The impact of information technology investment on enterprise financial performance in China

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Abstract

Purpose – This paper aims to examine the influence of information technology (IT) investment, including innovative IT investment and non-innovative IT investment, on comprehensive enterprise financial performance in a developing country, China.

Design/methodology/approach – This paper applies the method proposed by Barber and Lyon to construct the control group to study the impact of IT investment on financial performance of enterprises, using a sample of 229 IT investment announcement data of Chinese listed companies between 2011 and 2015.

Findings – The analysis of the financial benefits of these IT implementations yields mixed results. The results show that companies investing in IT can significantly improve profitability both the implementation and post-implementation periods for the full sample, improve the solvency only during the implementation phase, improve the growth ability after implementation time and cannot reduce business costs in all periods. At the same time, the authors find that, compared with non-innovative IT investment, the innovative samples do not achieve better financial performance, except the profitability financial indicator.

Research limitations/implications – There are several limitations in this research. First, there is no large sample about the IT investment information data set in China, so this study was compelled to use limited sample data from China; hence, this could lead to errors of too early generalization. Second, the firms in the sample are all in China's listed companies, so this may either not accurately or possibly could reflect the entire environment of developing countries.

Originality/value – First, it extends the scope of the established literature by examining the influence of IT investment with China's public firms data and IT investment to see if such spending has had an influence on corporate financial performance. Second, there is a lack of research on the impact of IT investment on comprehensive financial performance of an enterprise, compared with the previous one-sided financial performance, such as profitability or financial cost. Third, as far as the authors are aware, there are no studies on the impact of IT investment on firm financial performance based on innovative and non-innovative classification.

Keywords Developing country, IT investment, Enterprise finance

Paper type Research paper

1. Introduction

Information technology (IT) investments have significant implications for firm value (Kim *et al.*, 2017) and the agility of supply chain management (SCM) systems (Dehgani and Jafari Navimipour, 2019) in the business world nowadays. However, similar inquiries are found to be under-represented in emerging markets such as China, which motivates this work. Over the past few decades, IT has had a profound

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effect on the global economy, resulting in a shift from a manufacturing to an information economy. There is no doubt that, from the present situation, IT (i.e. computer hardware, software and communication technologies) of the enterprise has become an indispensable part of the smooth operation of the enterprise (Museli and Jafari Navimipour, 2018).

Despite the substantial IT investment, the debate has continued even in recent years, as the "IT productivity paradox" was proposed in 1987 (Solow, 1987). On one hand, some research studies find that IT investment has positive influence to the company, such as business operation (Alyari and Jafari Navimipour, 2018), user relationship management system (URMS) (Souri *et al.*, 2019) and enterprise cooperation (Alamir and Navimipour, 2016). Like research in operations management and information systems suggests that IT can play an important role in managing operations that support environmentally sustainable (green) growth (Khuntia *et al.*, 2018). The same positive result can be found in cloud computing investment (Fouladi and Jafari Navimipour, 2017), which is hot topic and investment recently (Hazratzadeh and Jafari Navimipour, 2016). On the other hand, a handful of studies on the impact of IT investments show weak or non-existent links between IT spending and productivity from different countries or areas and different industries. For example, In Ru and Shi's research, while the IT investment for vendor managed inventory (VMI) system implementation can be significant, the benefits of VMI to different supply chain members are not obvious based on anecdotal evidences and empirical studies (Ru *et al.*, 2017). Based on the above discussion, more in-depth and extensive research is needed on this phenomenon.

Although many studies have shown positive or negative benefits derived from IT investment, the findings of almost all these studies are based on data collected in developed countries (Kim *et al.*, 2009).Few studies have been conducted to verify these results and determine whether they are still applicable to developing countries. Several studies were conducted on developing countries or newly industrialized economies (Berk *et al.*, 1998; Teo and Wong, 1998), but the results were too different and limited to be used to understand the relationship between IT investment and firm performance in developing countries. Zhu, Kraemer and Dedrick grounded in the technology–organization–environment (TOE) framework found the positive impact of IT investment in developing countries with survey data (Zhu *et al.*, 2004). As the largest developing country in the world, the market value of China's listed companies has leaped into the second place in the world, which has an important impact on the world economy. At the same time, there are few research studies on the impact of IT investment on enterprise finance performance with Chinese companies.

This paper makes three main contributions to the literature. First, it extends the scope of the established literature by examining the influence of IT investment with China's public firms' data and IT investment to see if such spending has had an influence on corporate financial performance. Although the productivity paradox appears to be an international phenomenon, virtually all of the considerable debate on the subject has been restricted to the developed countries (Beccalli, 2007). That is to say, it is necessary to study the impact of IT investment in developing countries. Second, there is a lack of research on the impact of IT investment on comprehensive financial performance of an enterprise, compared with the previous one-sided financial performance, such as profitability or financial cost, which is important for the follow-up countries and enterprises. Third, as far as we are aware, there are no studies on the impact of IT investment on firm financial performance based on innovative and not innovative classification. Our research will make a clearer image of IT investment and enterprise financial performance.

2. Literature about relationship between IT investment and firm financial performance

The impact of IT investment is indeed an important issue for enterprise development, which has also attracted widespread attention from corporate managers and research scholars. In these studies, the impact on the short-term stock price of the company and the long-term financial performance of the company are the two main parts of the research. However, for the research on the impact of enterprise IT investment on enterprise financial performance, different researchers use research data from different countries or different industries and different research variables; the results are mixed even in recent years (Lim *et al.*, 2011; Mithas and Lucas, 2014).

Using a sample of Portuguese large companies, Guerreiro finds that "stakeholder orientation" impacts positively in the relation between IS/IT and firm performance, when firm financial performance is measured by returns on assets (ROA), returns on investments (ROI) and returns on sales (ROS) (Guerreiro, 2016). The research of impact of IT investment on firm return and risk financial performance shows the direct effect of IT capital is to increase firm risk for a given level of return (Dewan and Fei, 2011).According to Lee and Kim, enterprises' IT investment has a positive impact on corporate performance, but this effect has a lag effect (Lee and Kim, 2006). Research about IT investment in banking industry shows there is almost no relationship between total IT investment and improved bank profitability or efficiency indicating the existence of a profitability paradox (Beccalli, 2007). In the study of Hendricks and Singhal, the effect of investments in enterprise resource planning (ERP) and SCM is positive but not in the case of invest in customer relationship management (CRM) system samples (Hendricks *et al.*, 2007).

At present, there are very few studies on the developing countries which have very big difference with developed countries in IT investment, such as labor costs, competition, IT resources, culture, and education, and all this can affect the mechanism of IT value creation. A few studies were conducted on some developing countries (Kim *et al.*, 2009; Pholphirul and Bhatiasevi, 2016), but it is still difficult to discover firm-level empirical studies showing consistent results on the relationship between IT investment and firm financial performance. Kim and Xiang *et al.* investigated the effects of IT investment on firm financial performance in the electronics industry of China using survey data and the result shows difference with the USA (Kim *et al.*, 2009). However, Kim's research (Kim *et al.*, 2009) is limited to the electronics industry in China, which can lead to selective deviation and there research data is focus on 2004, which cannot reflect the actual situation after the big change of the environment in China. Pholphirul and Bhatiasevi studied constraints and determining factors of IT-related investment in a developing country by using Thailand as a case study using a survey of manufacturing data (Pholphirul and Bhatiasevi, 2016).

Many studies have been performed on the value of IT investment and enterprise financial performance, in the past, but there are still many problems that need to be solved. First of all, the existing literature about the impact of corporate IT investments on corporate financial performance is not comprehensive and complete. They are all aimed at one or two aspects of corporate financial performance to research, such as profitability or financial cost, which is too limited to understand the impact of these investments. Second, there is a lack of research with developing country samples and a lack of comparison with developed countries, which is important for supplementing this research. Finally, existing research lacks a categorical study and comparison of different types of IT investments, which will give us a clearer understanding of the impact of different types of IT investment on enterprises.

3. Sample selection procedure and indicator description

3.1 Sample selection procedure

The objective of this study is to analyze the financial performance of firms announcing plans to invest in IT. To accomplish this objective, we searched Wind database which is a leading financial company that provides financial data, information and software services over the five-year period from 2011 to 2015, for news articles about firms planning to make investments in information technology. We take the IT investment as the keyword to search for the full text of the announcements. After searched the announcement module of Shanghai and Shenzhen Stock Exchange listed companies, we obtained 15,087 possible IT investment announcements in total from 2011 to 2015, including main board listed company, small- and medium board-listed company and growth enterprises market listed company. The data include securities code, securities name, the date of the announcement appear, IT investment content, IT investment amount and the specific content of the announcement.

After we got the 15,087 possible IT investment announcements, we checked the title of the announcements and we obtained 506 possible IT investment announcements. The titles of these 506 possible IT investment announcements were reviewed to determine whether they were shown to invest in IT, including the completion of IT project construction, ongoing IT project construction or plans to buy equipment, software or services and if a company announced more than once of an same investment, e.g. one firm's announcement shows they have completed an IT project construction, the earliest announcement, including agree to purchases or ongoing the same project construction, was retained. At last, 229 IT investment samples were screened out after we read in detail the content of the selected 506 possible IT investment announcements one by one, and every announcement was also carefully examined to determine whether the proposed IT investment would result in an IT application that was innovative for the industry. According to Santos *et al.*, an investment would be classified as innovative if the announcements made a claim that (Santos *et al.*, 1993):

- the investment shows that the technology is used for the first time among firms competing in this industry;
- the investment would lead to the emergence of new products or services based on IT; or
- the investment would lead to the development of new technologies in the industry (e.g., software with new applications).

Announcements would be classified as non-innovative if the announcement indicated that:

- the firm was following investments already made by its competitors; or
- the investment was intended to maintain an existing application.

If it is not possible to determine whether the investment is innovative or not innovative after we read the announcement, the investment will be placed in the unclassified category. The distribution of 229 IT investment announcements over time is shown at Table I.

3.2 Financial variable description

This study revolves around the relationship between IT investment and firm financial performance in China. Several studies were conducted on enterprise financial performance based on a single aspect of financial indicator, especially profitability indicator and business cost, but the results were too inconsistent and limited to be used to understand the relationship between IT investment and comprehensive firm financial

performance in developing countries. Thus, because of little prior firm-level empirical research on this issue in developing countries, despite obvious differences of country characteristics (Dedrick *et al.*, 2003), the preceding issue – whether or not there are financial benefits derived from IT investment in China – is being tested in the flowing financial variable and hypothesis.

To estimate the company financial performance of IT investment, we analyze changes in operating ROA for firm profitability effect, profit/cost ratio (PCR) for firm cost effect, liability on asset (LOA) for firm solvency effect and net profit growth rate (NPG) for firm growth ability. ROA is equal to a fiscal year's earnings divided by its total assets, expressed as a percentage. We focus on operating income over other income measures (for example, net income or earnings per share) because it is a cleaner measure of performance, as it is not obscured by special items, tax considerations or capital structure changes (Papaioannou *et al.*, 2010). PCR is calculated by dividing profit by total enterprise cost. LOA is equal to total liabilities divided by total assets. NPG equals net profit minus last year's net profit and the net profit equals total profit minus income tax (Table II).

Although the positive relationship between IT investment and enterprise performance has recently been accepted by more and more scholars and practitioners, the results of the effects of IT investment on organizational growth are still mixed, especially when the research chooses different performance indicators. Therefore, based on previous studies, this paper chooses profitability (Ferraris *et al.*, 2018; Ravichandran, 2018) and cost (Kim *et al.*, 2009; Lee and Choi, 2018) financial indicators and adds solvency and growth ability financial indicators to study the impact of enterprise IT investment on enterprise financial performance more comprehensively.

Year	Innovative	Non-innovative	Unclassified	Full sample
2011	9	13	8	30
2012	11	20	7	38
2013	15	21	16	52
2014	13	22	20	55
2015	16	19	19	54
Total	64	95	70	229

Table I. Distribution of IT investment over time

Financial variable	Variable Name	Explanations	Hypotheses
Profitability	Return on asset (ROA)	Return on assets is equal to a fiscal year's earnings divided by its total assets, expressed as a percentage	H_1: Positive
Cost	Profit/cost ratio (PCR)	Profit-cost ratio is calculated by dividing profit by total enterprise cost	H_2: Negative
Solvency	Liability on asset (LOA)	Liability on asset ratio is equal to total liabilities divided by total assets	H_3: Positive
Growth ability	Net profit growth rate (NPG)	Net profit growth rate equals net profit minus last year's net profit. Net profit equals total profit minus income tax	H_4: Positive

Notes: The Hypotheses in this table means that enterprise IT investment has a positive/negative impact on financial variables

Table II. Variable description and hypotheses

4. Methodology

We also examine the performance during the one-year implementation period as well as the three-year post-implementation period. However, the evidence on the time required to implement the IT systems is limited. Raman and Singh's case study on i2 Technologies indicated that implementation of SCM systems can take about 6-12 months (Raman and Singh, 1998). Sambrani and Pol reports a 1.5-year implementation period for SCM systems (Grey *et al.*, 2005; Sambrani and Pol, 2016). Based on the evidence in the literature, we use a one-year implementation period for IT investment. According to Hendricks *et al.*, we choose a three-year post-implementation period for the IT investment (Hendricks *et al.*, 2007). Overall, we examine the changes in financial performance over a four-year period for IT investment (a one-year implementation period and a three-year post-implementation period).

For companies planning to invest in IT, the four-year period, including investment year and three post-investment years, of IT investment begins on the date of announcement day. If a company issues an announcement indicating that the company has completed an IT investment and implementation, such as ERP system or CRM system, we set the starting date back by one year relative to the announcement date of completion of the implementation of IT. Then we use these adjusted dates (or reset dates) to calculate the impact of IT investment on firm financial performance in both IT investment year and post-investment years.

The purpose of this paper is to study the impact of IT investment in Chinese listed companies on corporate financial performance. To achieve the research goal and control various factors that are not related to IT investment that may affect the financial performance, we established an appropriately chosen comparison group proposed by Barber and Lyon (1996). We estimate the abnormal performance by comparing the sample group with the control group. Specifically, let PI_{t1} and PI_{t2} be the performance level in year t_1 and t_2 (where $t_2 > t_1$), respectively, for the sample firm I. At the same time, for the chosen control group of sample firm I, the PC_{t1} and PC_{t2} are the median financial performance level in year t_1 and t_2, respectively (Hendricks *et al.*, 2007). At last, the API (abnormal performance of sample firm I) is:

$$\mathrm{API} = (\mathrm{PI}_{t2} - \mathrm{PI}_{t1}) - (\mathrm{PC}_{t2} - \mathrm{PC}_{t1})$$

In previous studies of firm financial performance, the establishment of control group is generally based on industry or company size. However, Barber and Lyon (1996) proposed a new method of setting up control group which give well-specified and powerful test statistics. At the same time, Barber and Lyon emphasized the significance and feasibility of the new method, in which the comparison group is chosen through similar prior performance. In addition, compared to the previous control group, which is usually one company, the new method of control group was established as a portfolio of companies. According to Barber and Lyon (1996), the control group is set up in the following four steps:

(1) For each company in the sample, we search all the companies with the same standard industrial classification (SIC) code in the Wind database as a possible comparison group. Afterward, we choose the firms, whose firm size in the starting year of the measurement period is within 90-110 per cent in the possible comparison group. According to Barber and Lyon, the 90-110 per cent range filter has well-specified test statistics (Barber and Lyon, 1996).

(2) If we do not find any firms in Step 1, then we attempt to match performance within the 90-110 per cent filter using all firms in the same one-digit SIC code.

(3) If we do not find any firms in Step 2, then we attempt to match performance within the 90-110 per cent filter without regard to SIC code.

(4) If we do not find any firms in step 3, then we chose the firm that is closest in performance without regard to SIC code.

The mean (median) number of firms in the comparison groups is 58 (47) for the full sample, 53 (36) for the innovative sample and 45 (30) for the not innovative sample. To pool observations across time, for each firm in our sample, we translate calendar year to event years as follows. The year of the announcement date is year 0 in event year, the next year is year1 and year after that is year 2 and so on. For IT investment firms the implementation period spans years 0-1 and the post-implementation period spans years 1-4.

5. Empirical results

What this section shows is the results of the impact of IT investment announcement on the firm's financial performance with different types of IT investment, including innovative IT investment and non-innovative IT investment and different investment time, including IT investment year and post three IT investment years. We illustrate the two aspects of the results of the full sample and the innovative and not innovative sample.

5.1 Results for the full sample

Table III presents results for the full sample of firms that invested in IT. During the implementation, post-implementation and the combined implementation and post-implementation periods, the financial performance metrics show mixed result. The results on changes in ROA provide some evidence of improvements in profitability. The mean and median changes in ROA are positive for all periods. At the same time, during the combined implementation and post-implementation periods, the median change of 0.93 per cent in ROA is significantly different from zero (p-value ≤ 0.01), and more than 58 per cent of the sample firm experienced positive abnormal change in ROA, significantly different from 50 per cent (p-value ≤ 0.01). The evidence suggests that IT adopters show an improvement in firm profitability and *H1* is verified. When PCR is used as the performance metrics of cost, there is no evidence of abnormal performance for all periods, which means that investing in IT cannot reduce enterprise cost, and *H2* do not pass the test.

When the performance is examined by firm solvency (LOA) over the full four-year period, (the combined implementation and post-implementation periods), there is no evidence of abnormal performance. The mean, median and positive percent of LOA is insignificantly different from zero (p-value = 0.63, 0.86, 1.13). Therefore, *H3* do not pass verification. However, the solvency indictor is significant in the implementation year with 1.32 per cent median change (p-value ≤ 0.05). The results for the growth ability (net profit growth rate) are mixed. These are the median and positive percentage significant change (p-value ≤ 0.05) during the post-implementation period and combined period but not in the implementation period. And 58.01 and 57.32 per cent of the sample firms in post-implementation and combined four-year periods experienced positive abnormal change in growth ability, significantly different from 50 per cent (p-value ≤ 0.05). The evidence suggests that investing IT more likely helpful for long-term growth ability of the company and *H4* is correct.

5.2 Results for the innovative and not innovative sample

In 1993, Santos and Peffers *et al.* examined the impact of IT investments on the market value of corporate stocks and found that innovative IT investments have a greater impact than non-innovative IT investments (Santos *et al.*, 1993). Since then, there are no scholars to study whether these innovative investments, compared with not innovative IT investment, will have a greater impact on corporate financial performance. Our research will fill this gap.

Performance measures	Observation	Implementation period from years 0 to 1			Observation	Post-implementation period from years 1 to 4			Observation	Implementation and post-implementation period from years 0 to 4		
		Mean	Median	(%) positive		Mean	Median	(%) positive		Mean	Median	(%) positive
Profitability (ROA)	229	1.12 (2.58)***	0.93 (2.60)***	57.32 (2.67)***	203	1.02 (2.01)**	0.94 (1.98)**	52.13 (2.01)**	229	1.10 (2.36)***	0.93 (2.76)***	58.32 (2.57)***
Cost (PCR)	229	−0.92 (−0.53)	−0.93 (−0.63)	48.53 (−1.03)	203	−0.99 (−0.38)	−0.87 (−1.12)	44.28 (−0.83)	229	−0.97 (−0.58)	−0.93 (−0.97)	47.28 (−0.93)
Solvency (LOA)	229	2.10 (1.17)	1.38 (1.32)*	53.48 (1.53)*	203	2.93 (1.04)	2.34 (1.17)	50.43 (0.96)	229	2.98 (0.63)	1.83 (0.86)	53.29 (1.13)
Growth ability(NPC)	229	1.38 (1.84)**	0.34 (0.95)	60.91 (1.05)	203	1.49 (0.88)	0.58 (1.37)*	58.01 (1.49)*	229	1.82 (1.84)**	0.73 (1.28)*	57.32 (1.47)*

Notes: Results on abnormal return on financial performance for full sample. *T*-statistics for the mean, Wilcoxon signed-rank test *Z*-statistic for the median and binomial sign test *Z*-statistic for the percent positive are reported in parentheses. ***Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test. **Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test. *Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

Table III.
Performance results for the full sample of firms investing in IT

Table IV and V present results for the innovative and non-innovative sample firms that invested in IT. Overall, there is no evidence of positive or negative enterprise cost indicator (PCR) performance during the implementation, post-implementation, and the combined implementation and post-implementation periods both innovative and non-innovative samples. And the results for the return on asset indicators provide strong support that firm investing in IT show improvements in both samples profitability performance during all the periods, but obviously, the innovative IT investment have a greater impact on firm profitability than not innovative samples, with 0.46 per cent (1.21 per cent-0.75 per cent) significant higher mean change, 0.79 per cent (1.62 per cent-0.83 per cent) significant higher median change, 0.79 per cent (58.81 per cent-58.02 per cent) significant higher positive percent (p-value ≤ 0.01) in the four-year implementation and post-implementation period. That is to say, investing in innovative IT can increase a company's profitability more than non-innovative IT investments, but neither investment significantly reduces business costs.

When it comes to the accounting metrics of solvency (LOA) and growth ability (NPG), the results are mixed. Overall, in both innovative and non-innovative investment cases, the solvency indicators are significant in the short implementation period, while the growth ability indicators are significant in the long run of post-implementation period and combined period. This may be partly because of the source of funding for IT investments is financing, which leads to an increase in short-term solvency and it takes a long time for an enterprise to improve its growth ability after the company invests in IT. However, compared with non-innovative IT investment, innovative IT investment does not show any advantages in solvency and growth ability financial performance. Specifically, over one-year implementation period, the mean (median) change of solvency is 2.37 per cent (1.42 per cent), and more than 54 per cent of the innovative sample firms do better than the median change of the firms that belong to their assigned portfolio and for not innovative sample, the number is 1.83 (1.46 per cent) and 50.28 per cent. The results for the combined implementation and post-implementation periods indicate that the mean (median) change in the level of growth ability is 1.32 per cent (0.74 per cent), and more than 58 per cent of the innovative sample firms do better than the assigned portfolio and the number for non-innovative sample is 1.53 (0.85 per cent) and 56.39 per cent.

6. Summary and future research

This study is a firm-level empirical analysis of the relationship between IT investment and firm financial performance in China, one of the developing countries. The following findings of this study were obtained. First, there is a positive relationship between IT investment and firm profitability in China (*H1*). Second, IT investment has no effect on enterprise financial cost in China (*H2*). Third, enterprise IT investment can improve corporate solvency in the short-term implementation stage (*H3*) and improve growth ability in the long-term post-implementation period (*H4*) significantly. At the same time, compared with non-innovative IT investment, enterprises' innovative IT investment has not performed better in other financial indicators except in the profitable financial indicators.

There are several limitations in this research. First, there is no large-sample about the IT investment information data set in China, so this study was compelled to use limited sample data from China; hence, this could lead to errors of too early generalization. Second, the firms in the sample are all in China listed companies, so this may not accurately reflect the entire environment of developing countries, and could possibly. Despite these limitations, this study empirically reveals the impact of enterprise IT investment on enterprise financial performance comprehensively, and finds the impact of innovative IT investment and non-innovative IT investment on enterprise financial performance.

Table IV.
Performance results for the innovative sample of firms investing in IT

Performance measures	Observation	Implementation period from years 0 to 1			Post-implementation period from years 1 to 4			Implementation and post-implementation period from years 0 to 4			
		Mean	Median	(%) positive	Observation	Mean	Median	(%) positive	Observation	Mean	Median	(%) positive
Profitability (ROA)	64	1.23 (2.95)***	0.97 (2.70)***	58.45 (3.17)***	60	1.42 (2.16)**	0.79 (2.84)**	54.21 (2.73)**	64	1.21 (2.83)***	1.62 (3.01)***	58.81 (3.43)***
Cost (PCR)	64	−1.09 (−0.82)	−0.83 (−0.73)	43.03 (−1.73)	60	−1.03 (−0.45)	−0.94 (−0.64)	43.08 (−0.43)	64	−0.64 (−0.85)	−0.85 (−0.32)	43.18 (−0.48)
Solvency (LOA)	64	2.37 (2.83)***	1.42 (1.97)**	54.29 (1.31)*	60	2.53 (0.74)	2.45 (0.54)	55.19 (0.56)	64	2.32 (0.64)	1.57 (0.86)	60.20 (1.01)
Growth ability(NPC)	64	1.28 (0.95)	0.84 (1.02)	59.40 (1.02)	60	1.35 (0.67)	0.75 (1.63)*	50.91 (1.38)*	64	1.32 (1.90)**	0.74 (1.30)*	58.20 (1.56)*

Notes: Results on abnormal return on financial performance for innovative IT investment sample. T-statistics for the mean, Wilcoxon signed-rank test Z-statistic for the median, and binomial sign test Z-statistic for the percent positive are reported in parentheses. ***Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test. **Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test. *Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

Performance measures	Observation	Implementation period from years 0 to 1			Post-implementation period from years 1 to 4				Implementation and post-implementation period from years 0 to 4			
		Mean	Median	(%) positive	Observation	Mean	Median	(%) positive	Observation	Mean	Median	(%) positive
Profitability (ROA)	95	1.03 (2.02)***	0.89 (2.07)***	57.00 (2.27)***	87	1.01 (1.93)**	0.86 (1.87)**	52.27 (1.84)**	95	0.75 (2.05)***	0.83 (2.17)***	58.02 (2.67)***
Cost (PCR)	95	−0.83 (−0.84)	−0.84 (−0.58)	49.09 (−1.01)	87	−1.24 (−0.77)	−0.92 (−0.83)	45.37 (−0.74)	95	−1.03 (−0.46)	−0.98 (−0.64)	46.90 (−0.67)
Solvency (LOA)	95	1.83 (1.83)*	1.46 (1.43)*	50.28 (1.47)*	87	2.64 (0.94)	2.56 (1.09)	51.86 (0.64)	95	2.53 (1.41)*	1.75 (0.35)	57.30 (1.01)
Growth ability(NPC)	95	1.24 (0.66)	0.65 (1.34)*	57.39 (1.00)	87	1.32 (1.64)*	0.64 (0.64)	53.25 (1.60)*	95	1.53 (2.04)***	0.85 (1.64)**	56.39 (1.39)*

Notes: Results on abnormal return on financial performance for not innovative IT investment sample. *T*-statistics for the mean, Wilcoxon signed-rank test *Z*-statistic for the median, and binomial sign test *Z*-statistic for the percent positive are reported in parentheses. ***Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test. **Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test. *Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

Table V.
Performance results for the not innovative sample of firms investing in IT

At the same time, the results of this study should be considered as a positive finding and have strong theoretical and managerial implications. On one hand, this research complements rich empirical studies and other quantitative work in IT investment research and verifies that IT investment has an impact on financial performance of enterprises. This study helps us to further understand the impact of IT investment on firm's financial performance through expanding the scope the impact of IT investment on the enterprise financial performance in developing country, expanding the scope of the influence and differences in different IT investment categories, including innovative and not innovative IT investment as well as investment and post-investment periods. On the other hand, for business management, this research shows that companies investing in IT can increase the company's profitability, solvency and growth ability, which will bring benefits to firms. However, the solvency ability is not sustainable and there is a lag effect on growth ability in firm IT investment. That is to say, in business practice, it is valuable for enterprises to invest in IT, but the benefits may have a time lag effect.

Future studies are needed to improve understanding of the corporate financial performance derived from IT investment in other business environments – e.g. Korea, India, Finland, Japan, Mexico – whether in developing countries or not. Empirical studies using similar methods and different samples may be necessary to devise a theory in IT business value literature. Second, the impact of enterprise IT investment on other aspects of the enterprise, like market value, needs further testing, which is helpful to deepen the understanding of the impact of IT investment. Finally, exploration of the role and mechanism of country characteristics in IT business value is also needed.

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