece of valuable information is communicated and shared, as are the opinions and the decision process. This environment greatly facilitates stimulating and sharing innovations. Hence, we propose the following hypothesis:

Hypothesis 3: The effect of IT capability on innovativeness is mediated by information synergy.

Research model

Based on the literature reviewed in the previous section, we present a research model as shown in Figure 1. The model shows the firm's innovativeness is affected by IT capability through information synergy. Furthermore, we posit the construct of information synergy be formative based on three criteria (Jarvis, Mackenzie and Podsakoff 2003): (1) the direction of causality is from indicators to constructs; (2) the indicators need not be interchangeable; and (3) the covariation among indicators is not necessary.

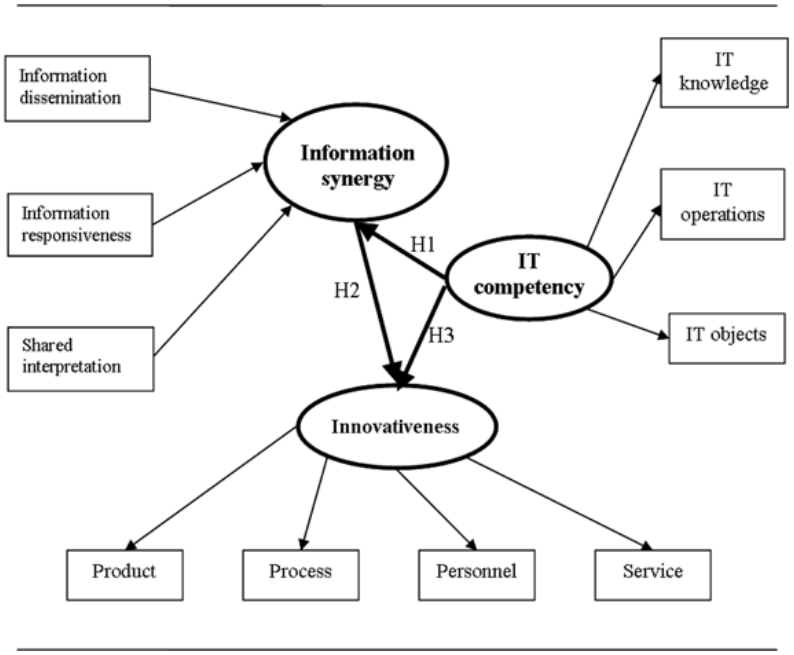

Figure 1: Research model

Research methodology

Scale items development

Considering the research model depicted in Figure 1, a three-part questionnaire was developed (See Appendix A). Some of the scales were adapted from previous literature; others were developed for this study. While the measures of IT capability were adapted from Tippins and Sohi (2003), the measures of innovativeness were adapted from Garcia and Calantone (2002), Subramanian and Nilakanta (1996) and Totterdell et al. (2002).

Although the original concept of information synergy was introduced by Dewett and Jones (2001), we proposed a new definition of information synergy which includes information dissemination, information responsiveness and shared interpretation. The concepts of these components were adapted from Tippins and Sohi (2003), Gefen and Riding (2002) and Ridings, Gefen and Arinze (2002), respectively.

In order to improve the content validity of the questionnaire, we also did a preliminary interview with some experts consisting of three academics and four practitioners. Table 1 summarizes the sources of every measurement item. The subjects were asked to indicate the extent to which they agreed with the condition described by the questionnaire item on a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Therefore, the data collected by this study are self-reported scores that represent the perception of the respondents toward the conditions of the questionnaire items.

Research variable		No. of items	Sources
IT capability[a]	IT knowledge IT operations IT objects	15	Tippins and Sohi 2003.
Information synergy[b]	Information dissemination	3	Tippins and Sohi 2003
	Information responsiveness	4	Gefen and Ridings 2002; Ridings, Gefen and Arinze 2002.
	Shared interpretation	2	Tippins and Sohi 2003
Innovativeness[b]	Product	3	Garcia and Calantone 2002; Subramanian and Nilakanta 1996; Totterdell, et al. 2002
	Process	5	Garcia and Calantone 2002; Subramanian and Nilakanta 1996
	Personnel	5	Totterdell, *et al*. 2002
	Service	3	Garcia and Calantone 2002
Total number of items		40	
[a] Questionnaire items are mainly adopted from Tippins and Sohi (2003)			

bComponents are newly constructed and questionnaire items are adapted from different sources.

Table 1: Sources of questionnaire items

Data collection and sample profile

Data were collected from a sample of 400 financial service firms (including banks, investment, insurance and trading companies) randomly selected from a directory published in 2005 by the Joint Credit Information Center in Taiwan. The questionnaire was sent to the IT department manager in each sample company by regular postal mail. On the questionnaire, we also provided the URL of the Website from which the online version of the questionnaire was available, enabling the respondent to choose to reply by filling in either the printed questionnaire or the online questionnaire. After eight weeks and several follow-up telephone calls urging recipients to complete their surveys, a total of 76 questionnaires was received, giving a 19% response rate. Of the 76 responses, 30 were received from our first wave of mailing while 46 were received after the follow-up calls. To check for the non-response bias, we conducted a series of t-tests to compare the first-wave and the second-wave respondents in terms of demographic characteristics and model variables. None of the t-tests of the means revealed any significant difference between these two groups of respondents, indicating insignificant non-response bias.

Table 2 provides a summary of the characteristics of the firms responding to the questionnaire. About a quarter of the sample companies are large companies that have over 300 million U.S. dollars in capital and were established over twenty-five years ago. The ratios of new services over company sales in most (73.7%) companies are below 20%. Besides, in most (82.9%) companies the value of IT investments is less than 10% of their budget. The gap in outsourcing ratios between different companies is wide. About one third (30.3%) of companies have IT outsourcing ratios of below 5%, while the ratios in some other companies (18.4%) are over 40%.

Characteristics	N	%	Characteristics	N	%
Number of company employees			***Capital of company (U.S. dollars)***		
100 or less	23	30.3	Less than 3 million	7	9.2
101 to 500	24	31.6	3 million to 15 million	24	31.6
501 to 1000	8	10.5	15 million to 30 million	8	10.5
1001 to 2000	6	7.9	30 million to 150 million	14	18.4
over 2000	13	17.1	150 million to 300 million	5	6.6
no response	2	2.6	over 300 million	17	22.4
			no response	1	1.3
Years company has been established			***The ratio of new product/service over company sales***		
Less than 5 years	2	1.3	Less than 5%	26	34.2
6 to 10 years	16	21.1	6 to 10%	16	21.1
11 to 15 years	27	35.5	11 to 19%	14	18.4
16 to 20 years	6	7	20 to 29%	6	7.9
21 to 25 years	2	2.6	30 to 39%	3	3.9
over 26 years	22	28.9	over 40%	3	3.9
no response	1	1.3	no response	8	10.5
The ratio of IT outsourcing			***The ratio of IT investment***		
Below 5%	23	30.3	Below5%	39	51.3
6-10%	9	11.8	6-10%	24	31.6
11-19%	6	7.9	11-19%	3	3.9
20-29%	10	13.2	20-29%	5	6.6
30-39%	10	13.2	30-39%	2	2.6
over 40%	14	18.4	over 40%	0	0
no response	4	5.3	no response	3	3.9

Table 2: Demographic profiles of the companies (N=76)

Data analysis and results

To measure the validity of our construct and test the proposed hypotheses, we conducted data analyses based on the research model in Figure 1 using Partial Least Squares, which is a powerful equation modelling technique and can be tested with a sample size as small as five times the number of measurement items (Chin 1998a; Chin and Newsted 1999). In addition, the ability of the technique to model formative as well as reflective constructs makes it applicable for this study. In this model, there are several sub-constructs of each construct. Under this condition, Bollen (1989) recommends the use of the two-step rule. The rule separates a structural equation model into two models: the measurement model and the structural model (Herting and Costner 2001). The measurement model defines the constructs (latent variables), which the model will use and assigns observed variables to each. The structural model then defines the causal relationship among these latent variables (Gefen *et al.* 2000). Therefore, our analysis was conducted in two steps. First, we performed the testing and refining of our measurement model, which included confirmatory factor analysis, checking for cross loadings, reliability coefficients of the constructs and discriminant validity. In the second step, we regarded those latent variables which were validated at the first step, as the observable variables and then constructed the structural model based on our research model. Therefore, we used Partial Least Squares to analyse the structural model consisting of ten composite indicators with seventy-six collected samples. This sample size is five times larger than the number of composite indicators, which meets the sample size requirement of the analysis.

To assess the psychometric properties of the measurement scales, the following sections present the tests of reliability, convergent validity, content validity and discriminant validity.

Scale reliability and convergent validity

The typical approach to reliability assessment is the Cronbach α coefficient, which ranges from 0 to 1. As shown in Table 3, all the Cronbach α values are above 0.7 which are acceptable for capturing the dimensions (Nunnally 1978).

Dimension	No. of items	Reliability coefficient

IT capability		
IT knowledge (ITKNO)	3	0.8952
IT operations (ITOPE)	4	0.8893
IT objects (ITOBJ)	5	0.9193
Information synergy		
Information dissemination (I_DISS)	3	0.8516
Information responsiveness (I_RESP)	4	0.8215
Shared interpretation (SHR_I)	2	0.8704
Innovativeness		
Product (PRODU_INN)	2	0.8763
Process (PROCE_INN)	4	0.9248
Personnel (PERSON_INN)	4	0.8936
Service (SERV_INN)	2	0.9046

Table 3: Assessment of consistency reliability

The composite reliability of the three constructs as shown in Table 4 exceeded the threshold of 0.7 recommended by Nunnally (1978). Furthermore, the average variance extracted of each sub-construct exceeded the 0.5 threshold (Fornell and Larcker 1981), indicating that 50% or more variance of the indicators should be accounted for, which shows satisfactory convergent validity.

	Mean	SD	ITKNO	ITOPE	ITOBJ	I_DISS	I_RESP	SHR_I	PRODU_INN	PROCE_INN	PERSON_INN	SERV_INN	Composite[a]Reliability
ITKNO	3.55	0.84	**0.91[b]**										0.94
ITOPE	3.73	0.80	0.67	**0.87**									0.93
ITOBJ	3.92	0.89	0.61	0.71	**0.90**								0.95
I_DISS	3.78	0.69	0.52	0.51	0.30	**0.88**							0.91
I_RESP	3.63	0.82	0.37	0.28	0.14	0.73	**0.83**						0.90
SHR_I	3.69	0.68	0.41	0.55	0.38	0.66	0.55	**0.94**					0.94
PRODU_INN	3.15	0.89	0.52	0.55	0.36	0.68	0.54	0.60	**0.88**				0.92
PROCE_INN	3.21	0.77	0.50	0.60	0.41	0.75	0.57	0.70	0.82	**0.89**			0.96
PERSON_INN	3.58	0.75	0.53	0.54	0.39	0.80	0.68	0.72	0.74	0.81	**0.82**		0.91
SERV_INN	3.36	0.86	0.48	0.46	0.34	0.70	0.55	0.67	0.71	0.76	0.83	**0.92**	0.95

[a]Composite reliability is estimated using $(\Sigma\lambda y_i)^2/[(\Sigma\lambda y_i)^2+(\Sigma\varepsilon_i)]$; where $\lambda y_i$is the standardized loading for scale item y_i and $\varepsilon_i$is the measurement error for thescale item y_i.

[b]Average variance extracted is estimated using $\Sigma\lambda y_i^2/(\Sigma\lambda y_i^2+\Sigma\varepsilon_i)$ (Fornell and Larcker 1981.) The diagonal elements represent the square root of the AVEs of the construct, while the other matrix elements represent the correlations with other latent constructs.

Table 4: Test of Reliability, Convergent and Discriminant Validity
(Note: Please refer to Table 3 for the meanings of acronyms.)

Content validity and discriminant validity

Content validity was established through several preliminary interviews with seven experts. As shown in Table 4, the correlations between any two constructs was lower than the corresponding square root of the average variance extracted of the constructs, indicating that each scale was measuring a construct that was significantly different from all other constructs, thus establishing discriminant validity (Fornell and Larcker 1981).

Summary statistics and correlation analysis

After confirming the validity of data and model, we began to perform data analyses for the three research variables using the composite average of the sub-construct scores as the construct's score. Similarly, the sub-construct score was the composite average of the item scores. The summary statistics and the correlations of the research variables, based on the composite average scores, are shown in Table 5. The scores of the three variables are plotted in Figure 2, in sequence of the values of information-synergy scores. A scrutiny of Figure 2 reveals that most of the IT capability scores are higher than the information synergy scores, while most of the innovativeness scores are lower. The scores of IT capability and innovativeness are mostly far apart. Table 5 also shows that the correlation coefficient of information synergy and innovativeness is the highest (.823) among the three paired variables, followed by IT capability and innovativeness (.582) and information synergy and IT capability (.485). The three t-tests of paired variables indicate that the differences of all three pairs of means were significant at $p<0.001$. The highest mean difference is between IT capability and innovativeness (0.4091), followed by information synergy and innovativeness (0.3765) and then information synergy and IT capability (0.0326). All these findings confirm our argument about information synergy being a better indicator than IT capability for innovativeness.

Variable	Description	Summary statistics	IT capability	Information synergy	Innovativeness
IT capability	N	76			
	Mean	3.7327			
	Standard deviation	0.74411			
	Pearson correlation		1.000	0.485a	0.582a
	Sig. (2-tailed)			0.000	0.000
Information synergy	N	76			
	Mean	3.7000			
	Standard deviation	0.6368			
	Pearson correlation		0.485a	1.000	0.823a
	Sig. (2-tailed)		0.000		0.000

Innovativeness	N	76			
	Mean	3.3236			
	Standard deviation	0.7451			
	Pearson correlation		0.582a	0.823a	1.000
	Sig. (2-tailed)		0.000	0.000	

[a]*Correlation is significant at the 0.01 level (2-tailed).*

Table 5: Summary statistics and correlations of research variables

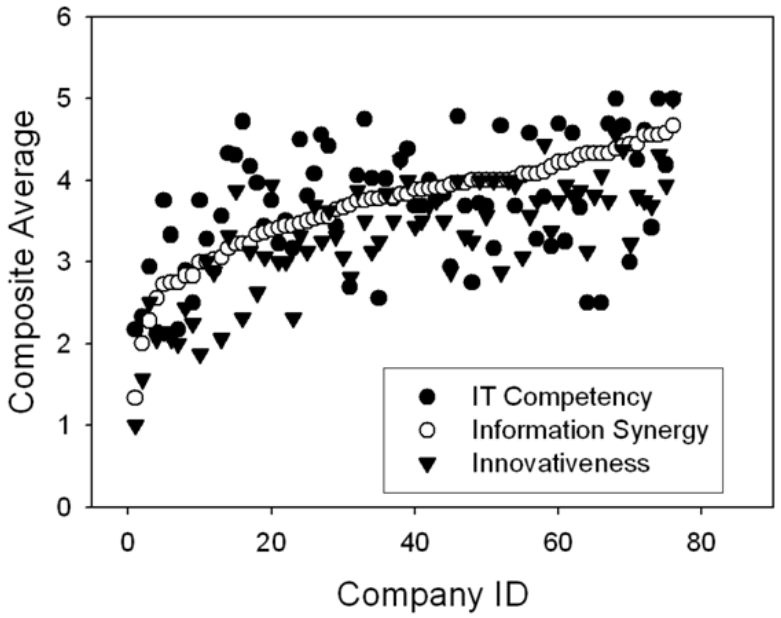

Figure 2: Information synergy as the mediator

The structural model

According to Bollen (1989), once the measurement parameters are identified during the first step, the whole model is identified if the latent variable model parameters can be identified. Therefore, we conducted the second step of the structural modelling based on our research model. Figure 3 shows the path loadings between constructs, the standardized loadings of scale items within two reflective constructs (IT capability and Innovativeness) and the weights of scale items within one formative construct (Information synergy). The reflective variables (also called effect indicators) are reflected by the latent variables and should be highly correlated with each other. The formative variables (called cause indicators) could determine the latent variables and should not be correlated (Chin 1998b; Blalock 1964). Based on the t-statistics, all the sub-constructs have either high loadings or high weights significant at $p<0.001$ level, except from information responsiveness to information synergy. Other results show that IT capability accounts for 32.3% of the variance in information synergy, while IT capability and information synergy account for 74% of the variance in innovativeness underlying the structural model. Since the PLS method makes no prior distributional assumptions, traditional significance tests and estimation of confidence intervals for the path coefficients cannot be done. However, the bootstrapping and jack-knifed estimates of mean, standard errors and t-statistic can be used to test the significance of the structural coefficients (Chin 1998a).

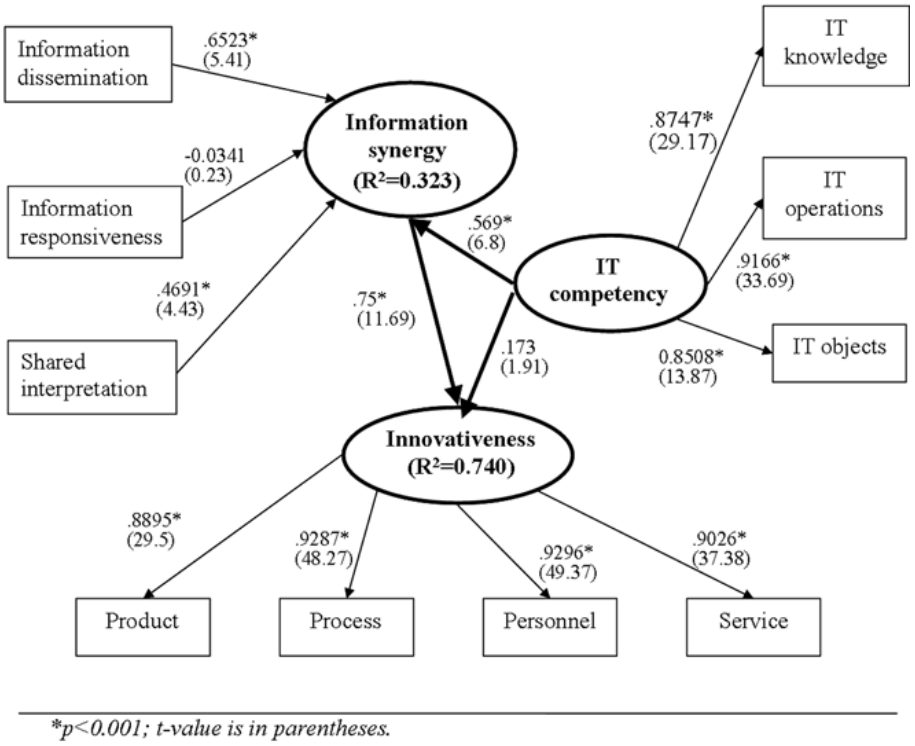

Figure 3: Structural equation modelling analysis result

Based on Baron and Kenny (1986), the following conditions must be satisfied for the mediation test and the related test result is shown in Table 6. First, the direct effect of the independent variable (IT capability) on the dependent variable (innovativeness) must be significant. Second, both the path from the independent variable (IT capability) to the mediator (information synergy) and the path from the mediator (information synergy) to the dependent variable (innovativeness) should be significant. Third, the introduction of a mediator will lower the path loading between the independent variable (IT capability) and dependent variable (innovativeness). Furthermore, if the path loading is not significant, the mediator has a fully-mediated effect; otherwise the effect is partially mediated. Therefore, our proposed model is a fully mediated model. The finding indicates that information synergy is an essential mediator; IT capability would not have a significant effect on innovativeness without information synergy. The results of three possible models are shown in Table 6.

Path			Direct effect	Full mediation	Partial mediation
			standard path coefficient (t-value)	standard path coefficient (t-value)	standard path coefficient (t-value)
Hypothesized paths					
IT capability	⟶	Innovativeness (H3)	0.581 (8.2794)a		0.173 (1.91)
IT capability	⟶	Information synergy (H1)		0.581 (8.2794)a	0.569 (7.8296)[a]
Information synergy	⟶	Innovativeness (H2)		0.849 (24.445)a	0.750 (10.8451)[a]
R2 (Information synergy)				0.325	0.323
R2 (Innovativeness)			0.337	0.72	0.74
[a]*p<0.001 (t value)*					

Table 6: Results of structural equations analyses for direct effect, full mediation and partial mediation models

Conclusions and implications

Previous research has revealed that IT investment has positive impact on a firm's output and productivity in the manufacturing sector but not in the service sector (Brynjolfsson 1993). This phenomenon might be because the amount of IT investment cannot represent the substance of IT value and that the effect of that investment is predicated upon how well IT is used for strategic gains. Consequently, in this study we focus on exploring the effect of IT capability instead of IT investment. We further propose the role of information synergy as the catalyst between IT capability and a firm's innovativeness. The empirical evidence of Italian banks suggests that the development of IT capability, such as creating an Intranet to serve as a repository and communication tool, can support the redefinition of the overall strategy of the bank. Furthermore, cultural integration of the branch network and a life-long training process have been conducted to sustain the banks' large scale network (Canato and Corrocher 2004). Despite the fact that the financial service industry is one of the early adopters of new information technologies, the effect of IT capability on firm performance is inconclusive in the service sector in general, which is contrary to its manufacturing counterpart (Brynjolfsson 1993). Therefore, we chose the financial service sector as our target sample to evaluate our proposed mediation model and to verify two propositions from Li *et al.* (2006). The empirical results of this study provide the following conclusions.

First, we considered the importance of intangible elements in the service sector and introduced the concepts of IT capability, information synergy and innovativeness. Our data analysis confirmed the reliability and validity of the construct of IT capability. Moreover, we modelled IT capability and innovativeness as reflective constructs and information synergy as a formative construct. The entire research model is divided into and analysed with a measurement model and structural model. Then, we analysed the entire research model with Partial Least Squares software once the measurement model was validated.

Second, after reviewing the literature, we argued for the effect of information synergy and proposed information dissemination, information responsiveness and shared interpretation as its three main components. The reliability and validity of the construct of information synergy were supported by the analysis. However, the result of the structural model analysis shows a low weight of information responsiveness, which means that the composite construct of information responsiveness is not a good indicator for information synergy. That is, we should not pay much attention to the speed for transmitting information in the organization.

Third, we adopted innovativeness as the pre-performance measure of firm performance, instead of traditional financial performance indices, such as return on investment and return on assets. In addition, we proposed four types of innovativeness: product, process, personnel and service innovativeness. We have verified that this construct of innovativeness possesses reliability and validity.

Fourth, we verified the validity of introducing information synergy as the catalyst between IT capability and innovativeness. According to our correlation analysis, IT capability has a significant correlation with innovativeness. However, the analysis shows that IT capability does not have a significant direct effect on innovativeness once information synergy is introduced into the model as a mediator. This suggests that information synergy is a better indicator of innovativeness.

The aforementioned findings and conclusions offer us several managerial implications. First of all, information synergy is the key to improving a firm's performance as represented by the level of innovativeness. Regardless of how large the size of IT investment is, what really matters is how well the IT is being used for sharing timely information and making the right business decisions. This is the condition where information synergy is achieved in a company. Therefore, information synergy is the lifeblood of firm performance; overlooking information synergy is likely to reduce the utility of IT capability and lower the level of innovativeness, which may eventually weaken the competitive advantage of the firm. In order to outperform its competitors, a firm must provide an environment for creating information synergy, instead of merely reinforcing their IT capability. One possible step toward information synergy is to implement an organization-wide knowledge management system, which involves knowledge creating, gathering, storing, communicating, synthesizing and disseminating activities.

Furthermore, this study provides valid instruments for measuring the constructs of IT capability, information synergy and innovativeness. These instruments are easy to administer. Both IT managers and business executives could periodically (e.g., quarterly or annually) perform self evaluations using these instruments. A trend chart could be plotted to track the changes. An item-by-item analysis could be performed to identify large decrements in the individual item scores and formulate actions to correct specific problems and improve the scores. This analysis could also help managers to prioritize action items and allocate appropriate resources to support the actions.

Limitations and future research

Though we tried to conduct our research analysis as thoroughly as possible, there are still some limitations. First, the respondents to our questionnaire were IT managers, which might not represent all employees in the sampled companies. In addition, although we have ensured the absence of common method bias, we could have avoided such a bias by collecting responses from multilevel sources in this study. Second, we only chose financial service firms as our samples from the service sector; this might overlook important information from other industry sectors. Future research should collect sample data from not only financial service firms but also other service or manufacturing sectors. This, in turn, could help us generalize our conceptual research model and the findings of our analyses. Third, since the sample data is a snapshot of the firms' conditions, we might have neglected the importance of the dynamic aspect. A longitudinal study is needed to trace the dynamics of business activities as time goes by. This will give us more clues to refine our research model. Finally, in addition to information synergy that we proposed as the mediator between IT capability and innovativeness, there might be some other factors worth considering, such as organizational culture and climate, top management support, education and training, etc. The mediating effects of these factors on innovativeness should be investigated in the future.

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Appendix A: Final survey items

IT capability

IT knowledge		**Sources**
*IT1_1	Overall, our technical support staff are knowledgeable when it comes to computer-based systems	Tippins and Sohi, 2003
IT1_2	Our firm possesses a high degree of computer-based technical expertise.	
IT1_3	We are very knowledgeable about new computer-based innovations.	
IT1_4	We have the knowledge to develop and maintain computer-based communication links with our customers.	
IT operations		**Sources**
*IT2_1	Our firm is skilled at collecting and analysing market information about our customers via computer-based systems.	Tippins and Sohi, 2003
*IT2_2	We routinely utilize computer-based systems to access market information from outside databases	
IT2_3	We have set procedures for collecting customer information from online sources.	
IT2_4	We use computer-based systems to analyse customer and market information.	
IT2_5	We utilize decision-support systems frequently when it comes to managing customer information	
IT2_6	We rely on computer-based systems to acquire, store and process information about our customers.	
IT objects		**Sources**
IT3_1	Our company has a formal MIS department.	Tippins and Sohi, 2003
IT3_2	Our firm employs a manager whose main duties include the management of our information technology.	
IT3_3	Every year we budget a significant amount of funds for new information technology hardware and software	
IT3_4	Our firm creates customized software applications when the need arises.	
*IT3_5	Our firm's members are linked by a computer network	

Information synergy

Information dissemination		**Sources**
ID1	Within our firm, sharing customer information is the norm	Tippins and Sohi, 2003
ID2	Within our firm, information about our customers is easily accessible to those who need it most.	
ID3	Representatives from different departments within our firm meet regularly to discuss the customers? needs.	
Information responsiveness		**Sources**
IR1	When one department obtains important information about our customers, it is circulated to other departments.	Ridings, Gefen and Arinze, 2002
IR2	The people on the bulletin board are very responsive to my posts.	
IR3	I can always count on getting responses to my posting fairly quickly.	
IR4	Most employees can respond quickly when receiving outside inquiries.	Gefen and Ridings, 2002
Shared interpretation		**Sources**
Shri1	When managers have different opinions about an issue, they tend to resolve the differences eventually.	Tippins and Sohi, 2003
Shri2	Managers in our firm tend to agree on how to make the best decision.	

Innovativeness

Product innovativeness		**Sources**
*Prod1	The company has different technical characteristics or specifications for different products.	Garcia and Calantone, 2002
Prod2	The company frequently introduces new classes of products.	
Prod3	The company offers products that are more complex than others which were introduced into the same market.	
Process innovativeness		**Sources**
Proc1	The company adopts new production processes.	Garcia and Calantone, 2002
*Proc2	The company's product technology is new to the customer	
Proc3	The company often adopts new policies and procedures.	Subramanian and Nilakanta, 1996
Proc4	Compared to other companies, this company usually adopts a new system earlier.	

Proc5	Within the company, managers are consistently concerned about innovation issues.	
Personnel innovativeness		**Sources**
Pers1	Change in organizational structure occurs very often in the company.	Totterdell, etc., 2002
Pers2	The company encourages employees to apply innovative ways to improving work processes.	This study
Pers3	Employees can apply new concepts and technology to their jobs in the company.	
*Pers4	Laying off unsuitable employees is a routine job in the company.	
Pers5	On-the-job training is a routine in the company.	
Service innovativeness		**Sources**
Serv1	The company often attracts new customers/clients.	Garcia and Calantone, 2002
Serv2	The company often adopts new marketing approaches (e.g., customer contacts, advertising promotions, etc.)	
*Serv3	The company clearly identifies and satisfies new customer/client needs.	

These items have been deleted because their loadings were less than 0.6 after assessing the fit of each measurement model.

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