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Xiaoxuan Ma
University of Sydney, Xiaoxuanma93@hotmail.com

Zhenning Wang
University of Nottingham Ningbo, zhenning.wang@nottingham.edu.cn

Kevin E. Dow
University of Nottingham Ningbo, kevin.dow@nottingham.edu.cn

Wangyue Zhou
Zhejiang Gongshang University, zhouwangyue@zufe.edu.cn

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Xiaoxuan Ma
University of Sydney
Xiaoxuanma93@hotmail.com

Kevin. E. Dow
University of Nottingham
Ningbo China
Kevin.dow@nottingham.edu.cn

Zhenning Wang
University of Nottingham
Ningbo China
Zhenning.wang@nottingham.edu.cn

Wangyue Zhou
Zhejiang Gongshang University
zhouwangyue@zufe.edu.cn

Abstract

From a resource-based view (RBV), information technology (IT) investments affect organizational slack resources and therefore influence firm economic productivity. In this study, we develop a framework and test the relationship between economic productivity and organizational slack through an examination of 9 years financial data of 106 U.S. listed companies. Each variable has been tested for three stages of IT investments. Our results suggest that organizational slack resources increase after IT investments which later are consumed and converted into economic productivity.

Key words:

IT; Organizational Slack; Economic Productivity; RBV

1. Introduction

IT investment is considered as the key factor driving economic productivity (Pitelis, 2007). IT investments can strengthen a company's competitive position (Davis et al., 2003), improve innovation ability (Dos et al., 1993), and reduce downside risk (Otim et al., 2012), therefore will increase firm market value. Current studies report a positive correlation between IT investments and slack resources (Dehning et al. 2004; George 2005). On one hand, organizational slack may breed inefficiency and inhibit firm performance (Daniel et al., 2004; Dehning et al. 2004). On the other hand, organizational slack resources are also firm-specific resources that provide the flexibility to generate new resources or strengthen existing resources to achieve organizational goals (Chewlos et al., 2002). However, there is no consistent significance for IT investments in enterprise resource planning (ERP) or customer relationship management (CRM) systems. How firms' performance and productivity are affected by IT investment is still not conclusive. The purpose of this paper is to revisit and update IT productivity research with an analysis of the moderating effect of organizational slack. To examine this relationship, we use IT investment announcement data of 106 U.S. listed companies and tests the mean of each variable at three test points in time following the investment in IT. We propose that there is a significant increase in organizational slack resources right after IT investments, which later are into economic productivity.

2. Conceptual Development and Hypothesis Development

A complementarities model (as depicted in Figure 1) has been developed to explain the improvement of economic productivity. Firms with an effective sense on external

information should have market-based advantages when introducing new products (Mendelson and Pillai, 1999). Through that mechanism, IT-led improvements in information processing will lead to higher economic productivity (Tamble et al., 2012). This leads to the first hypothesis:

2.1 Hypothesis 1. Investments in IT will result in an increase in economic productivity in the long run.

Superimposing IT over existing processes led many organizations to marginal improvement in their original processes, but the overall impact on financial performance were often limited. Firm could suffer organizational burden as the expense of adding new IT department which help firms to manage invested IT should also be considered. As a result, IT investments in the early time may lead to an increase in organizational slack instead of an improvement in economic productivity and financial performance. Hence, our second hypothesis:

2.2 Hypothesis 2. Firm will realize an increase in organizational slack after IT investment.

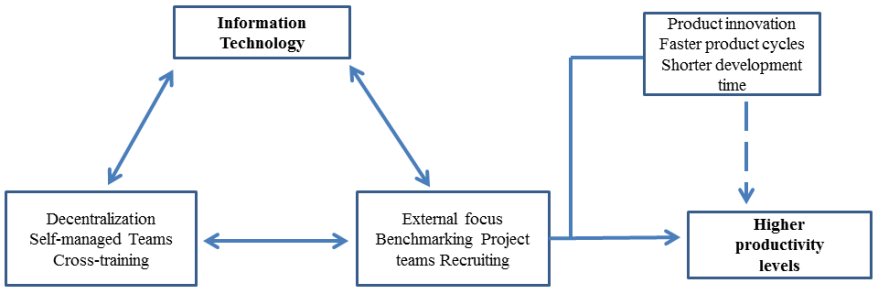

Figure 1 : Complementaries Model (Tambe et al, 2012)

A significant positive market reaction can be found for recent IT investments after a time lag (Im et al., 2001). The effort of IT-enabled reengineering will continue to emerge such as: the decrease of production overhead, the improvement in manufacturing cycle time or even the way of thinking in organization in the long-run (Hammer, 1990). At some point, increases in organizational slack will be sufficiently developed to allow firms to begin to use those slack resources. Consequently, organizational slack may decrease at some point after a time lag.

Organizational slack protects an organization to alleviate the conflict with innovation (Williamson, 1999). As IT is developed and implemented in a firm, firm learns more approaches to digest the resources (Pharasiyawar et al., 2007). Once a firm begins to consume these increased slack resources, it is likely that they could realize increases in economic productivity. Consequently, any decreases in organizational slack could result in increases in economic productivity. Hence, our third hypothesis:

Hypothesis 3a. Following an increase in organizational slack, firms will begin to realize a decrease in organizational slack.

Hypothesis 3b. Firms will realize increases in economic productivity as they consume the prior increases in organizational slack.

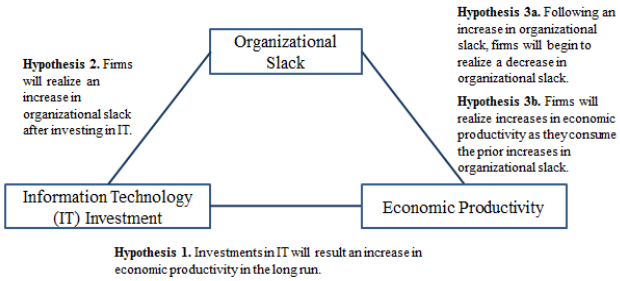

Figure 2: Hypothesis Module

3. Methodology and Data Analysis

This paper classified the whole measurement process into 3-time periods to test the value for each variable of organizational slack and economic productivity. This study takes the year of IT investment of each company as the base year, year 0. The 3-year average value prior to the IT investment of each variable for organizational slack and economic productivity will be set as basic number to express the condition when firm does not experience IT investment (T1).

3.1 Dataset

We use financial data for companies that announced a significant investment in IT during the period of 1981 to 2007. 106 unique IT investment announcements were identified for further examination. The average value of all variables then has been calculated based on the average of the specific test time period and the result has been shown below (Table 3, Panel A):

	T_1				T2				T3			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
Available Slack												
SLK_RE	0.03	0.04	-.16	0.16	0.04	0.04	-0.07	0.20	0.03	0.045	-0.09	0.23
SLK_DP	0.09	0.23	0	1.86	0.22	0.76	0	5.65	0.02	0.022	0	0.11
SLK_CE	0.18	0.35	0	2.58	0.24	0.32	0	2.45	0.16	0.31	0.00	2.48
Recoverable Slack												
SLK_AR	0.44	1.42	0	8.04	16.85	6.96	0	101.62	0.60	0.56	0	9.17
SLK_IN	0.18	0.08	0.01	0.43	0.89	0.71	0.01	3.11	0.13	0.08	0	0.54
SLK_GA	0.23	0.13	0.02	0.63	0.24	0.14	0.03	0.70	0.23	0.14	0.02	0.68
Economic Productivity												
PRO_OS	0.15	0.24	0.00	1.96	0.15	0.10	0.02	0.69	0.15	0.11	0.00	0.75
PRO_OE	15.87	47.61	0.00	445.05	20.80	75.55	0.05	744.70	50.96	112.71	0.50	1137.75
PRO_SE	83.79	167.59	0.02	1238.55	113.40	179.78	1.72	1325.36	273.20	223.04	44.67	1516.37
PRO_SA	140.77	162.27	0.08	745.68	1.19	0.62	0.07	3.99	1.19	0.64	0.077	3.89

Table 3: Descriptive statistics of Organizational Slack and Economic Productivity

4. Empirical Tests

In Hypothesis 1, we assume all 4 economic productivity variables would have an increase in the long run followed by IT investment and setting it as the Null Hypothesis with significant level of α=0.05. After the T-test of all variables, Panel A of Table 4 not only described the mean value of each variable at T1 and T3, but also approached the T-test result and showed the significant level of the Hypothesis 1 for each variable. For the overall sample, both PRO_OE (Mean= 2.953, P= 0.002) and PRO_SE (Mean= 6.990, P= 0.00) have a significant growth in the long run. However, for PRO_OS (Mean= 0.252, P= 0.401), even the mean increased in the long run, the result is not significant in the test sample. In contrast, the mean of PRO_SA (Mean= 8.856, P= 0.00) decreased in the long run and the result is not significant as well. Based on the above statement of T-test for Hypothesis 1, it shows economic productivity (PRO_OE and PRO_SE) does have a significant increase for the long run. Whereas for some measurements, the increase of economic productivity may not significant (PRO_OS) and some economic productivity may have an insignificant decrease (PRO_SA)

Panel A: Univariate tests: T1 – T3, Economic Productivity

Variables	T_1 Mean	T_3 Mean	T-Stat	Significance
PRO_OS	0.147	0.154	-0.252	0.401
PRO_OE	15.867	50.961	-2.953	0.002
PRO_SE	83.789	273.199	-6.990	0.00
PRO_SA	140.770	1.188	8.856	0.00

Panel B: Univariate tests: T1 - T2, Organizational Slack

	T1 Mean	T2 Mean	T1 to T2 (Short Run)	
Variable			T-Stat	Significance
SLK_RE	0.028	0.041	-2.15	0.016
SLK_DP	0.09	0.218	-1.661	0.05
SLK_CE	0.178	0.238	-1.293	0.099
SLK_AR	0.44	16.853	-7.66	0
SLK_IN	0.138	0.893	-10.844	0
SLK_GA	0.229	0.235	-0.337	0.368

Panel C: Univariate tests: T2-T3, Organizational Slack

	T2 Mean	T3 Mean	T2 to T3 (Long Run)	
Variable			T-Stat	Significance
SLK_RE	0.041	0.029	2.01	0.023
SLK_DP	0.218	0.0199	2.673	0.004
SLK_CE	0.238	0.158	1.823	0.035
SLK_AR	16.853	0.604	7.575	0
SLK_IN	0.893	0.128	10.982	0
SLK_GA	0.235	0.231	0.219	0.414

Panel D: Univariate tests: T2 - T3, Economic Productivity

	T2 Mean	T3 Mean	t Stat	Significance
PRO_OS	0.153	0.154	-0.019	0.493
PRO_OE	20.804	50.961	-2.288	0.012
PRO_SE	113.395	273.2	-5.743	0
PRO_SA	1.189	1.188	0.004	0.5

Change in the mean level of economic productivity after 3 years of IT investment

Table 4: Univariate T-tests Result, all Hypothesis

Secondly, to test whether organizational slack climbed in the short run followed by IT investment, Hypothesis 2 has been set as Dehning et al. (2004) predicted, the null hypothesis in the T-test assumed firms will realize an increase in organizational slack after implementing IT. With α=0.05 significant level, the one-tail test results and significant level for both 3 variables of available slack and 3 variables of recoverable slack have shown in Panel B of Table 4. These sample results showed both SLK_RE and SLK_DP, which measured the available slack, have a significant increase in the first 3 years after IT investment. And the same as two recoverable slack variables: SLK_AR, SLK_IN. However, even the trend curve showed a growth of SLK_CE during T1 to T2, T-test still detected the result of SLK_CE (Mean= 1.293, P= 0.099) is not significant. This could be caused by sample selecting error or others and should be discussed in the further study. For the SLK_GA (Mean= 0.337, P= 0.368), the t-test result showed the same insignificant result as predicted above.

Third, hypothesis 3 assumed one of these sustained advantages could be the increased economic productivity and claimed the organizational slack will drop with a climbed economic productivity after a time lag. However, to test the significance level of these movements for each variable, it is necessary to separate run the T-test for all variables of organizational slack and economic productivity.

Hence, the null hypothesis states firms will suffer a drop in organizational slack after the value culmination which followed the Hypothesis 3a. According to the result showed in Panel C of Table 4, all the variables which measured available slack and most recoverable slack variables (SLK_AR, SLK_IN) have a significant decreased after the time lag. However, the last variable which measured recoverable slack: SLK_GA (Mean= 0.219, P= 0.414) has an insignificant decrease as like the result showed in Figure 3.

In addition, as the result shown in Panel D of Table 4, the decrease of PRO_OE (Mean= 2.288, P= 0.012) and PRO_SE (Mean= 5.743, P= 0.00) is significant in the long run. Whereas the rest result is just like the tendency curve present above, even the mean of PRO_OS (Mean= 0.019, P=0.493) has increased during T2 to T3, the result is far from significant. Similarly, the sample result showed a decrease in PRO_SA (Mean= 0.004, P= 0.500) in the average value from T2 to T3 at an insignificant level. To some degree, this result is similar to the result of Hypothesis 1 which is worth to be discussed in the following section.

6. Conclusion and Limitations

This study contributes to IS literature in several ways. Through reviewing prior studies related to IT, organizational slack and economic productivity and introducing the RBV to theoretically explain the relationship among these factors, we offered an integrated model to

trace the effect of resources change process of invested IT within organizations. Also, a two-stage test has been used for measuring both short term and long-term changes of organizational slack and economic productivity. This methodology assists us not only to have a graphic overview of the mean change for all variables but also to test the significance of these changes in this sample data. In addition, this study provides the research managers a detailed explication on why sometimes IT investments increased organizational slack instead of economic performance. From this research, managers could identify the degree of invested IT haven't been explored and adopting strategies to optimize the utilization rate of invested IT. Further, this study provides suggestions for managers that IT investment is more likely improving employee productivity instead of operating productivity. Thus, for industries which contain numbers workers like manufacturing industry, investing IT could be an effective approach to improve firm's performance.

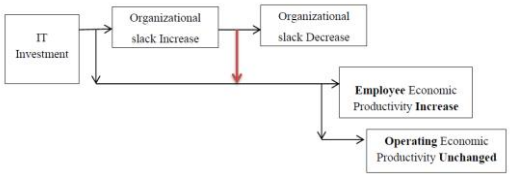

Fig. 6 Graphic Summary about the Research Result

What is more, there is no study researched without limitations. First, firms within different industries have characters which match their industry structure. Whereas, the hypothesis do not classify the type firms – as we focus on the overall impact on firm's performance. However, such overall performance cannot provide us a comparison of the different results for different type of industries. This study can be extended by classifying different industries when it analysis firm's performance in specific industry and it could guide the board directors with more specific ideas for organizations' technology investment. Second, this study only used the overall trend chart and student's T-test as the tools to analyze the data. As the most basic data analysis tool, student's T-test has lots of shortcomings, which is not strong enough to support the research results. Linear regression could be applied in future studies when analyzing the relationship between organizational slack and economic productivity.

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