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An Evaluation Model of IT Investment Effect

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정보기술 투자 효과 평가방법에 관한 연구

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Abstract Financial IT evaluation methods have been unable to satisfy firms' requirements. There has been a growing demand for more comprehensively and non-financially measuring the IT performance. We developed a process-based approach in evaluating impacts of IT on primary activities. In this research we proposed a model that uses the corporate objective of IT and strategic fitt as the core independent variables in measuring the IT effect. Based on the data collected from the management variables of the 125 companies located in Korea, the companies were classified into the 4 different groups according to their corporate objective for IT: un-oriented, operations oriented, market oriented and dual oriented. Through the empirical analysis, we were able to demonstrate that the management of the companies showing a higher orientation level perceives a better IT investment performance, and this shows that the corporate objective for IT serves as a useful index for measuring the IT investment effect. In this research, it was also demonstrated that the strategic alignment has a positive influence on perceiving the IT investment effect.

Key Words : Information Technology, Value Chain, Primary Activities, Strategic Alignment, Corporate Objective

요 약 재무적 IT 투자 효과 측정 방법들은 기업의 요구를 충족시킬 수 없었다. 그러므로, IT 투자에 대한 종합적이고 비 재무적 성과측정 모형에 대한 많은 요구가 있었다. 본 연구에서는, 이러한 요구에 부응하기 위해 기업의 업무 프로세스에 기반 한 IT 성과측정 모형을 제시하고 있다. 본 연구에서 제시된 모형은 기업의 IT목표와 전략적 조정을 측정변수로 사용하여 기업의 성과측정 모형을 제시한다. 국내 125개 기업을 IT에 대한 목표에 따라 다음과 같이 네 개의 그룹으로 분류하여 데이터를 수집하였다: "무 중심", "운영 중심", "시장 중심", "이중 중심". 분석결과를 통해서 우리는 IT에 대한 더 높은 집중(중심)을 갖고 있는 기업일수록 보다 더 높은 IT 투자 성과를 인지하고, 또한 이는 IT에 대한 기업 목표의 정도가 IT 투자의 성과를 측정하기 위한 척도가 된다는 것을 알 수 있었다.

주제어 : 정보기술, 가치사슬, 본원적 활동, 전략적 조정, 기업 목표

1. Introduction

In the corporate management, the role of IT(Information Technology) or information system has been expanding into the scope of leading the core competence of a company, restructuring the structure of an industry and promoting the global management. In particular, the IT including internet has been making rapid progress, and such IT progress and rapidly changing corporate environment have been accelerating the use of IT in the corporate management. In such circumstances, although various companies have been investing a significant amount of their capital in the field of IT, how and to which extent the pure IT

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investment affects the management performance still remain controversial.

The primary purpose of this research is to analyze the IT investment effect on the corporate management performance, and, thereby, provide a realistic guideline that will allow the companies to make an optimum IT investment. In particular, this research aims to conduct a survey among the companies located in Korea, and, thereby, propose the process-based IT investment performance measurement model different from the traditional financial approaches measuring IT investment effects.

Although the IT investment performance measurement has made significant progress, because the corporate-level financial performance measurement was unable to demonstrate the visible effect of IT, there has been a demand for more realistic IT performance measurement. Most of the researches on the IT investment performance measurement rely on the financial performance measurement [1, 2]. and such researches put emphasis on the financial performance of IT. However, since the corporate management performance is largely influenced by not only the use of information technology, but also the internal and external factors of a company such as the context of the domestic and world economy, the problem is that it is very difficult to separately measure the effect on the utilization of IT. In addition, since the final objective of such financial analysis is to calculate the financial performance of a company, the weakness is that the effect that occurs in the process of achieving the final objective, such as the enhancement of inventory management, the enhancement of product diversity and the enhancement of customer service, is excluded from the IT performance analysis. In such aspect, the IT-related management of a company is not aware of the pure IT investment effect on the management performance, and this serves as the reason why the management experience difficulties in making decisions on their IT investment. Accordingly, many scholars and executives involved in the field of IT demand that it is necessary to set the comprehensive IT investment effects(enhancement of product diversity, enhancement of customer service, etc.) as the variables in the IT performance measurement [3, 4].

As far as such realistic necessity is concerned, in this research, the process-based performance measurement model is proposed to calculate the effect of performance on the important primary activities within the value chain. The performance measurement model proposed in this research uses the IT-related corporate objective and IT-related strategic alignment as the independent variables in the process of measuring the IT performance. The corporate objective for IT can be classified into the 4 different types: ① no concentration, ② operation concentration ③ market concentration, ④ and operation and market concentration(double concentration. This research aims to demonstrate that the management of the companies showing a higher concentration perceives a better IT investment performance than the management of the companies showing a lower concentration, and, thereby, demonstrate that the IT-related objectives serve as a useful index for measuring the IT investment performance.

In this research, the effect perceived by the management of a company is used as the measured variable(dependent variable) to calculate the actual effect of IT on each activity within the value chain. Taking into consideration that the role played by the management in making decisions on the IT investment is becoming more significant, this research puts its emphasis on the effect perceived by the management of a company [5]. As the companies become aware that the IT has a potential strategic influence, the management of the companies has been actively participating in making decisions on how, when and where the IT resources are used. Despite such active participation of the management, the pre-existing researches showed that the management of the companies was very skeptical about the IT [6]. Such result shows that the opinion of the management on the

IT is influenced by the personal experience of the management and by the reports submitted by their subordinate employees. Nonetheless, the management of the companies is in an ideal position for determining how and from where the corporate value can be created. As a result, understanding the opinion of the management on the IT is important in terms of discussing the IT effect.

The IT effect measurement proposed in this research can be seen to complement the pre-existing financial IT performance measurement. However there are a few important differences. Initially, to understand the opinion of the management on the IT effect, this research considers the IT effect from the perspective of the corporate objective for IT. Therefore, according to how the companies use the IT to support their corporate strategy, the companies can be divided into the two: a company with an objective for IT and a company without an objective for IT [7]. showed that the IT contribution to corporate performance evaluated by the management is closely related to the role of IT in that company. Secondly, this research selects the IT effect measurement variables that hold a candle to the process that counts as one of the core management activities(primary activities) within the value chain. Thirdly, this research measures how the difference in the corporate objective for IT affects the strategic alignment(aligning IT to the corporate strategy) selected by that company. [7] contend that a company selects the strategic alignment suitable for their corporate objective for IT. The objective of this research is to examine, at the process level, the relationship among the corporate objective for IT, strategic alignment for IT and IT effect.

2. Theoretical Background and Research Model

2.1 Theoretical Background

The conceptual model shown in Fig. 1 shows the relationship between the corporate objective for IT, strategic alignment for IT and IT effect. In this research, the following research questions are raised.

1). Does the management have a differentiated objective for IT?
2). From which part of the value chain does the management perceive the IT effect(usefulness)?
3). What is the relationship between the corporate objective for IT and the perceived effect?
4). To which extent can the strategic alignment for IT enhance the IT effect?

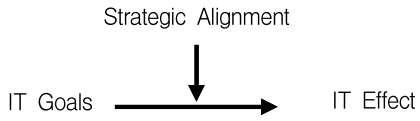

Fig. 1. IT Performance Model

To provide the theoretical background for the research model proposed in this research, the research literatures are examined from the following two perspectives. Initially, since the model proposed in this research uses the effect perceived by the management as the alternative index to the realized IT effect, it is necessary to determine the scope in which the management can evaluate the process-level IT effect. Secondly, although many researchers acknowledge the process-level analysis of the IT effect, since there is not enough empirical evidence that proves such type of analysis, it is necessary to conduct a new research along with the pre-existing research.

2.1.1 IT Effect Perceived by the Management

The legitimacy of the IT effect index perceived as the alternative to the objective IT effect index remains controversial due to the following two reasons. Initially, there is a possibility that the management of a company may exaggerate their opinion on the IT effect. Secondly, in terms of business organization and market uncertainty, the complexity of a modern company makes it difficult to genuinely evaluate the IT effect.

Despite such concerns, there is a research result showing that there is a close correlation between the perceived index and the traditional objective index. The

research by [8] shows that there is a close correlation between the perceived performance index and the objective performance index. The research by [9] shows that the IT effect perceived by the management is correlated to the index used for measuring the financial performances such as profit, net profit and productivity.

[10] contend that the management is in a position of important information provider as to evaluating the IT effect of a company. There are two grounds that support such contention. Initially, the management, as the direct consumer of IT, relies on their personal experience as to perceiving the IT effect. Secondly, as the management of a company participates in making decisions on the IT investment, they are provided with various opportunities to hear from their colleagues and subordinate employees about the performance of the previous IT investments. To sum up, the management serves as an important information source to the IT effect, and using the IT effect perceived by the management to evaluate the IT effect is supported.

The management's perceived evaluation index does not replace, but complements the traditional financial evaluation index to a certain extent. This is because, although it is appropriate to use the objective evaluation index, it is not always possible for the management of a company to find the accurate evaluation index for measuring the IT effect.

2.1.2 Process-based Approach for Evaluating IT Effect

Since the IT investment and investment effect different, it is difficult to evaluate the IT effect at a corporate level. To resolve such problem, it is necessary to group the evaluation indexes that share the same investment purposes such as cost reduction, productivity enhancement and customer service. Such approach is based on the process-based IT effect evaluation assuming that the IT investment effect initially occurs at a process level, and is supported by many scholars [11, 12]. Such process-based perspective contends that the IT enhances the connection between the individual task process and task, and, thereby, creates the corporate value.

There are many methods used to define the process within an organization. However, the value chain model is the most well-known method. The value chain model divides the activities into the primary activities (warehoused distribution, production activity, calculated distribution, marketing and sales) and supporting activities, and defines each activity as an activity that adds values to a company. Such activities are called as value activities, and a company can apply the IT to such value activities in order to enhance its value creation potential. A company can analyze the effect of IT on such value activities in order to develop the process-level IT effect evaluation index. Table 1 shows an example of the effect of IT on diverse activities within the value chain. The process-level IT effect evaluation index may serve as more of an abundant evaluation index than the corporate-level IT effect evaluation index.

Table 1. Dimension of IT Effect

Production Planning and Support	IT improve the efficiency of organization's planning and decision making
Supplier Relationship	IT improve the function of linking with suppliers
Production and Operations	IT improve the efficiency of production of products
Product and Service Improvement	IT can be used to develop new products or servises
Sales and Marketing Support	IT can be used to analyze market trends and market response
Customer Relationship	IT can be used to maintain relationship with customers

2.2 Research Model and Hypothesis Setting

[13] contends that companies must differently focus(oriented) on the important corporate objectives such as operation efficiency and strategic positioning. Although these two orientation strategies are both essential to the corporate performance, a unique method is used to respectively run these two orientation strategies. For example, the operation efficiency

oriented strategy allows a company to conduct the same activities better than its competitors, and the strategic positioning allows a company to conduct the activities different than its competitors or conduct the same activities using different methods. The companies focusing on their operation efficiency are able to eliminate their wasteful factors, use more advanced technologies and achieve a higher productivity than their competitors.

Although the operation activities are flexible to the market demand to a certain extent, they are not as flexible to the market demand as the activities of creating and enhancing the strategic positioning in the involved industry.

Table 2. Relation Between Corporate Strategy and Corporate Objective for IT

Corporate Strategy	IT Objective
Operational Efficiency	**Internal Perspective**
Efficiency	Cost Saving and Productivity Improv.
Effectiveness	Organizational Efficiency Improv.
Strategic Positioning	**External Perspective**
Market Scope	Current Market and Geographic Range
Market Structure	Current Business and Change of Marketing Practices

2.2.1 Corporate Objective for IT

As shown in Table 2, the corporate strategies such as operation efficiency (efficiency and effectiveness) and strategic positioning(market scope and market structure) can be interpreted as the corporate objective for IT. To reduce the operation cost or enhance the productivity, the IT can be used to enhance the efficiency, and the IT can be used to flexibly respond to the changing market demand. At this point, the market change can be divided into market scope change and market structure change. The market scope refers to a process where the IT is used to expand the scope of geographical approach or the scope of customer approach, and the market structure refers to the process where the IT is used to change the pre-existing industry or the pre-existing market practice.

Depending on how the companies use the relationship between the corporate strategy and corporate objective for IT to emphasize either or both the operation efficiency or/and strategic positioning, the companies can be classified into the 4 groups such as "un-oriented", "operations oriented", "market oriented", and "operations and market oriented" (dual oriented).

The companies classified as "un-oriented" can be defined as the companies that do not have a certain objective for or interest in IT. Such lack of interest makes the companies look at the IT-related expenditure not as the investment to be managed, but as the cost to be minimized. For such companies, there is a possibility that the past IT-related experience of the management is negative. As a result, the management of such companies takes a wait-and-see attitude and do not make the IT investment until there are no other alternatives. Such passive attitude toward the IT investment is understandable, but not having a certain objective for IT may cause a major problem. In case the management of a company is not interested in the IT, their IT investment can be incorrectly operated and such incorrect operation may cut back the performance that can be realized through the IT investment.

The companies classified as "operations oriented" focus their IT objective on their operational efficiency. Such companies emphasize the quality, flexibility and mobility, and use the IT to reduce their operation cost and enhance the overall efficiency of their business operation.

On the other hand, the companies classified as "market oriented" use the IT for their strategic positioning. Such "market oriented" companies use the IT to create and enhance the values required by their customers. Although such "market oriented" companies focus their IT objective on the outside, they use the IT for their internal operation from time to time. As a result, the "operations oriented" must be supported to a

certain extent in order for the customer-based strategy(market oriented) to be successful.

Finally, although certain companies use the IT for their operation efficiency or strategic positioning, more companies are aware that the IT can support their dual orientation (operations and market oriented). The companies that select such dual orientation use the IT to not only enhance their operation efficiency, but also expand their markets and create new markets.

The companies can be listed from those with the highly focused objective to those with the lowly focused objective in the following order: dual oriented, market oriented, operations oriented and un-oriented. Porter contends that the companies that prefer their strategic positioning to their operation efficiency are likely to achieve the higher-level corporate performance. To expand such contention, it can be said that the companies with a more oriented or strategic objective for IT will perceive the more higher-lever IT effect than the companies without a more focused objective for IT. Accordingly, we set the hypothesis as follows:

Hypothesis 1 : The management of the companies with a more oriented objective for IT will perceive the more higher-level IT effect than the management of the companies without a more oriented objective for IT.

2.2.2 Strategic Alignment for IT Investment

The strategic alignment refers to a process where a company aligns its IT investment to its corporate strategy or business strategy, and can be considered the most important problem faced by the management. If a company is unable to realize a sufficient effect from the IT investment, it is due to the lack of strategic alignment [14]. If the IT investment effect depends on the strategic alignment, it is necessary to align the IT to the business strategy in order to enhance the IT effect. In this research, based on the point that the companies with a more oriented objective for IT will achieve a more higher-level strategic alignment, the hypotheses are set as follows:

Hypothesis 2: The management of the companies with a more oriented objective for IT will achieve the more higher-level strategic alignment.

Hypothesis 3: The more higher-level strategic alignment will contribute to the more higher-level IT effect.

2.2.3 Data Collection and Interpretation

To verify the hypotheses set above, a survey among the management(positions above executive) of the 200 companies located in Korea was conducted. As a result of distributing the questionnaire copies to the management of the 200 companies, the 125 questionnaire copies filled out by the subject companies were empirically analyzed. Since the questionnaire samples were filled out by the management of the subject companies ranging diversely, the analysis of variance was conducted to review whether or not any bias exists in terms of geographical location, industry and company size.

(1) Measurement of Corporate Objective for IT

Using the 4 questions proposed in Table 2, the strategic intent or corporate objective for IT was measured. The 7-point Likert scale was applied to every question. Depending on the survey respondents' level of agreement, they were asked to select the score on a scale of 1-7, with 1 being "totally disagree" and 7 being "totally agree". For example, in case the management selects a score below 4 for each question specified in Table 2, the involved company is determined to have no particular objective for IT, and, therefore, is classified as "no orientation". In case the management selects a score above 5 for the two questions in the upper section and a score below 4 for the two questions in the lower section, the involved company is classified as "operation oriented". Using the method, in case the management selects a score below 4 for the two questions in the upper section and a score below 5 for the two questions in the lower section, the

involved company is classified as “market oriented”. Lastly, in case the management selects a score above 5 for all four questions, the involved company is classified as “dual orientation”(operation and market oriented).

Table 3. IT values for Orientation type

Activities	Orientation Type	Average	F value
Production Planning & Support	Un-oriented Operations Oriented Market Oriented Dual Oriented	3.82 4.28 4.71 5.11	8.157
Supplier Relationship	Un-oriented Operations Oriented Market Oriented Dual Oriented	3.42 3.82 3.97 4.52	6.815
Production & Operations	Un-oriented Operations Oriented Market Oriented Dual Oriented	3.67 4.27 4.52 5.01	8.023
Products & Services Improv.	Un-oriented Operations Oriented Market Oriented Dual Oriented	3.68 3.92 4.51 4.98	11.817
Sales & Marketing	Un-oriented Operations Oriented Market Oriented Dual Oriented	3.42 3.91 4.61 4.64	7.926
Customer Relationship	Un-oriented Operations Oriented Market Oriented Dual Oriented	3.79 4.01 4.75 5.09	10.452
Significant Level (p<0.01)			

(2) Process-level Measurement Index for IT Effect

Using the IT effect research literature review shown in Table 1 as reference, the 30 questions were selected for evaluating the effect of IT on the various primary activities within the value chain. Some of these questions were selected in the previous research [14]. These 30 questions were classified into the six primary activities or processes (production plan/support, supplier relationship, production/operation, product/service enhancement, sales/marketing support and customer relationship). These 30 items all included the IT investment effect on the value chain.

(3) Strategic Alignment

The strategic alignment is evaluated using one question. Depending on the extent to which the IT supports the business strategy of a company, the questionnaire allows the respondents to select the score on a scale of 1-7.

Table 4. Analysis Results of Strategic Alignment for Orientation Type

Variable	Orientation Type	Average	F
Strategic Alignment	Un-oriented Operation Oriented Market Oriented Dual Oriented	3.96 4.82 5.17 4.99	6.873

3. Results and Analysis

In this research, the empirical analysis sets the relationship between the corporate objective for IT and the IT effect as priority. The analysis of variance

Table 5. Correlations Between Strategic Alignment and IT Values

	Corporate Business Processes					
	Production Planning &Support	Supplier Relationship	Production & Operation	Products and Services Improv.	Sales & Marketing	Customer Relationship
Strategic Alignment	0.285**	0.165**	0.318**	0.255**	0.149**	0.198**
** Significant Level (p < 0.001)						

according to the company's orientation type was used to confirm whether or not the realized it effects show difference. As shown in Table 3, it was found that the six corporate activities showed a difference among the orientation types.

To verify the hypothesis 2, the relationship between the strategic alignment and corporate objective for IT was analyzed. To confirm whether or not the difference in the corporate goal for IT causes the difference in the strategic alignment, the analysis of variance per each concentration type was conducted. Table 4 shows that there was a significant difference($F=6.873$, $p<0.001$). The mean values shown in Table 4 show that the management of the companies that concentrate more on the IT perceive the more higher-level strategic alignment. Accordingly, the hypothesis 2 was selected. [15] contend that the strategic alignment is an important determinant factor that determines the corporate value of IT. Table 5 shows the correlation between the strategic alignment and IT performance. As Table 5 shows, there is a significant correlation between the strategic alignment and IT performance. Such result proves that the strategic alignment is related to the perceived IT value. Accordingly, the hypothesis 3 was selected.

4. Discussion and Implication

What is discovered through this research can be summarized as follows.

Initially, this research shows that the management of a company has diverse objectives for IT, and that the environment under which IT is operated is an important factor to be considered by the researchers conducting a research on the IT performance [16]. This research shows that it is incorrect to contend that all companies have the same strategic objective for IT [17].

Secondly, this research shows that the corporate objective for IT varies depending on the company. The companies can be classified into the following 4 groups according to their objective for IT: "un-oriented" company, "operations oriented" company, "market oriented" company and "dual orientation" company. Since the corporate objective for IT is influential on that company's IT investment and that company's IT investment contributes to its corporate performance, it can be said that such 4 orientation types are important.

Third, this thesis proves that the perceived IT performance is directly related to the corporate objective for IT. It should be noted that the management of the dual orientation companies perceived the IT performance at the highest level.

Fourthly, this thesis shows that the IT performance perceived by the management of a company is consistently related to the corporate objective for IT. For example, the management of the operations oriented companies perceived the IT performance at the highest level in the tasks related to their production and operation. Similarly, the management of the market oriented companies perceived the IT performance at the highest level in the tasks related to their customer relationship.

Lastly, it was found that the strategic alignment has the closest relationship with the perceived IT investment performance. It was found that the companies with a corporate strategy well aligned to the IT perceived the high-level IT performance, and that the companies with a poor strategic alignment perceived the low-level IT performance.

It can be said that the research results acquired in this research is significant to not only the IT-related management, but also the general management [18]. The fact that the management of a company has a differentiated corporate objective for IT shows that the IT-related management and general management are required to communicate with each other in order to well understand and execute their corporate objective.

This research proposes that the management of a company must be able to not only clearly set up the corporate objective for IT, but also identify the fields

where the IT can create values. The higher IT performance can be expected through clarifying the corporate objective for IT that supports the corporate strategy.

5. Conclusion

This research makes academic contributions in terms of measuring the IT performance. This research selects the process-level measurement as the comprehensive method for measuring the IT performance, and this method forms a contrast with the pre-existing financial performance measurement. In this research, the value chain representing diverse business processes was used to comprehensively construct the survey questions required for calculating the perceived effect.

This research uses the IT performance perceived by the management in the process of evaluating the IT investment performance, and such perceived performance is limited in that it serves as an alternative to the realized performance. Nonetheless, the management of most of the companies believes that the past IT investment will contribute to achieving the corporate objective. Moreover, the objective selected by the management in relation to the IT investment affects the task performance, and, thereby, affects the extent to which the IT performance is perceived.

The relationship between strategic alignment and IT effect is particularly important, considering the point that strategic alignment is the most important issue managers are facing. If firms want to achieve more in the short term from their IT investment, they can do this through strategic alignment that clearly defines their objectives for IT. In the long run, firms should try to have a strategic or focused goal for IT.

This research uses multiple process-oriented measurements to assess IT investment value, but our research has limitations on adopting a single enterprise-level measurement for strategic alignment.

Another limitation of this research is in using executives' perceived values as measurements of IT investment effect.

Finally, as IT strategic effects become increasingly relevant in areas such as product, service innovation, and customer relationships, we need to evaluate these effects first.

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