Technology Valuation Using Patent and R&D Expense Information

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Abstract**:** *Recently, as technology-intensive industry has big part of whole economy, technology became an important factor of success. Therefore, enterprises spend more money to obtain more valuable technology. In many case, many enterprises purchase the companies, which have the needed technology, or the technology. For this reason, it is needed to evaluate the value of certain technology. In this study, we deduce technology value index through the invested R&D cost for technology acquisition and company's patent information. Also we conducted correlation analysis to analyze whether which technology value index is close correlation with the future profitability*

Keywords: *Management of Technology, Technology Valuation, Correlation analysis, Patent, R&D Expense.*

1. Introduction

Recently, as technology-intensive industry has big part of whole economy, technology became an important factor of success. Therefore, enterprises spend more money to obtain more valuable technology than other rival companies. However, obtaining needed technology through R&D requires huge R&D organizations, so there is a limitation in cost. Because of this, many enterprises purchase the companies, which have the needed technology, or the technology[1]. In this case, it is needed to evaluate the value of certain technology. Valuation of technology is to evaluate the economic value of certain technology. Technology valuation's object includes patent right(the right to exclusively use certain technology), utility model, computer software, technical business secret, and knowhow. A patent, the typical intangible asset, is useful for technology valuation and technology value analysis because it minutely describes certain technology, reference information, and scope of a right.

Currently, according to the approach way, the widely used way for technology valuation can be divided into three types: income approach, cost approach, and market approach. Firstly, income approach evaluates the future profit through certain technology, then based on this, it evaluates the economic value of the technology. The cost approach is to evaluate the economic value of certain technology based on the cost spent for developing or obtaining the technology. The market approach evaluates the value of certain technology by considering cases of similar technology in the past and market situation.

In this study, we deduce technology value index through the invested R&D cost for technology acquisition and company's patent information of 29 American IT companies. Also, to analyze whether which technology value index is close correlation with the future profitability, this study will perform a correlation analysis.

2. Technology Valuation Using Patent Information

For technology valuation, this study used income approach. The summary of this study is shown in the figure 1.

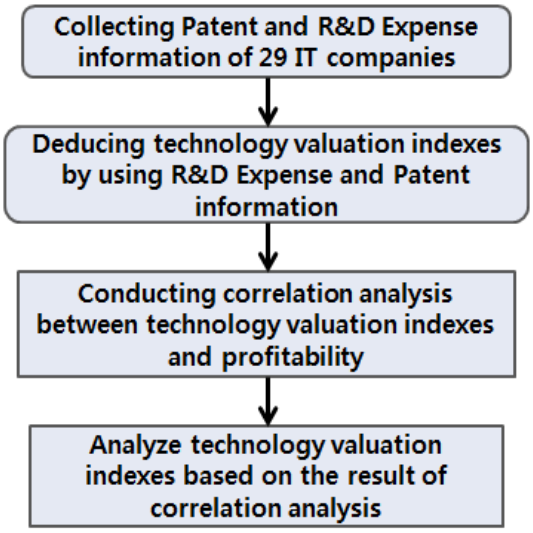

Fig. 1: Summary of this study

To evaluate the value of a company's technology, this study used a company's patent information. The paten information, which is widely used for quantitative analysis, is the number of patent application, citation, and patent family. The number of citation means how many times certain technology has been cited by other patents after its patent application. The relation of citing is subjective information that can evaluate the correlation and development relation between technologies[2]. Also, frequently cited patents by the follow-up patents usually have wider scope of a right and higher economic and technical value[3]. For the technology valuation index deduction, this study used R&D cost besides patent information. Table 1 below is the technology valuation index, which was deduced in this study.

TABLE I: Deduced Technology Valuation Index

Technology Valuation Index	Mean	Standard Deviation
The number of Patent Application	0.0341	0.0676
The number of Citation	0.0341	0.0710
CPP	0.7711	0.6819
R&D Expense	0.0345	0.0450
The Number of Patent Application/ R&D Expense	1.0567	1.3925
The number of Citation / R&D Expense	0.0563	0.1488

To analyze the relation between the deduced technology valuation index and the future profitability, this study conducted a correlation analysis. Generally, whole process of a technology development, commercialization, and improvement in profitability takes several years. For this reason, this study applied three years as the time difference between the technology valuation index and the time of profitability improvement. Table 2 below is the result of the correlation analysis between the technology valuation index and the amount of increase.

TABLE Ⅱ: The Result of the Correlation Analysis

	Increase of equity	Increase of sales	Increase of operating income	Increase of net profit
The number of Patent Application	.041	.146*	.116	.114
The number of Citation	.147*	.242**	.165*	.157*
CPP	.280**	.292**	.165*	.148*
R&D Expense	.095	.158*	.081	.077
The Number of Patent Application / R&D Expense	.044	.075	.059	.056
The number of Citation / R&D Expense	.115	.228**	.165*	.159*

As a result of analysis, R&D expense and the number of patent application have a significant relationship between the Increase of Sales. However, They were unrelated to the improvement of operating income and net profit. The number of citation and CPP were in a significant relationship with the four categories of profitability improvement. Through the result, we verified that the number of citation could be an important information to evaluate the value of patent and technology. In the analysis, while the number of citation / R&D expense had a significant relationship to increase of sales, operating income, and net profit, it had the biggest correlation to the increase of net profit among the six technology valuation indexes. On the other hand, the number of patent application/R&D expense was not related to a company's profitability increase.

3. Conclusion

This study deduced the technology valuation index for technology valuation in income approach and performed a correlation analysis to analyze the relation between the deduced technology valuation index and a company's actual increase of profit. As a result, the number of citation/R&D expense, CPP, and the number of citation had a significant correlation to a company's sales, operating income, and increase of net profit. Among the six indexes, the number of citation/R&D expense had the highest correlation with increase of net profit. Through the result, we analyzed that highly cited patent had the biggest value in the perspective of income approach. This study verified that in technology valuation, the number of patent's citation and a company's R&D expense are useful information.

It is suggested that a follow-up study needs to use market approach and cost approach besides income approach and analyze which property of a technology has a correlation to the value of a technology.

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5. References

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