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Corporate IT Paradox in the Network Era

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Abstract: Business executives are paying large bills on information technologies every year hoping to stay competitive in the network era. According to the literature, IT paradox still exists. We are not sure the big investments on IT will result in positive returns. An improved event study methodology is proposed to address the suspected causes for the paradox, such as mismeasurement of performance, time lags for gains to show up, mismanagement of IT and redistribution of benefits. Using investment on e-channel as a context, a research model based on long-term event study is proposed to investigate performance gains at different levels.

Keywords: IT investment, IT business value, IT paradox, E-channel

1. Introduction

Information technology (IT) has enabled organizational transformation, cost cutting and efficiency improvement (Jifeng Luo, 2012). In the network era today, even more investments are rushing onto IT hoping to create capabilities as competition becomes more intense. Therefore, whether IT investments improve firm productivity, if so, how would it happen and what are the necessary conditions for it to happen are crucial questions that ought to be addressed.

IT researchers try to establish a direct relationship between IT investment and firm performance, but findings are mixed (Murali D. R. Chari, 2008). Instead, a consensus is reached that IT in itself does

not always enhance firm performance. It often requires complementary IT and organization resources to take effect (Powell and Dent Micallef 1997, Clemons and Row 1991; Powell and Dent Micallef 1997; Weill and Aral 2006). Hence, IT paradox, a clash of expectations of IT investment and IT productivity existed. Just as Nobel Laureate, Robert Solow once said "we see computers everywhere except in the productivity statistics."

While we cannot deny IT plays an important role in firm performance, we have yet to be able to verify corresponding productivity gains. Various explanations have been suggested which can be grouped into four categories (Erik Brynjolfsson, 1993, 1996), namely mismeasurement of outputs and inputs; time lags due to learning and adjustment, redistribution of profits, and mismanagement of information or technology. The redistribution argument suggests that those investing in technology often gain private benefit at the expense of others, so no net benefits at the aggregate level. On the other hand, mismanagement suggests that firms often invest on IT without proper IT and/or organization resources. IT investments when complementary with favorable conditions, such as competitive strategy, finance, and human resources, can improve firm performance.

In the attempt to investigate whether IT investment generate business value we consider e-channel as an of IT investment in this study. We then proposed a modified event study and a comprehensive research model to re-examine the IT paradox.

2. Literature Review

2.1 Findings in Empirical Survey Studies

In survey studies, researchers use questionnaire to measure the IT business value, which could assess the performance from such as customer side (RongRuey Duh, 2006), quality improvement (Sarv Deva-raj,2000), competitive position (Shutao Dong 2009), not only evaluate the financial performance of IT investment. Because of the flexibility of the measurement, there are more factors involved in the empirical studies based on questionnaire surveys than the researches using secondary data.

The extend and dimensions of IT business value are dependent on internal and external factors, including IT resources and complementary organizational resources of the firms and competitive and macro environment (Melville, 2004). The IT resources mean the technological IT resources (such as IT infrastructure, shared technology and technology services across the enterprise) and human IT resources (such as technical skills and managerial skills). Complementary organizational resources refer to the non-IT resources in firms (non-IT physical resources, non-IT human resources, and organizational resources (Barney,1991), including organizational structure policies and rules, workplace practices, culture, etc.), which could improve the IT resources performance when they co-present with IT resources.

Based on this view, we categorize the factors discussed in the surveys into IT resources, complementary organizational resources. The resources are sorted into two levels, first order resources is the higher level classification in our research; the second order is the sub-level of the first order resources, and all the constructs involved in the second order are from the related literatures. The first order IT resources include the IT assets, Technology IT resources, Human IT resources, and IT-enabled intangibles, which are composed of the second-order IT

resources, such as IT staff, IT infrastructure, IT spending; the first order complementary organizational resources involve firm's strategic level, operational level or department level (financial, human resource, production, business process),and supply chain level.

As for the research model, it is suggested that the integrative model of the IT investment business value can show the process of IT performance. IT payoff firstly is shown at business process level, which is the specific application context of the portfolio of IT resources and complementary organizational resources, then the business process performance or capability may lead to the firm performance. This model comprehensively considers the factors that could affect the IT business value, but few of the survey verified the integrative model. They proved parts of the whole model by missing the mediate business process performance or considering the process performance as the dependent variable in their model.

As for the time lag issue, questionnaire surveys have the advantage of assessing current outcomes, but not future performance contributing to the IT after the survey conducting time. That is to say, addressing the time lag issue, questionnaire survey is not a better option. Researchers compensate its shortage with combination of questionnaire data and secondary data. We will discuss this method in the following part in this paper.

2.2 Findings in Secondary Data Studies

The IT business value studies using secondary data can be sorted into two groups: one uses market value to evaluate overall firm performance; while the other assesses performance by accounting data, such as revenue, costs, or profits.

2.2.1 Event Studies

In an event study, the objective is to examine the

stock market's response to events that are often related to the release of information to the stock market, which is an unbiased estimate of risk and return on IT investments. It allows the measurement of stock market reactions to the release of information about IT investments. In other words, if rational investors value both tangible and intangible aspects of IT investments, a change in stock price should approximate the true contribution of IT to the firm's value not only in cost reductions, but also in increased variety, timeliness, and quality. (Kun Shin Im, et al, 2001)

The validation of this methodology depends on two necessary important underpinnings. In an efficient stock market, the IT investment announcement should be a whole new information for all the investors, and the stock market should immediately react to the announcement. In this case, the change of market value during the event day could reflect the change of the firm performance attributing to IT investment. And the market value not only considers the current investment status, but also includes the cash flow in the future, so it takes the future effects of IT investment into account to address time lag.

The related event study discusses how the stock price--the consensus expectation of all the investors for firm's market value, reacts to IT-related investment announcements. So the typical research model tries to find out the direct link between IT investment and firm business value.

However, not all the studies using event study find significantly positive effect of IT-related initiatives on firm performance. In the 15 event studies, for the full sample (which means the IT-related investments samples were not classified by industry or firm characteristics, such as industry, firm size), only 9 studies find significantly market value improved by firm's IT investment, 5 are insignificant, and one is negative.

The event study results show that IT investment may not experience firm value improvement, while a specific IT investment, such as IT applied into some business process, such as e-commerce or e-channel can give investors more positive expectation. In addition, at the strategy level, when the IT investment transformational, or innovative, which means the IT application is not only a simple replace manual labor or offer information, but also a decision support. These are examples of IT investments complementary with organizational resources. They also have reached the same conclusions as those in IT business value empirical studies. IT in itself cannot improve firm performance, IT business value is contingent on the presence of complementary factors or contexts (Clemons and Row 1991; Powell and Dent Micallef 1997; Weill and Aral 2006; Murali D. R. Chari, 2008; Sunil Mithas, 2011; Jianliang Chen, 2012).

However, by the limitation of the typical research model of the event study, event study only focuses on the direct relationship between IT investment and firm performance, and the firm-level or industry-level factors which moderate the direct link. Actually, the effect of IT investment firstly appears on business process level at early stages, or the firm performance improvement sources from the organizational capabilities, which is formed by the application of the portfolio of IT resources (such as IT infrastructure and IT assets) with the complementary organizational resources (such as firm strategy and financial resources). These mediating factors, business process performance or organizational capabilities were not discussed in the existed event studies yet.

2.2.2 Accounting data

Accounting data can be used for measuring firm performance, IT resources and organizational resource. Accounting data are objective ways that can show firm's investment by some kinds of assets data, operational performance by the data such as sales

revenue, inventory turnover, and overall firm performance by profits.

As for the time lag consideration in these studies, researchers collect the financial data to measure firm performance by using a certain period time lag. Though it is a simple way, it still can deal with the facts that the IT business value needs a period of time to be applied into business process to form some certain capabilities, finally to be shown on firm performance.

But unfortunately, there are only three paper conduct their related studies in this way. The researches using accounting data to evaluate firm performance and tackling with time lags reach a consensus: IT-related investment (Sarv Devaraj, 2000) or IT-enabled capacity (Jifeng Luo, 2012; Radhika Santhanam, 2003) significantly improves firm performance.

2.3 Findings in Combined Methods Studies

Besides the studies individually using the empirical and secondary data to measure IT input and output, there are some researchers combined use the two kinds of data in a single study.

As for time lags, for example, in a study of the synergistic effects of IT-enabled resources on organizational capabilities and firm performance (Jianliang Chen, 2012), all empirical data were collected in the third quarter of 2010 to measure the constructors, such as human IT resources, and operations capability, whereas the financial performance was collected in the second quarter of 2011 to measure the firm performance.

But these researches have the same limitation with the questionnaire surveys, they only proved parts of the whole model by missing the mediate business process performance or considering the process performance as the dependent variable in

their model.

2.4 A Summary

We find that different method has its advantages and disadvantages. Indeed, measurement of performance is still an issue. In IT business value studies, the value could be shown not only in organizational tangible assets through revenue increasing and costs decreasing, but also in intangible ways, such as customer satisfaction improvement. Surveys, event study, and combined method could involve tangible and intangible IT value, but as for the degree of the data objective, accounting has a prominent advantage over other methods.

Besides the Surveys, all the other methods can resolve the time lag, one important explanation for IT paradox, but there are still few studies can tackle this problem well.

In addition, different research model has different level of ability to clarify the process of IT business value generation and what other complementary factors and context can influence the firm performance. In this case, the typical event study method, though it has the advantage in measurement, it only can verify whether there is direct link between IT investment and firm performance, which is also one cause for the results inconsistency. Besides this, as for the complementary factors and environmental factors, the typical event study model only can regard them as moderate factors, while we know that these organizational and environmental factors can also be combined with IT resources to generate capabilities or performance.

As for the other three methods, they should have applied integrative model to study the process of how IT was converted into firm performance, but unfortunately, based on our literature review, few researcher could verify the whole process that IT investment improves firm performance by the mediate effect of certain business process performance and

capabilities from the portfolio of IT resources with complementary organizational resources.

Therefore, despite many progress in the IT investment business value research, when considering IT paradox resolutions in these study, there are at least several areas we can improve:

- Using objective data to measure the IT inputs and outputs, and considering time lag to estimate all the value attribute to IT investment.
- Further prove the process of how IT investment is converted into firm performance, in a specific context :
 - What other organization resources complementary to IT resources?
 - What kind of business process performance or organizational capability can mediate the IT performance relationship?
 - What organizational or environmental factors can be as the moderator and control variables?

3. IT Investment in the Network ERA

In the network era, IT plays a more important role on both sides of suppliers and demanders. On supplier side, there are many new IT-enabled technologies and their applications in business process, which make firm to get more demand information from customers and react to the market changes more quickly by various means of, such as call centre and social network services, when compared with the earlier IT-enabled applications such as e-mail, website, and enterprise systems. On the demand side, more customers are now accustomed to purchase products and services online. In addition, customers even can take an active part in co-creating products or services from design to sales. This could greatly enhance customization and improve customer satisfactory. There is no doubt that investing on IT is a strategic decision in the network era. However, such move may only render temporary competitive advantages. Competitors may soon imitate the innovative technologies.

Last but equally important, for the earlier entrants, the circumstance may more complicated. For the firms which already have some IT-related resources and IT-enabled capabilities, when they add new IT investments to keep up with the technology cycles and gain new business opportunities from the Internet, they should consider the effects of the existed IT resources or capabilities. IT capability could improve other organizational capabilities and even affect the new investment decision (for example the amount of the money invested in IT).

In sum, in the network era, investment in IT is meaningful no matter for the new entrants or the earlier entrants. Applying IT into business process to form unique capabilities with the support of complementary organizational resources is equally important for both of them to have a position in competition, especially for the earlier entrants, how to make use of the prior IT-related capabilities can't be ignored.

3.1 e-Channel as an IT Investment

In the network era, investing in online business to broaden the channels to connect with market is commonly used by firms. With the development of IT, the channel improved from the earlier IT applications, such as EDI, e-mail, and Website with simple functions, to current ERP, online trade, and social network services, such versatile IT applications. So the channel, to some extent, is an information and technology (ICT) based channel dealing with products and services, which is called e-channel (Solveig Wikstrom, 2005). Electronic marketing channels use the Internet to make products and services available (Rosenbloom B, 1999). In this study, according to the nature of IT based, e-channel can be viewed as a specific IT investment.

In the IT investment business value studies, e-channel business value is a research area that has the similar results with the summary of the literature

review in part 2 of this paper. The direct link between Internet channel and firm market value was verified by Inge Geyskens (2002), which was also moderated by some characteristics of firm-level (for example, direct marketing experience) and industry level (for example, product-demand growth). Yusen Xia (2010) also found the positive effects of online sales implementation on sales, cost and inventory and return on investments, however, not all the performance metrics were significantly influenced by online sales addition, for example, gross profit margin (GM). It is not surprising to have the above results. E-channel is also an IT-related investment, just as we pointed out above, so its firm level performance should be in accordance with the main explanation with IT paradox. In Inge Geyskens's research on Internet channel performance, a traditional event study was applied to prove the positive consensus expectation of the e-channel addition at a short term period. In addition, due to the limitation of the research model of traditional event study, it can't clarify what organizational resources play a complementary role and what process the e-channel investment was converted into business value. That is to say, it only verified a short-term (10 days event period was discussed) performance. Even considering a three years time lag, some firm performance metrics were not significantly affected by online sales implementation in the study of Yusen Xia (2010). Our explanation for this is the lack of a mediate business process performance or capability in the research model.

In this case, in order to find out how e-channel investment affects firm performance, we need improve the current related research in methodology and model to address the main explanations for IT paradox. The research design is stated in the following part with considering the characteristics of e-channel in the research model.

4. Designing an Event Study based Re-

search Model

As this paper analyses in literature review part, although a few recent studies use survey data to examine IT investment benefits, survey-based research imposes limitations, due to its self-reporting and subjective-assessment nature. Specifically, the same survey respondents typically provide responses for both independent and dependent variables, which could create a potential source of bias. Because of this concern, there is an urgent need to confirm survey results by using more objective secondary data (Hsu, Kraemer, & Dunkle, 2006; Yusen Xia, 2010). There are two kinds of secondary data, accounting data and market value (stock price in event study).

However, It is important to note the limitation of the use of stock market reactions as measures of the business impact of information technology investments, because abnormal returns, especially over a short period of time, may not provide an accurate assessment of the value of investments (Hendricks, Singhal, & Stratman, 2007; Yusen Xia, 2010).

So we proposed an improved event study methodology, which retains the advantages of accounting data and the way of sample selection in event study. The improved event study methodology using publicly available financial data and other objective information from the COMPUSTAT, not the stock price to assess the IT investment performance, and as for the samples firms implementing IT investment, we searched the Factiva database with the key words of the specific IT investment to find press releases or articles that described the implementation of the online channel.

With the above improved event study, we can ensure the objective data collection to overcome the bias from the subjective measurement. Despite there are very few related studies use objective secondary data to measure IT performance, but there are still some area needs to be improved, which are mainly on

the research model. In the following part, our improved model is introduced with the e-channel as an example.

4.1 The Research Model

Despite of many researchers using secondary data, there are few verifying the whole process how IT investment is converted into business value. Just as our literature review pointed out that they only verified parts of the integrative model, or mix the conception of new IT investment and existed IT resources. These are just what we attempt to improve in our event study based research model.

Since e-channel investment in this paper is regarded as a specific IT investment, the integrative model for IT business value that was suggested by many literatures can be used to verify the process of the e-channel performance: in the e-channel context, based on RBV, IT resources with the complementary organizational resources are applied into the process of using IT to connecting with market, and the e-channel investment outcome is firstly shown at the business process level, then at the overall firm level with the organizational capabilities build in the process of the e-channel implementation. The key issues in our research model are as following:

- What IT resources and complementary organizational resources should be involved as independent variables in the e-channel business value model?
- What business process performance or capability mediates the e-channel investment performance?
- What internal or external environment factors can be as moderate variables?

In the context of e-channel, identifying characteristics of its specific implementation could help to answer the above questions. It is a notion that in the network era, investing in IT is a continuous behavior to sustain the competition position, so it is necessary for us to indentify the investment. According to the

time of the investment in the firm, there are two kinds of them: one is newly invested in the firm or some business processes, the other is the firm invested before and already put into use for outcome, and some of them even formed organizational capabilities. According to the integrative e-channel business value, investments occur in different time play different role in the process of business value generation. In this paper, when we say the e-channel investment, we refer to the new investment on e-channel.

4.2 Independent variables

Firstly, in order to indentify the new investment in E-channel, we introduce the concept of e-channel commitment. By commitment, we refer to the proportion of the firm's tangible resources devoted to building and maintaining the online channel. John Hulland (2007) proved that online channel commitment can positively affect the firm online performance. In our research model, we divided the investment into two parts: e-channel establishment investment, and e-channel maintaining investment. Establishment refers to the initial investment, such as website set up and software purchasing. The e-channel needs continuous investments, such as the online channel promotion, the system upgrade, and human resources training. And various investments occur at different time, so it is necessary to differentiate them according to the time. More importantly, it also helps us to deal with the time lag issue by time series model analysis.

Besides the new investment may affect the firm operations and performance, the existed resources or capabilities can also influence the performance. We try to consider three factors in our model: IT capacity, prior e-channel experience and prior financial performance. Though each of them was proved respectively to affect the IT business value, there is no research systematically considering the prior resources or capabilities.

IT capacity is defined here as its ability to mo-

bilize and deploy IT-based resources in combination or co-present with other resources and capabilities. The ability can be used to control IT-related costs, delivery system when needed, and effect business objectives through IT implementation (Jeanne W. Ross 1996). IT leaders with high IT capability, which are effective and efficient users of IT have the superior firm performance when compared to the average level in the respective industry (Radhika Santhanam, 2003). So IT capability positively affects the firm performance.

Prior e-channel experience means the intensity and scope of experience of the firm entered the network market. The effect of direct channel experience was proved by an event study of online channel announcements by Inge Geyskens (2002). Prior e-channel experience can help firm to decrease the length of period of learning new channel operation techniques. Learning is also a reason for the time lag of the IT investment performance. In this case, prior e-channel experience is not only considered as a complementary factor, but also consider the time lag issue in the conceptual model.

Prior financial performance is suggested to be considered when conduct the IT business value by some researchers (Radhika Santhanam, 2003; Jifeng Luo, 2012). Just as researchers suggest that IT resources should be complementary with organizational resources, from this view, the IT capability can be considered as IT resources; prior e-channel experience and prior financial performance can be regarded as the complementary resources. The portfolio of these prior resources/capabilities could improve the business process performance, then finally the firm performance in the specific context.

4.3 Dependent Variables

There are several levels of IT investment performance researchers: firm level, industry level, country and economic level. In our research, we focus on firm level

performance. Some researches use survey methodology to assess the firm performance, the other use secondary data, includes accounting data and market value. In our research, we design to use the accounting data (such as profits/costs/ sales/revenue) to evaluate the overall firm performance.

4.4 Mediating Variables

Based on the integrative model of IT business value, IT investment should manifest at the business process level, that is to say, the business process of the IT investment application can be as the mediate variables in the model. As for which process is involved, it depends on the specific contexts the portfolio resources or capabilities are applied into. In our research, the e-channel is the specific IT investment, so the e-channel implementation is the business process in our model.

It is suggested that mere online presence does not necessarily yield significant performance improvement and that the sophisticated use of the Internet with integration of the existing channels could be key to achieving remarkable financial performance (Yusen Xia, 2010). The existing established distribution channels act as double-edged swords, with divergent effects on commitment and performance; the greater the established distribution, the weaker the positive relation between online commitment and online performance (John Hulland, 2007). Therefore, operational performance of e-channel depends on the integration of e-channel and its existing channels. In our research model, we define across-channel marketing capability as multichannel (e-channel and existed traditional channel) marketing capability. This capability makes it possible to coordinate existing channel and e-channel, which we called multichannel synergy, the performance of multichannel marketing. The multichannel synergy includes super-additive value synergy and sub-additive cost synergy. The former synergy means the value of multichannel op-

eration are more than the sum of the value of each channel individually. The latter synergy means the cost of multichannel operation are less than the sum of the cost of each channel individually.

4.5 Moderating Variables

The moderators affecting the process of IT business value come from the firm level and industry level. Firm-level involves strategy, financial, managerial, technological and marketing factors; industry level includes the moderate effect from competition, demand and financial market.

In our research, we discuss multichannel type, e-channel type and competition intensity. We use Horizontal/Vertical multichannel to define the multichannel type. Horizontal multichannel means customer have only one channel option (traditional channel or e-channel) at every stage of the purchase process (search-purchase-after sale service), there is no conflicts between two channels, it may be easier to

integration of them; Vertical multichannel means the customer have more than one channel options at every stage of the customer purchase process, it is possible for the occurrence of channel conflicts between two channels. The different multichannel may affect the transfer of the e-channel investment into multichannel marketing capability.

E-channel type refers to different commercial mode of the channel on Internet, firms may choose B2C or B2B, and provide tangible goods or intangible goods to its customer through Internet. Competition intensity refers to the extent that the firm is affected by its competitors in online market.

Based on the integrative IT business value model (Melville, 2004), and the above analysis of e-channel context, our research model and the possible variables involved in this paper is illustrated in the figure 1.

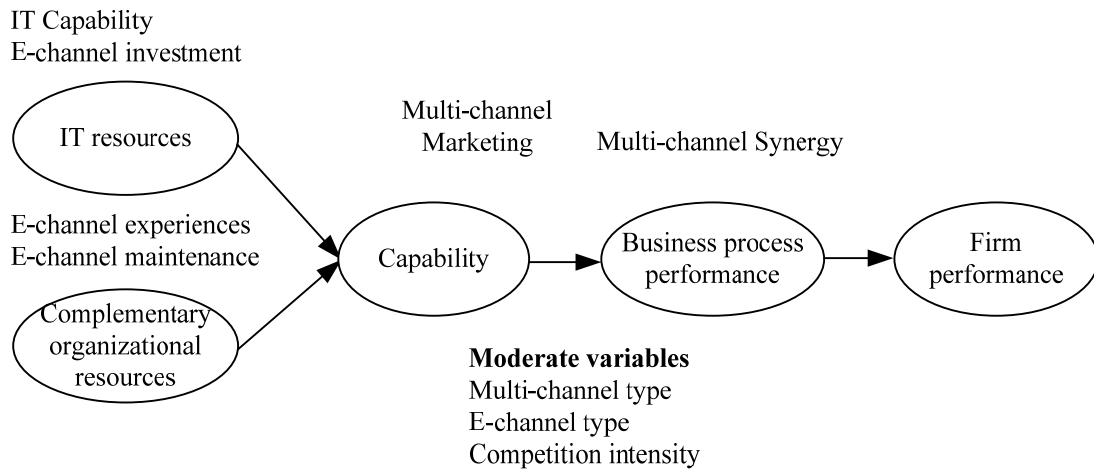


Figure 1. Research model for e-channel investment and performance

5. Discussion

Business value of Information Technology (IT) is one of the most important issues in IS research (Jifeng Luo, 2012). When firms decide to invest in IT and implement the technology, it is crucial to assess the IT

business value and clarifying how the portfolio of IT resources affecting firm’s performance and sustainable competitive advantage today (Jianliang Chen, 2012). Though there are many progresses in the current related studies, the IT paradox that obscures the truth of IT business value still needs to be dealt with in IT

business value studies. The main explanations for IT paradox are not solved well in the current related studies. Our proposed research model attempts to address these problems in the following ways.

5.1 Using Objective Accounting Data

Use of accounting data could alleviate bias resulting from subjective survey measurements and avoid the arguments of using stock price to evaluate the market value of firm performance. What's more, we try to combine the way of data collection in event study, which we called improved event study (see section 4). This is also one of the contributions to IT business value research area. Time lag issue by conducting long term improved event study

In the very few researches considering time lag in IT business value, conducting a long term study is a common way to address this problem. In our research, we collect the IT input data from the fiscal reports and the publicly announced information of the sample firms at a given time, and collecting the performance data from the same secondary data source in a period of time lag. In this way, panel data can be used in the time series analysis to test our research model. This is also an improvement to the event study methodology, after all, the short-term event study only test the immediate market reaction to IT-related investment announcements. As for the typical long-term event study, more confounding effects exist in a longer period.

Besides this, the long term event study based methodology also can make it possible to test the mediate effect of the business process performance or capabilities, which is not verified in the current research status. In this case, the long term improved event study methodology is another contribution to IT business value research area.

5.2 IT and Organization Resources as Control Variables

In addition to the factors in our research model may affect the IT business value, there are also some others factors influencing the firm performance, which should be controlled in the research. There are internal and external control variables discussed in the related literature. They can be sorted into three levels: firm-level, industry-level, and country level. Because our data collection limitation, we don't try to conduct the across-country research currently, then we consider the control variables at firm level and industry level. We will test our model after control the effect of the firm size, industry type.

6. Conclusions

An improved event study methodology is proposed. In order to further understanding and implement the methodology, we show the research model and the variables in the e-channel context. We use accounting data to address the measurement, conducting a long-term improved event study to consider the time lag issue, and other factors affecting the firm performance are also controlled in our model.

Though this paper may contribute to the IT business area by verifying the process of how IT investment is converted into firm performance with improved means to deal with the IT paradox, and help manager to assess IT investment performance objectively to alleviate mismanagement issue, we also can improve this study in the following areas: continually optimize the means for measurement or time lag; complete the whole research design and test the proposed model in e-channel context; modify the proposed model based on the natures of other IT applications.