Information & Management 49 (2012) 142–150

Contents lists available at SciVerse ScienceDirect

Information & Management

journal homepage: www.elsevier.com/locate/im

The synergistic effects of IT-enabled resources on organizational capabilities and firm performance

Jian-Liang Chen *

Department of Information Management, National Penghu University of Science and Technology, No. 300, Liu-Ho Rd., Makung City, Penghu County 88046, Taiwan, ROC

ARTICLE INFO

Article history:
Received 26 April 2010
Received in revised form 30 July 2011
Accepted 22 January 2012
Available online 10 March 2012

Keywords:
IT value
IT resource synergy
Organizational capability
Resource based view of the firm

ABSTRACT

Computing the value of IT investments and clarifying how the portfolio of IT/IS resources affect a firm's performance and sustainable competitive advantage are critical issues today. We attempted to develop an effective measurement technique and use organizational theory to discover the strategic role of IT-enabled resources in the firm's competitive agenda. Based on a resource-based view of the firm, we proposed a way to evaluate the synergistic effect of such resources on the firm's capabilities, as they, influence the firms' strategic objectives and improve its financial performance. The technological, human, and organizational resources work together to generate sub-additive cost and super-additive value synergies. Operations, R&D, and marketing capabilities allow firms to implement a business strategy that reflects its customer needs. A survey was conducted to check our framework. Our findings should provide valuable decision guides for practitioners when choosing a portfolio of IT/IS resources for implementing business strategies.

1. Introduction

Investment in IT resources has long been assumed to be essential in providing competitive advantage by implementing the firm's business strategies [17,19]. IT innovations used in the automation and reengineering of organizational processes have reformed customer-centric services and reduced cost, etc.

From a resource-based view (RBV), the firm can sustain its competitive advantages if it possesses valuable, rare, non-substitutable, and inimitable resources [25]. Nowadays, packaged applications or back-office suites are available in the open market. Such commodities are easy to adapt in the firm without much, if any, rework. However many have asked whether IT commodities can provide sustainable competitive advantage because they are easy to replicate in a competing firm. Even worse, firms may overspend if the resource is neither rare nor highly relevant to strategic advantage.

This point of view ignores the fact IT innovations may be fundamental drivers of organizational transformation for successful business outcomes [5]. Hence, the evaluation of IT should focus on the planning, execution, and management of all investments. Accordingly, a firm should (1) ensure that IT investments meet the strategic objectives of the new business model; (2) be innovative by continuously reviewing a firm's dynamic capabilities to cope with the transformation of industry; and (3) tightly interact IT resources with others to maximize the overall value. Thus, the IT business value model must compute the value that the impact has on the organization' bottom line [12].

However, many questions remain and need to be answered:

(1) When IT-dependent and complementary organizational resources are deployed in the business, how does the synergy between the resources affect organizational transformation?
(2) How is a general intermediate web formed to improve the financial performance of the organization?
(3) How can the firm examine and link dominant dynamic capabilities to fit the firm's sustainable strategic objectives and financial performance without producing causal ambiguity and social complexity [20]?

Accordingly, we hoped to develop a model for exploring the underlying mechanisms linking the synergistic effects of IT-enabled resources to organizational capabilities and firm performance. IT resources and complementary organizational resources are its first-tier factors. They also act as primary inputs in increasing organizational capabilities which help to create and deliver customer and shareholder value.

2. The research model

2.1. Strategic objectives and financial performance

Continuously improving financial performance (measured as a rate of a firm's ROI) and producing above-average economic rents are generally the goals of profit-seeking enterprises. Thus, a firm

* Tel.: +886 6 9264115x5624; fax: +886 6 9277401.
E-mail address: jacoblight@npu.edu.tw.

0378-7206/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
doi:10.1016/j.im.2012.01.005

should either introduce productivity strategies to boost financial outcomes, or adopt revenue-growth strategies to enhance profitability.

Firms adopting a productivity strategy are usually sensitive to changes in their competitors' positions. They need to reexamine organizational structure, routines, tasks, and resource utilization periodically and actuate organizational change schemes, e.g. TQM and BPR. These make productivity a short-term competitor-oriented strategy because a firm's capability in operations is usually not sustainable.

In contrast, a revenue-growth strategy focuses on long-term sales and profit growth by increasing revenue and improving profitability. This strategy tends to focus externally, stressing a need to be aware of the market and change to consumer needs; it can be viewed as a long-term customer-oriented strategy, because firm-specific capabilities in product leadership and customer care are valuable, rare, non-substitutable, and thus inimitable.

Developing a business strategy should include differentiating customer value propositions that become strategic objectives of the firm [7]. Firms have to excel at the favorite disciplines while meeting threshold standards in the others. Operational excellence involves a set of strategic approaches that produce and deliver goods and services efficiently and flexibly. The firm should improve its productivity and obtain financial benefits from cost savings [16]. Product leadership is achieved when a firm continuously offers leading-edge products or services with great functionality, availability, quality and lower prices. A firm with product leadership will gain competitive advantages and achieve greater revenue-growth through differentiating its products or services from those of competitors. Based on these concepts, we posited that:

H1. The achievement of strategic objectives has a positive impact on financial performance.

2.2. Organizational capabilities

To gain sustainable competitive advantages and retain long-term survival, a firm needs to develop its controllable organizational resources and capabilities to satisfy the RBV of the firm. From this view of the firm, organizational capabilities enable a firm to sustain its competitive advantage as their development is best protected by isolating mechanisms such as socially complex, path-dependent, and unique historical conditions. Organizational resources are anything tangible or intangible that an organization uses to implement business strategies. Once a firm possesses the ability to integrate and utilize organizational resources to create customer and shareholder value, they become its core competencies [26].

Operations capability is a firm's ability to improve its business processes, manufacturing, and logistics to make a firm an efficient and effective provider with a minimum wastage of organizational resources [9,22]: disciplines such as JIT, Six Sigma, TQM, and BPR are ways to promote operations excellence [21]. For some industries, operations capability can be a source of competitive advantage. For example, a firm can make its operations capability inimitable and imperfectly mobile if the functions have great complexity and the firm can utilize process knowledge to create and refresh operations capability over time [10]. In this case, operations capability tends to be dynamic and complex and a source of sustainable competitive advantage.

An R&D capability allows a firm to develop and apply new technology to effectively invent new products and services. It also provides a means to innovate or redesign manufacturing processes that lower production costs and improve product quality. Through organizational learning, an R&D process can embed firm-specific knowledge, experience, and tacit knowledge that make the capabilities extremely difficult to imitate.

Marketing capabilities allow a firm to deepen its customer relationships, expand its market share, and enjoy greater financial gains. Because knowledge assets are tacitly held across several people or groups and needs to be developed over time, the development of marketing capability tends to be socially complex, path-dependent, and firm specific. Thus, we posited:

H2. Operations capability has a positive impact on strategic objective.

H3. R&D capability has a positive impact on strategic objective.

H4. Marketing capability has a positive impact on strategic objective.

2.3. IT-enabled resources

A firm must investment in training employees, enhancing IT, and aligning organizational routines to eliminate the gap between capabilities and needs for improved performance. However, organizational resources usually have limited effect on increasing the effectiveness of organizational capabilities. IT-enabled resources are assumed to be a force for organizational change in its operational and management practices. Strategic investments in IT-enabled resources also contribute to creativity in products and services [1,4]. They may also be critical to a firm's market-sensing and customer-linking ability [24]. They also improve a firm's ability to explore and exploit market opportunities and quickly respond to customer needs [13,18]; they are generally classified into technological IT resources (psychical IT assets and information repositories) and human IT resources (technical and managerial IT skills) and complementary organizational resources (non-IT resources that can interact with IT-dependent resources to generate synergy) [14].

IT resources help to improve most business functions [3]. However, research results on the relationship between technological IT resources and firm performance have been seen as paradoxical in many studies. IT resource relatedness can only serve as the source of temporary competitive advantages [23]. Individual dimensions of IT resources relatedness, however, can be integrated or combined with other non-IT resources into a complementary resource system that provides unique value to the firm. We therefore posited that:

H5. IT-enabled resources have impact of sub-additive synergy on operations capability.

H6. IT-enabled resources have impact of sub-additive synergy on R&D capability.

H7. IT-enabled resources have impact of sub-additive synergy on marketing capability.

H8. IT-enabled resources have impact of super-additive synergy on operations capability.

H9. IT-enabled resources have impact of super-additive synergy on R&D capability.

H10. IT-enabled resources have impact of super-additive synergy on marketing capability.

3. Research design

To test all our hypotheses, we conducted a survey to collect empirical data. Public manufacturing and service firms in Taiwan were used as survey subjects.

3.1. Instrumentation

The survey was made up of two-parts: the first gathered demographic information about the respondents, which included education level, age, working experience, and position, and their companies, such as industry type, annual revenue, and number of employees, while the second was a questionnaire whose answers were intended to measure the organization's IT-enabled resources, process capabilities, and strategic objectives using a 7-point Likert scale. The subjective measures of the questionnaire were adapted from prior studies and were the first-order constructs in our theory and all were composed of six measurement items. These constructs were then aggregated to become second-order constructs.

Constructs concerning technological IT resources, human IT resources, and complementary resources were developed based on the studies of Mata et al. [11], Melville et al., and Piccoli and Ives [14]. Three individual constructs were modeled as the antecedents of each organizational capability to examine the effects of *sub-additive* synergies, because they generally arise from individual dimensions of IT resources. In contrast, a reflective second-order factor was used to capture the effects of *super-additive* synergies among the three constructs because they generally arise from complementarity of the three constructs. A reflective second-order factor modeling approach was appropriate for capturing complementarities because it assumed that the first-order factors interacted or were correlated.

Operations capability, R&D capability, and marketing capability were posited as independent constructs and therefore did not need to be correlated. They were adapted from the studies of Dutta et al. [6], Kotabe et al. [8], Tan et al., and Krasnikov and Jayachandran. Finally, strategic objectives of firms were measured in three dimensions: operational excellence (items concerning operating cost and asset utilization), product leadership (items about leading products and superior services), and customer relationships (items concerning customer satisfaction and loyalty).

When the predictor and criterion variables are obtained from the same source, it is possible to introduce common method biases [15]. Thus, a technique of counterbalancing question order and psychological separation of measurement was used to avoid it. Two batches of the questionnaires with counterbalancing order were designed. Each construct was re-specified by a cover story page to make it appear that the measurement was not connected to other constructs in order to create a psychological separation. Then the empirical data of the firms' financial performance were extracted from public information issued by the Taiwan Stock Exchange Corporation in May 2011. Six objective metrics were used for financial performance: return on total assets, return on shareholders' equity, operating income to paid-in capital, profit before tax to paid-in capital, net profit to sales, and earnings per share (in NT Dollars).

Pretest of the questionnaire was performed in two steps to eliminate possible weakness and flaws in the questionnaire design. The first pretest was performed with EMBA students to refine the questionnaire items, especially the terminology and language used in high-tech manufacturing. In this step, the questionnaire was prepared in Chinese. The second pretest was performed with researcher's colleagues from the Information Management Department of National Penghu University. The members of an expert panel tested the final version and made minor revisions of the wordings and expressions. They were also asked to examine the translation between Chinese and English. In this step, the questionnaire was prepared in both Chinese and English.

3.2. Sample organizations and respondents

Because our study was intended to clarify the role of IT-enabled resources in the cultivation of organizational capabilities and implementation of competitive strategies, the companies that have made large IT investments for several years were the appropriate research population. Therefore the top 1500 high-tech manufacturing firms of Taiwan were selected as the research population—selected from the list of public firms published by the Taiwan Stock Exchange Corporation in the year 2010. The top managers of these firms included chief CEOs, general managers, CFOs, and operational executives. These people were mainly responsible for conceiving of implementing the firm's competitive agenda. The basic information of the firms, are made public in a web site, and thus, it was convenient to conduct a mail survey to collect data.

Altogether 1475 questionnaires were successfully sent to the potential respondents. In order to improve survey return, a follow-up procedure was initiated by sending another round of mail for non-respondents after 2–3 weeks. Ultimately, 233 valid questionnaires were returned resulting in a response rate was 15.8%. To check systematic non-response bias, the respondent samples were divided into early and late groups. These two were correlated by their demographics. Because the correlations for all characteristics were insignificant, there was no systematic non-response bias. To ensure that the survey process had not caused a selection bias among respondents, distributional statistics of early and late groups were compared using χ^2 tests. These showed that the characteristics of respondent firms were all the same. Table 1 summarizes the demographics of sample firms and respondents.

3.3. Scale validation

SmartPLS was used to evaluate the psychometric properties of the scales and test our hypotheses. This employs a nonparametric and component-based approach for estimation purposes, allowing latent variables to be modeled as either formative or reflective constructs, with minimal demands on sample size and residual distributions. SmartPLS allows users to estimate both parameters of measurement and of structural models together. The relative statistics are re-arranged into two parts in terms of the requirements of measurement and of structural models. The measurement model is used to assess convergent and discriminant validity, while the structural model is used to estimate the path coefficients and variances explained within the research model. Because PLS did not provide significant test and estimation of confidence intervals, a bootstrapping algorithm with 100 sub-samples was used to compute means, standard errors, and significance for item loadings, item weights, and path coefficients.

The measurement model was built to assess convergent and discriminant validity of first-order constructs. Each first-order construct was modeled as a reflective latent construct accounting for its indicators. Convergent validity was assessed by three criteria: (1) all item loadings (λ) should be statistically significant and exceed 0.70 and, (2) composite reliability for each construct should exceed 0.70 and e interpreted like a Cronbach's coefficient, and (3) average variance extracted (AVE) for each construct should be larger than 0.50. Next, discriminant validity between constructs was assessed using the criterion that the square root of AVE for each construct should exceed the correlations between that and all other constructs. As shown in Table 2, standardized item loadings ranged from 0.72 to 0.96, composite reliability ranged from 0.93 to 0.96, and average variance extracted (AVE) ranged from 0.68 to 0.78. All therefore exceeded the minimum loading criterion of 0.71 and were significant at $p < 0.001$. Composite reliabilities of all factors exceeded the minimum requirement of 0.70, and all AVE values were greater than the normal 0.50 cut-off. The results indicated all first-order constructs had a high degree of reliability and convergent validity. In Table 3, the square root of AVE for each

Table 1
Demographics of sample firms and respondents.

Firm Characteristics	Frequency	Percent	Respondent characteristics	Frequency	Percent
Industry types			**Gender**		
Information and electronics	131	56.2	Female	55	23.6
Traditional manufacturing	63	27.0	Male	178	76.4
Biochemistry	25	10.7			
Others	14	6.0	**Age**		
Annual revenue (NTD)			<30	11	4.7
<1000M	65	27.9	30–39	58	24.9
1000–2999M	62	26.6	40–49	105	45.1
3000–9999M	67	28.8	≥50	59	25.3
10,000–29,999M	27	11.6	**Working experience**		
≥30,000M	12	5.2	<10	45	19.3
No. of employees			10–19	96	41.2
<100	33	14.2	20–29	74	31.8
100–299	78	33.5	≥30	18	7.7
300–999	74	31.8	**Education level**		
1000–2999	28	12.0	High school	5	2.2
3000–10,000	15	6.4	College	134	57.5
>10,000	5	2.2	Graduate college	86	36.9
			Ph.D.	8	3.4
			Position		
			Chief executive officer	94	40.3
			Operational executive	60	25.8
			Chief financial officer	40	17.2
			Specialist or special assistant	21	9.0
			Other	18	7.7

Table 2
Assessment of convergent validity.

Constructs	No. of items	Item loading	Cronbachs Alpha	Composite reliability	AVE
Technological IT resources	6	0.78–0.89	0.92	0.94	0.73
Human IT resources	6	0.82–0.91	0.94	0.95	0.77
Complementary organizational resources	6	0.74–0.89	0.90	0.93	0.68
Operations capability	6	0.85–0.91	0.94	0.95	0.77
R&D capability	6	0.79–0.89	0.92	0.94	0.72
Marketing capability	6	0.72–0.92	0.92	0.94	0.73
Strategic objectives	6	0.86–0.88	0.93	0.95	0.75
Financial performance	6	0.80–0.96	0.87	0.96	0.78

construct exceeded its correlations with all other constructs. Thus, all constructs met the criterion for discriminant validity.

Finally, Harman's one-factor test and CFA were conducted to test the presence of common method effect. The principal component factor analysis with direct rotation revealed the presence of eight distinct factors with eigenvalue greater than 1.0. These eight together accounted for 76.5% of the total variance and the first factor did not account for a majority of the variance (37.8%). Thus, no general factor was apparent. Moreover, the CFA showed that the single-factor model did not fit the data well ($\chi^2 = 2442$, $p = 0.000$, RMR = 7.28, GFI = 0.70 AGFI = 0.66, RFI = 0.78, and RMSEA = 0.08).

3.4. Hypotheses testing

The structural model was built to examine the causal structure of the research model. Though PLS has the ability to model latent variable as either formative or reflective constructs,

Table 3
Assessment of discriminant validity.

	TR	HR	CR	OP	RD	MK	OBJ	FP
TR	**0.85**							
HR	0.30	**0.88**						
CR	0.45	0.42	**0.83**					
OP	0.54	0.43	0.38	**0.88**				
RD	0.30	0.54	0.53	0.46	**0.85**			
MK	0.34	0.49	0.56	0.63	0.53	**0.85**		
OBJ	0.45	0.54	0.57	0.59	0.61	0.65	**0.87**	
FP	0.14	0.23	0.24	0.22	0.11	0.17	0.32	**0.88**

The diagonal values are the square root of the AVE for each construct.
TR: Technological IT Resources, HR: Human IT Resources, CR: Complementary Organizational Resources, OP: Operations Capability, RD: R&D Capability, MK: Marketing Capability, OBJ: Strategic Objectives, FP: Financial Performance.

all of the first-order constructs in our research model were depicted as reflective latent constructs accounting for indicators. Our decision to model a latent variable as a formative construct followed four major criteria: (1) the indicators were assumed to cause a latent variable, (2) the indicators need not be interchangeable, (3) correlations among indicators were not necessary, and (4) the nomological net of indicators could differ. However, if the opposite conditions were met, a latent variable was modeled as a reflective construct. In our study, IT resource complementarity was modeled as reflective second-order constructs.

The evaluation of the structural model was carried out in three steps. First, the standardized path coefficient and its statistical significance for each cause-effect relationship in the structure model were examined. Bootstrapping analysis was done with 100 subsamples to estimate the path coefficients and significance. Second, the *R*-square coefficient for each endogenous construct was calculated to assess the predictive power of the structural model. The *R*-square coefficients obtained from PLS analyses are similar to those found in multiple regression analyses. Finally, the relative importance of each antecedent construct in affecting dependent latent variable was assessed in terms of its item loading.

Figs. 1 and 2 show the results of the analysis for the two structural models. In them, strategic objective has shown a significant effect on financial performance. The effect of strategic objective had significant path coefficients with values of 0.32 and explained about 11% of the variance in financial performance. This showed that the achievement of strategic objectives determined the improvement of financial performance.

Operations, R&D, and marketing capabilities all affected the firm's strategic objective. They had significant path coefficients and jointly explained about 57% of the variance in the strategic objective. Operations capability had a weaker effect than R&D and marketing capabilities. This indicated that R&D and marketing capability were important in achieving strategic objectives. Thus, hypotheses 1, 2, 3, and 4 were supported.

In the sub-additive model, technological IT resource and human IT resource are two salient antecedents of operations capability; they had significant path coefficients with values of 0.43 and 0.27, respectively and jointly explained 39% of the variance in operations capability. R&D capability is motivated by human IT resource and complementary organizational resource; they obtained significant effects of 0.39 and 0.36, respectively and explained about 41% of the variance in R&D capability. Similarly, human IT and complementary organizational resources also had significant effect on marketing capability they had significant path coefficient with values of 0.32 and 0.40, respectively and explained 43% of the variance in marketing capability. Technological IT resource had no significant impact on R&D and marketing capabilities. This result agrees with the findings of prior research. Thus, hypotheses 5, 6, and 7 were only partially supported.

In the super-additive model, technological IT resource, human IT resource, and complementary organizational resource had significant item loadings; they also had significant correlations between each other. Thus technological IT, human IT, and complementary organizational resources work together to generate IT synergies when they are tightly intertwined. This shows that IT resource complementarity is an enabler of organizational capabilities that utilize them to deliver customer value and renew a firm's business processes and organizational structure through organizational learning. Thus, hypotheses 8, 9, and 10, were fully supported.

To test the mediated effect of organizational capabilities, a non-mediated model was built based on the super-additive model. An additional path linking IT resource complementarity to financial performance was added. Fig. 3 shows the result of the analysis for this model. Obviously, IT resource complementarity had no significant direct impact on financial performance.

4. Discussion

4.1. The achieving of strategic goals and firm performance

In our models, achieving strategic objectives was significant and had a positive impact on a firm's financial performance.

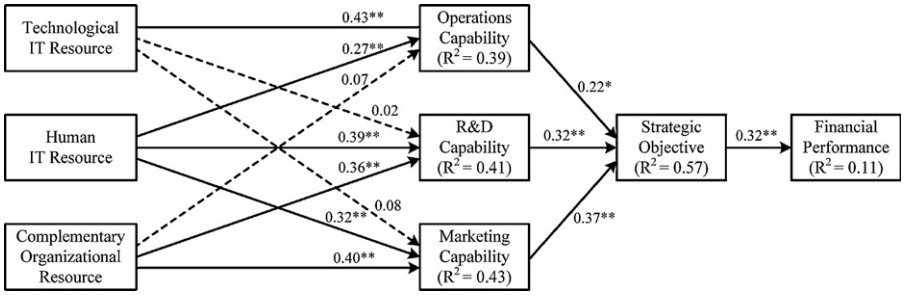

Fig. 1. The sub-additive effects of IT resources.

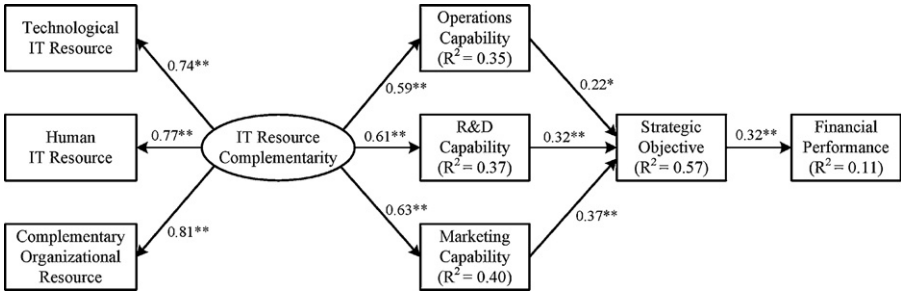

Fig. 2. The super-additive effects of IT resources.

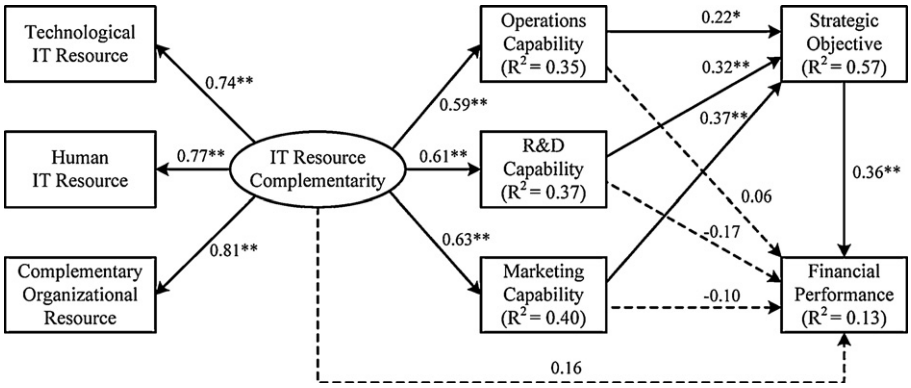

Fig. 3. Test the mediated effect of organizational capabilities.

However it is only after competitive strategies been successfully implemented and their objectives achieved that a firm can reach superior competitive position and gain sustained long-term advantage.

Operations capabilities are generally the enablers of operational excellence. Thus, firms may adopt certain process improvement techniques to promote operational excellence. However, operations capabilities can only conduce to temporal competitive advantage. Firms must cultivate R&D capabilities to maintain product leadership over competitors. Through continual innovation, firms will be able to shorten product development cycles, satisfy consumer demands, improve organizational flexibility, and response to variable environment.

To foster marketing capabilities, corporations need to be sensitive to changes in market environment and customer expectations. A superior marketing capability will enable firms to respond to customer requests or complaints.

4.2. IT resource synergies

IT resources have long been assumed to be the important factor affecting organizational change [2], but this really concerns the interaction of technology, tasks, people, and the organizational structure. Failure to manage these interactions can lead to their underutilization. As the rapid development of internet and mobile communication technologies, economic and industry environments have been undergoing dramatic changes. IT has significantly transformed the way a firm conducts business. The new business models allow firms to reach more potential customers, direct access to more customer information, remove restrictions on time and place of sales, and increase the timeliness and ability to respond to customers. Organizational members should have superior technical and managerial IT skills to rebuild business process, reshape organizational structure and culture, and respond to environment changes.

Comparing our sub and super-additive models, IT resources complementarity has stronger impact on operations, R&D, and marketing capabilities than their individual effects. They all are indispensable strategic resources for firms wishing to gain sustainable competitive advantage.

5. Conclusion

Our study explored the strategic value of IT-enabled resources and the effects of IT investments on firm performance from the RBV of the firm. IT-enabled resources were found to have significant sub-additive and super-additive synergistic effects on organizational capabilities. Because these are essential to create customer value and implement competitive strategies, IT-enabled resources are possible sources of sustainable competitive advantages.

For practitioners, our models provide an integrated view of overall organizational performance to help them make appropriate decisions about the use of IT-enabled resources. For researchers, our study provides a useful framework for identifying the pathway of effect from IT-enabled resources to firm performance. Due to organizational learning and adjustment, IT investments may take time to foster IT-enabled resources, leverage organizational capabilities, and achieve business goals before gaining major financial outcomes. Quantitative financial performance may be finally attained if firms possess superior organizational capability and are able to achieve their strategic objectives successfully.

5.1. Limitation of our study

Because the research population was in one industry and the empirical data were collected during a specific period of time, our study has some limitations. First, all empirical data were collected in the third quarter of 2010, whereas the financial performance was collected in the second quarter of 2011. The time interval between these events spans only half a year but the qualitative metrics were mostly *leading* indicators, whereas the financial metrics were *lagging* ones. Thus, the realization of financial performance is generally later by one or more years. In contrast, the strategic objectives of business are mid to long-term metrics that will be consistently influenced by qualitative metrics and impact the financial performance of business. Therefore, H1 to H4 were supported in our study.

The surveyed population was mainly from high-tech manufacturing in Taiwan: 56% were in information and electronics companies and 10% in biochemistry companies. Thus, our conclusions are applicable to high-tech manufacturing and may not be true in others. Nevertheless, high-tech manufacturers still rely on operational excellence to achieve cost strategy and gain competitive advantage. For instance, the high-tech OEM/ODM companies of Taiwan can continuously upgrade and improve their manufacturing processes to provide higher yield and lower production cost. Because of the complexity of high-tech manufacturing processes, the operations capabilities of OEM/ODM companies are difficult to imitate, and consequently a source of sustainable competitive advantage.

Acknowledgement

This study is funded by National Science Council, Taiwan, ROC, under grant number NSC 98-2410-H-346-004 -MY3.

Appendix A. Factor structure matrix of loadings and cross-loadings

	TR	HR	CR	OP	RD	MK	OBJ	FP
tr1	**0.78**	0.26	0.42	0.46	0.31	0.29	0.39	0.14
tr2	**0.89**	0.27	0.38	0.44	0.18	0.23	0.36	0.12
tr3	**0.85**	0.22	0.40	0.54	0.25	0.34	0.42	0.08
tr4	**0.88**	0.25	0.31	0.47	0.21	0.30	0.39	0.12
tr5	**0.85**	0.25	0.35	0.40	0.20	0.24	0.32	0.10
tr6	**0.87**	0.28	0.47	0.47	0.37	0.34	0.41	0.15
hr1	0.24	**0.91**	0.35	0.37	0.50	0.40	0.47	0.21
hr2	0.22	**0.91**	0.33	0.34	0.47	0.45	0.45	0.18
hr3	0.15	**0.87**	0.39	0.29	0.47	0.43	0.41	0.23
hr4	0.22	**0.89**	0.31	0.37	0.45	0.44	0.45	0.19
hr5	0.37	**0.87**	0.41	0.42	0.46	0.43	0.50	0.17
hr6	0.38	**0.82**	0.41	0.48	0.52	0.45	0.57	0.23
cr1	0.28	0.37	**0.81**	0.27	0.40	0.42	0.42	0.20
cr2	0.42	0.24	**0.78**	0.29	0.44	0.38	0.37	0.07
cr3	0.39	0.44	**0.89**	0.38	0.47	0.53	0.55	0.27
cr4	0.33	0.21	**0.74**	0.22	0.43	0.35	0.45	0.17
cr5	0.48	0.43	**0.87**	0.37	0.43	0.54	0.52	0.24
cr6	0.37	0.35	**0.86**	0.35	0.46	0.53	0.50	0.22
op1	0.50	0.37	0.37	**0.91**	0.34	0.58	0.54	0.22
op2	0.45	0.38	0.33	**0.91**	0.46	0.54	0.54	0.15
op3	0.51	0.37	0.40	**0.85**	0.41	0.53	0.48	0.16
op4	0.47	0.39	0.27	**0.88**	0.37	0.47	0.52	0.24
op5	0.46	0.36	0.29	**0.88**	0.42	0.56	0.49	0.19
op6	0.49	0.39	0.37	**0.85**	0.42	0.64	0.54	0.18
rd1	0.21	0.40	0.41	0.32	**0.84**	0.35	0.51	0.07
rd2	0.28	0.45	0.48	0.44	**0.89**	0.49	0.55	0.06
rd3	0.36	0.49	0.57	0.40	**0.88**	0.46	0.49	0.13
rd4	0.22	0.51	0.42	0.40	**0.79**	0.44	0.50	0.11
rd5	0.23	0.48	0.44	0.40	**0.80**	0.51	0.56	0.13
rd6	0.21	0.43	0.39	0.38	**0.88**	0.43	0.51	0.05
mk1	0.37	0.57	0.52	0.44	0.52	**0.72**	0.67	0.19
mk2	0.26	0.35	0.45	0.56	0.41	**0.89**	0.53	0.20
mk3	0.27	0.41	0.49	0.56	0.45	**0.92**	0.54	0.15
mk4	0.25	0.39	0.44	0.56	0.46	**0.90**	0.50	0.12
mk5	0.23	0.38	0.43	0.59	0.43	**0.90**	0.55	0.09
mk6	0.39	0.47	0.54	0.53	0.46	**0.78**	0.60	0.15
obj1	0.35	0.47	0.52	0.51	0.59	0.58	**0.86**	0.20
obj2	0.40	0.48	0.54	0.46	0.51	0.56	**0.88**	0.26
obj3	0.47	0.57	0.55	0.54	0.52	0.56	**0.87**	0.27
obj4	0.38	0.41	0.40	0.57	0.51	0.59	**0.86**	0.27
obj5	0.36	0.43	0.49	0.53	0.56	0.57	**0.88**	0.31
obj6	0.37	0.44	0.45	0.47	0.51	0.53	**0.86**	0.37
fp1	0.12	0.21	0.24	0.21	0.11	0.15	0.30	**0.95**
fp2	0.09	0.18	0.19	0.19	0.11	0.12	0.25	**0.82**
fp3	0.14	0.20	0.21	0.19	0.12	0.19	0.28	**0.84**
fp4	0.14	0.19	0.23	0.19	0.11	0.17	0.30	**0.93**
fp5	0.10	0.23	0.15	0.16	0.02	0.10	0.25	**0.80**
fp6	0.15	0.20	0.24	0.20	0.11	0.18	0.32	**0.96**

TR: Technological IT Resources, HR: Human IT Resources, CR: Complementary Organizational Resources, OP: Operations Capability, RD: R&D Capability, MK: Marketing Capability, OBJ: Strategic Objectives, FP: Financial Performance

Appendix B. Questionnaire

Part I. Basic information

1. Type of industry: _____
2. Annual revenue (NT$ millions):
   ☐ Less than 100M ☐ 100M ~ 499M ☐ 500M ~ 999M ☐ 1,000M ~ 4,999M ☐ 5,000M~9,999M
   ☐ Equal to or greater than 100,000M
3. Number of employees (Persons):
   ☐ Less than 100 ☐ 100 ~ 499 ☐ 500 ~ 999 ☐ 1,000 ~ 4,999 ☐ 5,000 ~ 9,999 ☐ Equal to or greater than 10,000
4. Your Working experience:
   ☐ Less than 5 years ☐ 5 ~ 9 years ☐ 10~14 years ☐ 15~19 years ☐ 20~24 years ☐ Equal to or greater than 25 years
5. Your education level: ☐ High school ☐ College ☐ Graduate college ☐ Ph. D. ☐ Other _____
6. Your gender: ☐ Female ☐ Male
7. Your age:
   ☐ Younger than 20 ☐ 20~29 ☐ 30~39 ☐ 40~49 ☐ 50~59 ☐ Equal to or older than 60
8. Your position: _____

Part II. Research model

Questionnaire items	Mean	Std. dev.
Technological IT resource: My firm has invested in...		
1. Communication networks and shareable technical platforms across business units.	5.50	1.02
2. Database management systems or data warehouse systems across business units.	5.09	1.20
3. Office automation systems across business units.	5.16	1.11
4. Enterprise resource planning systems across business units.	5.01	1.17
5. Decision support systems or strategic information systems across business units.	5.05	1.16
6. Knowledge management systems across business units.	5.25	1.05
Human IT resource: The employees of IS functions have...		
1. Know-how to design and develop information systems.	5.37	0.98
2. Skills to deploy and maintain information systems.	5.33	1.00
3. Ability to lead and manage IS functions and projects.	5.41	0.94
4. Ability to coordinate and interact with user communities.	5.49	0.97
5. Ability to understand the business needs of other business functions.	5.32	1.03
6. Ability to appreciate and anticipate IT needs of other business functions.	5.25	1.03
Complementary organizational resource: My firm has...		
1. Well-defined organizational structure that enables employees to coordinate well.	5.45	1.03
2. Explicit policies and rules that guide employees to work effectively.	5.08	1.16
3. Supportive corporate culture that allows individuals to try things.	5.29	0.98
4. Clear and efficient organizational routines and management processes.	5.28	1.28
5. Valuable intellectual property rights such as patents and trademarks.	5.49	0.92
6. Innovative workplace practices that lead to a healthy and favorable work environment.	5.52	0.94
Operations capability: My firm has ability to...		
1. Perform total quality management (TQM).	5.33	1.01
2. Perform business process reengineering (BPR).	5.39	0.99
3. Improve process flexibility.	5.24	1.00
4. Improve process quality.	5.31	1.01
5. Improve delivery dependability.	5.45	1.02
6. Improve operational efficiency.	5.60	0.89
Research-and-development capability: My firm has ability to...		
1. Develop and apply new technologies.	5.09	1.16
2. Invent new products and service.	5.49	0.92
3. Innovate new manufacturing and service processes.	5.41	1.01
4. Improve product and service quality.	5.65	0.94
5. Lower price of product and service.	5.17	0.99
6. Improve functionalities of product and service.	5.38	1.01
Marketing capability: My firm has ability to...		
1. Sense market change and build strong and steady bonds with customers.	5.27	1.02
2. Obtain precise knowledge of customer profiles to differentiate its products and services.	5.35	1.00
3. Obtain customer feedbacks and forecast customer needs.	5.41	0.91
4. Quickly respond to customer needs.	5.42	0.99
5. Minimize customer complaints.	5.54	0.95
6. Improve the quality of customer service.	5.58	0.87
Strategic objective: My firm performs well in...		
1. Reducing operating cost.	5.37	0.98
2. Improving material and asset utilization.	5.40	1.05
3. Providing leading products.	5.36	1.03
4. Providing superior services.	5.24	1.08
5. Improve customer satisfaction.	5.22	1.05

Appendix B (*Continued*)

Questionnaire items	Mean	Std. dev.
6. Improve customer loyalty.	5.18	1.06
Financial performance		
1. Return on total assets.	1.68	11.23
2. Return on shareholders equity.	−2.23	29.91
3. Operating income to paid-in capital.	13.18	22.74
4. Profit before tax to paid-in capital.	11.13	28.73
5. Net profit to sales.	−1.17	25.39
6. Earnings per share (NT Dollars).	0.81	2.64

References

[1] M. Basadur, G.A. Gelade, The role of knowledge management in the innovation process, Creativity and Innovation Management 1 (15), 2006, pp. 45–62.
[2] G. Bhatt, A. Emdad, N. Roberts, V. Grover, Building and leveraging information in dynamic environments: the role of IT infrastructure flexibility as enabler of organizational responsiveness and competitive advantage, Information & Management 47 (7–8), 2010, pp. 341–349.
[3] S. Devaraj, R. Kohli, Performance impacts of information technology: is actual usage the missing link, Management Science 49 (3), 2003, pp. 273–289.
[4] T. Dewett, Understanding the relationship between information technology and creativity in organizations, Creativity Research Journal 15 (2), 2003, pp. 167–182.
[5] V. Dhar, A. Sundararajan, Information technologies in business: a blueprint for education and research, Information Systems Research 18 (2), 2007, pp. 125–141.
[6] S. Dutta, O. Narasimhan, S. Rajiv, Success in high-technology markets: Is marketing capability critical? Marketing Science 18 (4), 1999, pp. 547–568.
[7] R.S. Kaplan, D.P. Norton, The strategy map: guide to aligning intangible assets, Strategy and Leadership 32 (5), 2004, pp. 10–17.
[8] M. Kotabe, S.S. Srinivasan, P.S. Aulakh, Multinationality and firm performance: the moderating role of R&D and marketing capabilities, Journal of International Business Studies 33 (1), 2002, pp. 79–97.
[9] A. Krasnikov, S. Jayachandran, The relative impact of marketing, research-and-development, and operations capabilities on firm performance, Journal of Marketing 72 (4), 2008, pp. 1–11.
[10] H. Lee, B. Choi, Knowledge management enablers, processes, and organizational performance: an integrative view and empirical examination, Journal of Management Information Systems 20 (1), 2003, pp. 179–228.
[11] F.J. Mata, W.L. Fuerst, J.B. Barney, Information technology and sustained competitive advantage: a resource-based analysis, MIS Quarterly 19 (4), 1995, pp. 487–505.
[12] N. Melville, K. Kraemer, V. Gurbaxani, Information technology and organizational performance: an integrative model of IT business value, MIS Quarterly 28 (2), 2004, pp. 283–322.
[13] C. Nakata, Z. Zhu, Information technology and customer orientation: a study of direct, mediated, and interactive linkages, Journal of Marketing Management 22 (3), 2006, pp. 319–354.
[14] G. Piccoli, B. Ives, Review: IT-dependent strategic initiatives and sustained competitive advantage: a review and synthesis of the literature, MIS Quarterly 29 (4), 2005, pp. 747–776.
[15] P.M. Podsakoff, S.B. Mackenzie, N.P. Podsakoff, Common method biases in behavioral research: a critical review of the literature and recommended remedies, Journal of Applied Psychology 88 (5), 2003, pp. 879–903.
[16] A. Rai, R. Patnayakuni, N. Seth, Firm performance impacts of digitally enabled supply chain integration capabilities, MIS Quarterly 30 (2), 2006, pp. 225–246.
[17] T. Ravichandran, C. Lertwongsatien, Effect of information systems resources and capabilities on firm performance: a resource-based perspective, Journal of Management Information Systems 21 (4), 2005, pp. 237–327.
[18] V. Sambamurthy, A. Bharadwaj, V. Grover, Shaping agility through digital options: reconceptualizing the role of information technology in contemporary firms, MIS Quarterly 27 (2), 2003, pp. 237–263.
[19] R. Santhanam, E. Hartono, Issues in linking information technology capability to firm performance, MIS Quarterly 27 (1), 2003, pp. 25–153.
[20] P.J. Sher, V.C. Lee, Information technology as a facilitator for enhancing dynamic capabilities through knowledge management, Information & Management 41 (8), 2004, pp. 933–945.
[21] K.C. Tan, V.R. Kannan, J. Jayaram, R. Narasimhan, Acquisition of operations capability: a model and test across US and European firms, International Journal of Production Research 42 (4), 2004, pp. 833–851.
[22] K.C. Tan, V.R. Kannan, R. Narasimhan, The impact of operations capability on firm performance, International Journal of Production Research 45 (21), 2007, pp. 5135–5156.
[23] H. Tanriverdi, Performance effects of information technology synergies in multibusiness firms, MIS Quarterly 30 (1), 2006, pp. 57–77.
[24] P.R. Varadarajan, M.S. Yadav, Marketing strategy and the internet: an organizing framework, Journal of the Academy of Marketing Science 30 (4), 2002, pp. 296–312.
[25] M. Wade, J. Hulland, Review: the resource-based view and information system research: review, extension, and suggestions for future research, MIS Quarterly 28 (1), 2004, pp. 107–142.
[26] L.Y. Wu, Resources, dynamic capabilities and performance in a dynamic environment: perceptions in Taiwanese IT enterprises, Information & Management 43 (4), 2006, pp. 447–454.

Jian-Liang Chen is an Associate Professor in the Department of Information Management at National Penghu University of Science and Technology, Taiwan (ROC). He received his Ph.D. in information management from National Chung Cheng University, Taiwan. He specializes in electronic commerce and strategic management, with a particular interest in customer behavior and strategic information systems. His research on customer acceptance of online service and information technology value has been published in the International Journal of Human–Computer Studies, Computers in Human Behavior, International Journal of Information Management, Information & Management, and Computers & Education, etc.