

Predicting the financial performance index of technology fund for SME using structural equation model

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Abstract

As the technology credit fund is available to support SMEs which have intangible technology assets, many organizations are involved in technology evaluation with various factors. Technology evaluation has worth when the evaluation result can be related to financial performances of the recipient of credit funds. In this study, we propose a structural equation model (SEM) to analyze the relationship between technology evaluation factors and the financial performances by developing financial performance index (FPI). It is expected for the proposed model, which will be evaluated for the technology evaluation of enterprises, to be applied not only for the effective management of the technology credit funds for SMEs, but also will be used to evaluate financial performance of SMEs.

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1. Introduction

As the value of intangible technology assets becomes increasing, much investment commitment is needed on the companies in a manner to strengthen the technology competitiveness. In order to support the small and medium enterprises (SME) which have potential technology, governmental level of financial supports has been made based on some technology evaluation procedure. Because use of inadequate evaluation model would jeopardize the entire funding process causing critical economic loss, accurate technology evaluation is crucial.

Many organizations are involved in technology evaluation: National Technology Transfer Center (NTTC) in USA, British Technology Group (BTG), Center of Technology Assessment (CTA) in Japan, Korea Technology Credit Guarantee Fund (KTCGF), Korea Institute of Industrial Technology Evaluation and Planning (ITEP) and Korea Technology Transfer Center (KTTC).

Although many different forms of technology evaluation are used, the scoring model based on multi attributes of technology is the most popular form. These multi attributes are used differently according to the purpose of evaluation and technology evaluation institutes. Nevertheless, multi attributes generally consist of factors such as manager's integrity, level of technology, marketability of technology, technology profitability and external environment factors.

In a typical evaluation, applicant SMEs are assessed in terms of these factors and the resulting score is used to decide a technology loan to enterprise. However, the structural relationship among the technology evaluation factors and financial performances of credit fund recipient SMEs has not been carefully analyzed yet. Evaluation factors can have causal relationship (Sohn, Moon, & Kim, 2005) with financial performances such as profitability, growth, liquidity, debt, turnover, and valuation ratios (Bank of Korea, 2004; Weston & Thomas, 1985).

In this study, we propose a structural equation model (SEM) to analyze direct and indirect relationships between technology evaluation factors and financial performance indicators. Based on this structural relationship, we suggest

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the financial performance index (FPI) of enterprise and propose some strategies for improving financial performances in accordance with characteristics of enterprises. It is expected for the proposed model, which will be evaluated for the technology evaluation of enterprises, to be applied not only for the effective management of the technology credit funds for SMEs, but also will be used to evaluate financial performance of SMEs.

This paper is organized as follows. In Section 2, the proposed structural equation model is introduced along with our research hypotheses. Additionally empirical data analysis is carried on to fit the proposed SEM. In Section 3, we compare the FPI according to the characteristics of enterprises. Finally, we summarize the results of our study and suggest the areas for further research.

2. Research hypotheses and model

In this section, we propose an SEM to analyze the relationship between technology evaluation factors and financial performances of fund recipient SMEs.

Structural equation model (SEM) has become one of the most widely used multivariate statistical tools in various areas, such as psychology, education and behavioral sciences (Bentler, 1983; Joreskog & Sorbom, 1989; Parhizgari & Ronald, 2004; Sohn & Moon, 2003).

SEM is basically formulated by two types of equations namely, measurement model and structural model. While the measurement models can be used to grasp the relationships between observed variables and latent factors, the structural model can be used to assess the hypothesized relationship among latent factors.

Maximum likelihood estimation (MLE) and partial least square (PLS) are common tools to estimate SEM. Although the MLE is widely used, it still has limitations since the MLE needs not only distributional assumptions but also a large number of samples. PLS, however, is free from such limitations. We use the PLS method to estimate SEM and verify the relationship among the factors. In addition, we propose the overall financial performance index of various SME groups based on the customer satisfaction index (Fornell, 1992; Sohn & Moon, 2003).

We briefly review the previous research concerning the technology evaluation factors latently affecting financial performances as well as those related to measuring variables for financial performances.

Coster and Butler (2005) suggested that factors such as technological and commercial risk, level of product innovation, market criteria, product extensions, entrepreneurial background, protecting competitive advantage are important when evaluating for technology. NTTC uses 10 technology evaluation factors such as technical merit, proprietary position, competitive environment, market attractiveness, technical hurdles, manufacturability, regulatory issues, time to market, organizational needs and return on investment (NTTC, 2005). Center of Technology

Assessment (CTA) evaluates technology assets with respect to three factors: the level of technology innovation, marketability, and feasibility of technology (JTTAS, 2005). Korea Technology Credit Guarantee Fund (KOTEC) uses about sixteen factors which can be summarized into four aspects: management ability, the level of technology, marketability of technology, technology profitability (KOTEC, 2005), Small and Medium Business Administration (SMBA) in Korea uses four factors: technology development capability, commercialization capability, production capability, and management capability (Small & Medium Business Administration, 1989) where each factor consists of about 3–5 individual attributes.

On the other hand, some literatures suggested that financial performance be measured in terms of return on assets (ROA), return on investment (ROI) and return on sales (ROS) (Cannella & Lubatkin, 1993; Daily & Johnson, 1997; Johnson, Hoskisson, & Hitt, 1993; Shang & Marklow, 2005). On the other hand, the following papers showed that financial performances be measured by multiple aspects such as liquidity, growth, and activity. Financial performance has been measured in terms of profitability, liquidity, solvency, managerial performance, and capital structure (Courtis, 1978; Laitinen, 2002). Also, Van-Horne (1989) evaluated financial performance by liquidity ratios, debt ratios, coverage ratios and profitability ratios. Weston and Thomas (1985) considered financial performance in terms of leverage ratios, activity ratios, growth ratios and valuation ratios.

In terms of the relationship between the technology evaluation factors and financial performance, much research has shown that there exists a positive relationship between the experience of entrepreneur in the line of business and profit of enterprise. Thus, it is important to take such relationship into consideration in order to improve the profitability of company (Duchesneau & Gartner, 1990; Jo & Lee, 1996; MacMillan, Siegel, & Subba Narasimha, 1985; Sandberg & Hofer, 1987; Stuart & Abetti, 1990; Tyebjee & Bruno, 1984).

Also, Henderson and Cockburn (1994) mentioned superior technology as a major source of strategic competence that has a positive effect on the financial performance in high-technology firms. Technologies are a set of pieces of knowledge that includes both practical and theoretical know-how, methods, procedures, experience and physical devices and equipment. Many other authors also have shown that the superior technology has a positive impact on the financial performance (Afuah, 2002; Kumiko, 1994; McGrath, MacMillan, & Venkatraman, 1995; Torkkeli & Tuominen, 2002; Wang, Lo, & Yang, 2004; Walsh & Linton, 2002).

Sohn and Moon (2003) and Lassere (1982) indicated that the following factors are significantly related to technology commercialization success: researcher's experience, application possibility of technology, marketability, and competitive edge of the technology. Kumar and Jain (2003) indicated that status of technology, market

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