An Empirical Study on the Performance of Software Company with Software Type

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***Abstract*—The purpose of this study is to examine the factors influencing performance of software companies. This model tests various theoretical research hypotheses related to innovation, standardization and technology marketing strategy and software type. Smart PLS (Partial Least Square) 2.0 and SPSS 15.0 have been utilized for deriving the study results. The result of hypothesis testing is as follows. First, standardization and technology marketing strategy positively influence financial performance. Second, innovation, standardization and technology marketing strategy positively influence technical performance. Finally, mobile and non-mobile software companies was shown that innovation, standardization, and technology marketing strategy has different effects to financial and technical performance.**

***Index Terms*—Innovation, Standardization, Technology Strategy, Performance, Software Company, Software Type**

I.INTRODUCTION

IN the world of globalization now in progress, while there is evolution in capital, manpower, and resources free movement in the global world, diffusion of global sourcing and infinite economy have been intensified. Accordingly, for the sustainable growth of our future domestic economy, service-oriented knowledge economy's movement is essential. Software (SW)'s role has been emphasized as the possible core-base of knowledge and information's accumulation·organization · utilization. In particular, SW and R&D, manpower training and knowledge with the OECD's investment as three indicators of knowledge-based society have established itself as key elements.

Software industry is said to be all industries involved in a series of steps of software development, distribution, maintenance, etc. The software industry can be defined as software development·manufacture·production·distribution, etc. and related services, and information system operating in related industries. According to Korea Software for Market Analysis and Forecasts Report Domestic software market in 2010, in a scale of US$3.18 billion is expected to be among the annual growth of 7.0% over the previous year, is also expected to grow 7.2% in the long term average to US$4.205 billion in the year of 2014. In Korea ICD, software market recent international economic situation is recovering steadily improving the performance of the major corporate customers and is expected to increase investment and as a result, overall domestic demand for investment in software and the market was expected to grow steadily [8].

Meanwhile, software companies include in the study about standardization and flexibility of software processes and project performance [9], the software flexibility and project management control factors that impact on performance [14], a study on the project risk and performance [13], Studies on the effect of performance of product innovation considering the product development process and the knowledge acquisition process [6], success factors of software ventures [1], and a study on the profile of uncertainty and project performance [10]. There is a lack of researches regarding software company's innovation, standardization, and technology marketing strategy.

The paradigm of the recent market evolved into an open market; even in mobiles for users, there is a growing interest for the provision of a variety of applications and content to enable mobile software platform. In the future mobile software's dependence to wireless internet service and mobile devices, applications and content will increase. In the mobile software market initiative to ensure competition is expected to be keen. Therefore, there is an expected difference of the impact of software companies and mobile software companies and non-mobile innovation, standardization, technology marketing strategy on the performance of software companies.

The purpose of this study is to verify the factors affecting the performance of software companies' innovation, standardization, technology marketing strategy and depending on the type of software, whether there are differences in these factors. To achieve the research objectives, demonstration software for companies in Korean were investigated. The result of the study that identifies the factors affecting Korean software companies will provide the strategic implications.

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II. RESEARCH MODEL AND HYPOTHESES

A. Innovation

Software innovation can be related to several aspects of the product, such as its features and performance parameters, the impression of its newness according to various market actors, and the novelty of its architectural structure [6]. Garcia and Calantone (2002) provided novelty of product innovation for customers (newness) and defined the novelty of the market and technology and market expertise and technical know-how. Jordan and Segelod (2006) have been suggested to be able to lead software product advantage, product newness and company structural change. The software innovation project outcomes will be improved. Thus, based on previous literature and the arguments presented above, the followings are hypothesized:

H1-1: Innovation has a positive effect on the financial performance.
H1-2: Innovation has a positive effect on the technical performance.

B. Standardization

In the software development process, standardization can be said as the procedure of documenting the development of the software or technical information. Nidumolu (1996) categorized standardization as output controls standardization and behavior controls standardization. Because of the influence affecting software process performance and product performance these standardized residual risks were negatively affected. Shu and Jeong (2003) formulated the procedure regarding the development and standardization of technical requirements and they found out that standardization improves process performance. Na(2004) studied about the impact of standardization and requirements uncertainty to software project performance and found out that standardization of software development reduces the risk of residual. Liu et al. (2008) software process standardization improved project performance and found out that software flexibility was also a significant influence. Thus, based on previous literature and the arguments presented above, the followings are hypothesized:

H2-1: Standardization has a positive effect on the financial performance.
H2-2: Standardization has a positive effect on the technical performance.

C. Technology Marketing Strategy

Technology marketing strategy, while supporting the business strategy in the position to lead the business strategy linked to each other organically, the lower companies reserve technical resources based on external business attribute acts as the main expression. In companies developed superior software products are being introduced to many customers and in order to be continually utilized, especially in order to ensure insufficient sales force in normal sized enterprises technology-based strategies are important for product sales. In marketing of software products customer-facing products is essential, distribution may depend on the specific hardware and in virtual space, regardless of the intent of the provider you choose a product that can have a variety of distribution channels [11].

Ahn and Kim (2002), on the study of factors affecting performance of software ventures, technology strategy affects performance is studied. In technology marketing strategy characteristics of technology and software products, technology and product development strategies, technology marketing strategy was set up as a study. Technology and product development strategy and technology marketing strategy showed the (+) effect on company performance. Similarly, Ahn and Kim (2001) stated that the technology marketing strategy improves performance of customer, internal processes, learning, and innovation. Thus, based on previous literature and the arguments presented above, the followings are hypothesized:

H3-1: Technology marketing strategy has a positive effect on the financial performance.
H3-2: Technology marketing strategy has a positive effect on the technical performance.

D. Software Type

Recent mobile devices such as smart phones, including the tablet expands the prevalence of competition in the mobile software market is unfolding. According to increased use of mobile devices, mobile software industry continues to grow, mobile software companies and non-mobile software companies and innovation, standardization, technology marketing strategy expects to influence the performance of software companies. Thus, based on previous literature and the arguments presented above, the followings are hypothesized:

H4-1: Innovation's impact on financial performance will differ depending on the type of software.
H4-2: Innovation's impact on technical performance will differ depending on the type of software.
H5-1: Standardization's impact on financial performance will differ depending on the type of software.
H5-2: Standardization's impact on technical performance will differ depending on the type of software.
H6-1: Technology marketing strategy's impact on financial performance will differ depending on the type of software.
H6-2: Technology marketing strategy's impact on technical performance will differ depending on the type of software.

The research model is presented as in Figures 1.

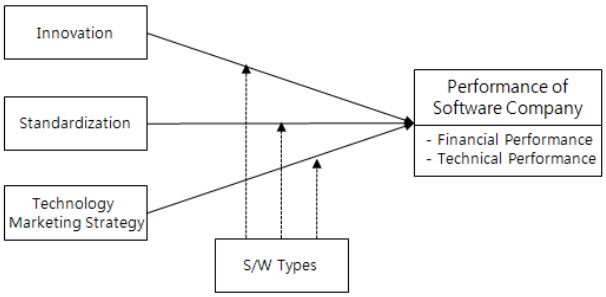

Fig. 1. Research model.

III.RESEARCHMETHODOLOGY

A. Operational Definition of Variables and Measurement Items

Innovation was defined as a new platform or module level than traditional software products. Standardization has been defined as the extent standardized and documented software development process. Technology marketing strategy was defined as the extent analysis of ideas and economic for software's marking and development. Financial performance was defined as software related to corporate financial and technical performance were defined as the number of new products development and R & D budgets percentage increase.

Measurements in previous studies were developed in order to use empirically validated metrics. Except for the demographic variables, all variables were measured as 7-point scale. Table I is a summary of measurement items.

TABLEI
MEASUREMENT ITEMS

variables	Measurement Items	Indicators	Relate Literature
IN	-Feature set differences over the closest prior developed product -New platform for an existing software product -New modules for an existing software product -Product performance compared to closest available competitive product in the relevant market segment	4	Jordan and Segelod (2006)
ST	-To what extent does the software organization use a standardized software development process? -To what extent does the software organization use a standardized and documented software development process on each project? -To what extent is a mechanism used for ensuring compliance with the software engineering standards?	3	Liu et al.(2008)
TMS	-Degree to correspondence closely to development of trade -Degree to secure product supply chain and cooperation -Thorough data gathering and evaluation -Thorough analysis of feasibility	4	Ahn and Kim (2002)
FP	- Increase of average sales -Increase of net profit -Level of increment on the return on invested capital -Improvement of cash flow	4	Rai et al.(2006), Yao et al.(2007)
TP	- Increase the number of degree of development of new software products - Increase in R & D budget, and feeding rate	2	

IN: Innovation, ST: Standardization, TMS: Technology Marketing Strategy
FP: Financial Performance, TP: Technical Performance

B. Sample and Survey Research Methods

Data for this study were collected from August 1, 2010 to October 31. After removing the unsuitable questionnaires, a total of 100 survey data were considered to be analyzed. The statistical analysis used in this study was Smart PLS 2.0 and SPSS 15.0.

There are 89 males and 11 females. In the number of employees, there are 35 companies (35.0%) that have the 10 to 30 employees and 26(26.0%) companies have less than 10 employees. In annual sales, 46 companies (46.0%) had less than US$10 billion and 27 companies (27.0%) have US$ 10 billion – US$50 billion. In software type, 47 companies are mobile companies and 53 companies is non-mobile companies. Table II shows the characteristics of the sample data.

TABLE II
SAMPLE CHARACTERISTICS

Classification		Frequency	Percentage (%)
Gender	Male Female Total	89 11 100	89.0 11.0 100.0
Number of Employees	Less than 10 10~30 30~50 50~110 More than 110 Total	26 35 16 12 11 100	26.0 35.0 16.0 12.0 11.0 100.0
Annual Sales	Less than US$10 billion US$10 billion~ US$50 billion US$50 billion~ US$110 billion More than US$100 billion Total	46 27 17 10 100	46.0 27.0 17.0 10.0 100.0
S/W type	Mobile S/W company Non-mobile S/W company Total	47 53 100	47.0 53.0 100.0

IV. RESULTS DATA ANALYSIS

A. Reliability and Validity Analysis

In this study, Cronbach's α coefficient was used to verify the reliability of measurement tools. In the reliability analysis, Cronbach's α of all variables were above 0.8. Thus, overall reliability is higher and all configuration concepts used can be seen as reliable. In order to verify constructs between reliability and validity, the value of the concept of reliability (ICR) and Average Variance Extracted (AVE) were calculated. If the reliability concept is higher than 0.7 [4], it considers valid.

Parameters and limits in this study are exceeded and values exceed 0.5. Thus, it has reliability and validity. Table III shows the reliability and validity analysis.

TABLE III
RELIABILITY AND VALIDITY ANALYSIS

Variables	Item	Factor Loading	AVE	ICR	Cronbach'sα
Innovation	IN1 IN2 IN3	.870 .953 .898	.824	.933	.895
Standardization	ST1 ST2 ST3	.934 .943 .825	.814	.929	.887
Technology marketing strategy	TS1 TS2 TS3 TS4	.858 .863 .865 .872	.747	.922	.888
Financial performance	FP1 FP2 FP3 FP4	.891 .946 .879 .888	.813	.946	.924
Technical performance	TP1 TP2	.949 .950	.902	.948	.891

B. Correlation Analysis

Correlation analysis is an analytical technique to measure how close two variables are. There is analyzed with the structural model since there are no multi-collinearity problems as shown in Table IV. Table IV is presented on the diagonal square root of the AVE values. The square root of AVE exceeded 0.707. If the correlation coefficient exceeded its value, the validity between each component of the concept can be secured [16]. The AVE values for all variables' square root showed to be bigger than the correlation coefficient between the concepts. Since the correlation coefficient exceeded its value, it proved the existence of discriminant validity.

TABLE IV
CORRELATION ANALYSIS

Variables	IN	ST	TMS	FP	TP
Innovation	**.908**$^{++}$				
Standardization	.246	**.902**			
Technology marketing strategy	.514	.393	**.902**		
Financial performance	.154	.321	.411	**.842**	
Technical performance	.487	.278	.562	.479	**.954**

$^{++}$ The values are presented on the diagonal of the square root of AVE

C. Hypothesis Testing

The results: First, innovation appears to have (+) positive effects on technical performance. Hypothesis 1-2 (path coefficient = 0.267, t = 8.079) was adopted. And innovation appears to influence (-) negatively on financial performance. Hypothesis 1-1 (path coefficient =- 0.089, t= 2.458) was rejected. Second, standardization appears to have a (+) positive effects on financial performance and technical performance. Hypothesis 2-1 (path coefficient = 0.194, t = 6.279) and Hypothesis 2-2 (path coefficient = 0.053, t = 1.914), respectively were adopted. Third, technology marketing strategy appears to positively influence financial performance and technical performance. Hypothesis 3-1 (path coefficient = 0.380, t = 14.421) and Hypothesis 3-2 (path coefficient = 0.404, t = 10.281), respectively were adopted.

Table V is a summary on the results of hypothesis testing.

TABLE V
HYPOTHESIS TESTING RESULTS

Channel		Path Coefficient	t value	Test Results
H1-1	Innovation -> Financial performance	-.089	2.458	Not-accept
H1-2	Innovation -> Technical performance	.267	8.079***	Accept
H2-1	Standardization -> Financial performance	.194	6.279***	Accept
H2-2	Standardization -> Technical performance	.053	1.914**	Accept
H3-1	Technology marketing -> Financial performance	.380	14.421***	Accept
H3-2	Technology marketing -> Technical performance	.404	10.281***	Accept

Significance level: *: p<0.1 **: p<0.05 ***: p<0.01

D. Software Type

In this study, we verified whether there are differences between mobile software company (n = 47) and non-mobile software company (n = 53). In Figure 2, mobile software companies and non-mobile software companies is a result of the structural model analysis.

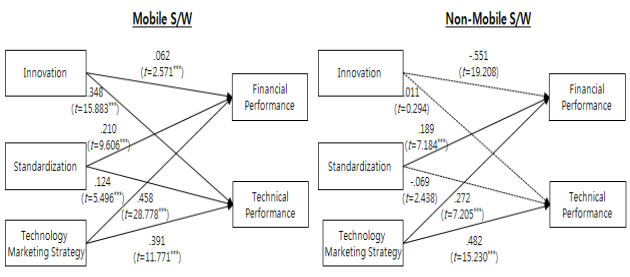

Figure 2. Path analysis of the type of software.

A comparison of the difference between the path coefficients, Chin et al. (1996) proposed a formula. This formula was applied in the studies of Keil et al. (2000), Ahuja and Thatcher (2005).

$$t_{ij}=\frac{p_1-p_2}{\sqrt{\frac{n_1-1}{n_1+n_2-2}\times SE_1^2+\frac{n_2-1}{n_1+n_2-2}\times SE_2^2}\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

p_i : i second path coefficient , n_i : i second sample size
SE_i : i second path, the standard error of coefficient,
t_{ij} degrees of freedom : n_1+n_2-2

The above formula for calculating the non-mobile software, mobile software companies and enterprises value of the path coefficients and standard errors can be found in Table VI. Using the formula above, the result is also shown in Table VI. The results, all path coefficients and t value of the difference appeared significantly H4-1, H4-2, H5-1, H5-2, H6-1, H6-2 and were both adopted

TABLE VI
ANALYSIS OF THE DIFFERENCE BETWEEN THE TYPE OF SOFTWARE

Hypothesis		Mobile S/W	Non-mobile S/W	Test Results
H4-1	Path coefficient Standard error	0.062 0.033	-0.551 0.032	Accept
	Coefficient *t* value of difference	94.215***		
H4-2	Path coefficient Standard error	0.348 0.016	0.011 0.038	Accept
	Coefficient *t* value of difference	56.495***		
H5-1	Path coefficient Standard error	0.210 0.023	0.189 0.028	Accept
	Coefficient *t* value of difference	4.067***		
H5-1	Path coefficient Standard error	0.124 0.022	-0.069 0.026	Accept
	Coefficient *t* value of difference	39.796***		
H6-1	Path coefficient Standard error	0.458 0.022	0.272 0.038	Accept
	Coefficient *t* value of difference	29.454***		
H6-2	Path coefficient Standard error	0.391 0.024	0.482 0.029	Accept
	Coefficient *t* value of difference	16.966***		

Significance level: *: p<0.1 **: p<0.05 ***: p<0.01

V. CONCLUSION

The purpose of this study is to verify the factors (innovation, standardization, technology marketing strategy) affecting software company's performance and whether there are differences depending on the type of there software. To achieve the research objectives an empirical study was conducted between 100 software companies in Korea. The results of this study can be summarized as follows.

First, it was found out that innovation improves the technical performance but decreases financial performance. Innovative software products has a significant impact on software companies' new products, the extent of R & D budgets but to develop innovative new software product a lot of cost and effort is needed so it can be interpreted as a negative (-) effect on financial performance.

Second, standardization improves both financial and technical performance. Software companies to improve the performance of the standardization process have become important.

Third, technology marketing strategy influences financial performance and technical performance. In order to develop software technology, collect ideas and a feasibility analysis. To ensure cooperation and product supply chain, technology strategy is trying to improve financial and technical performance of software companies.

Finally, for mobile software companies and non-mobile software companies it was shown that innovation, standardization, technology marketing strategy has different effects to financial performance and technical performance. The mobile companies indicate that innovation and standardization improve financial and technical performance. Therefore, this study implies that mobile software developer importantly considers innovation, standardization and technology marketing strategy.

This study has some limitations. First, in this study of the factors affecting software companies, considered were only innovation, standardization and technology marketing strategy. In future research, there is a need to consider other factors. Second, this study the performance of software companies' financial performance and technical performance show the only factors considered. In future researches, we may be able to measure performance using software quality and performance of software companies using balanced scorecard (BSC) in order to make better decision making in technology management strategy.

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