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A STUDY ON TECHNOLOGY FINANCING FOR KOREAN SMES IN KNOWLEDGE INTENSIVE SERVICE INDUSTRY

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Abstract. *Together with the growing emphasis on knowledge intensive service (KIS), KOTEC (Korea Technology Finance Corporation) which was originally established to support new technology business (NTB) has shifted to KIS as its main industry domain for technology financing. However, the perception gap in the definition of 'Technology' and 'Knowledge' could be a constraint on funding KIS for KOTEC's legitimate operation. In this study, through a survey to companies in Korea that can be possible beneficiaries of technology funding, authors have identified the existence of such constraint, and also have suggested some ways for institutional improvements to overcome such constraint.*
Keywords: KIS, Technology financing, Determinants of innovation, KOTEC

1. **Introduction.** Together with the slowdown in Korean economic growth and with the persistence of jobless-growth, the importance of knowledge intensive service (KIS) industry has been emphasized. The Korea Technology Finance Corporation (KOTEC) which was originally established to support new technology business (NTB) has shifted its main part of technology financing from NTB to KIS since 2009, and earlier studies have found that KOTEC's financial guarantee has actually promoted innovative operations of such companies.

However, the foundation purpose of KOTEC that is specified in applicable law is set to support for new technology business (NTB). So the perception gap about the meaning between 'Technology' and 'Knowledge' can be a constraint for KOTEC's legitimate operation, and thus can be an obstacle for expanding KIS financing more actively. Therefore, in this research, through a survey to companies in Korea, authors want to identify the existence of such constraint, and to suggest some ways for institutional improvements to overcome such constraint.

The remainder of this paper is organized as follows. Section 2 reviews the existing literature as to determinants of innovation and KOTEC's financial guarantee (technology financing) as an innovation facilitator. Section 3 explains constraint on technology financing in KIS. The data, model and the empirical findings of this study are specified in Section 4. The final section contains some suggestions to improve technology financing for KIS as well as suggestions for further research.

2. **Determinants of Innovation.** KOTEC's financial guarantee, with superior results on the beneficiaries' financial records and R&D investment ratio, is likely to facilitate firm's innovation [15,16]. In other words, KOTEC's financial guarantee can influence positively to the determinants of firm's innovation. Therefore, KOTEC's financial guarantee (technology financing) needs to be increased.

Former researches have empirically found that the determinants of a firm's business operation are firm size [1,15,19], market concentration ratio [2,15], corporate network [3], financial resources [4], trade shares [5], and profit rate [6]. Applicability of internal financing is better than external financing for firms' innovation [7], and companies which raise debt ratio usually decrease R&D cost [8,16,17,21,22]. However, existing research has also found that small firms with heavy debt spend lots of R&D expenses, and they usually afford it by a loan [8,16,17,20,22].

There also are researches that report KOTEC's technology financial guarantee actually facilitates innovations of the beneficiaries. Ventures' technology evaluation level in KOTEC's technology financial guarantee has positive effects on their future sales growth [9]. The beneficiary firms' business profit rate, ordinary margin ratio and added value ratio are higher than those of the other ordinary companies, and also beneficiary firms' R&D investment ratio is higher than that of the other firms [10,20]. C.-B. An et al. estimated the influence of technology guarantee on firm's financial performance with quantile treatment effect (QTE), and found the improvements on firm's profitability, especially on return on equity [11]. According to a 2011 report (Report of in-depth evaluation of government project in 2010) by Ministry of Strategy and Finance, using difference-in-difference (DID) and propensity score matching (PSM), the increase in sales rates, profitability, and business growth rate were higher for technology guaranteed companies (treatment group) than non-guaranteed companies (control group).

3. **Technology Financing for KIS.** Technology financing can be defined as a process and procedure of financing activities that technology-based firms exert with technology evaluation [12]. Due to inherent property of technology financing, it is considered as a representative sector of market failure, and thus technology financing for KIS should be considered more importantly. The amount of technology financing in Korea was about 9,767 billion won at 2009, and about 88.4% of that money were attributed to the loan that was guaranteed by KOTEC's technology evaluation [13]. The KTRS (KOTEC Technology Rating System) evaluation system appraises future growth potentials of a firm or a technology, and thus judges its commercialization possibility. KOTEC refers this evaluation result for technology transfer contracts, investment and assurance.

Former studies have suggested about the development of new technology financing product [14], improvement of current technology evaluation model, and enlargement of application area for technology evaluation [13]. However, there is no research about the regulations and institutional improvement to expand the application area of technology financing.

KOTEC made an internal regulation for guarantee of KIS in 2009 that nominates companies with proper technology evaluation grades as NTBs, and thus makes them to be lawful candidates for support. With this effort, the proportion of KIS guarantee over overall financial guarantee increased from 10.1% in 2009 to 14.8% in 2013. And the ratio of KIS companies in numbers increased from 14.0% to 20.2%.

However, unless KIS industry is included as a lawful sector for technology financing, it will be fundamentally restricted in expanding its support. The perception gap between technology and knowledge that exists on their definition and scope can be a fundamental constraint in providing technology evaluation guarantees for KIS firms by counting them as NTBs.

4. **Research Hypothesis and Verification.** There could be some differences on counting a specific firm as NTB due to the company's character. Since KOTEC's role can be regarded as an organization for supporting manufacturing-centric NTBs rather than for KIS firms, authors want to make it clear that there exists a need to improve institutional

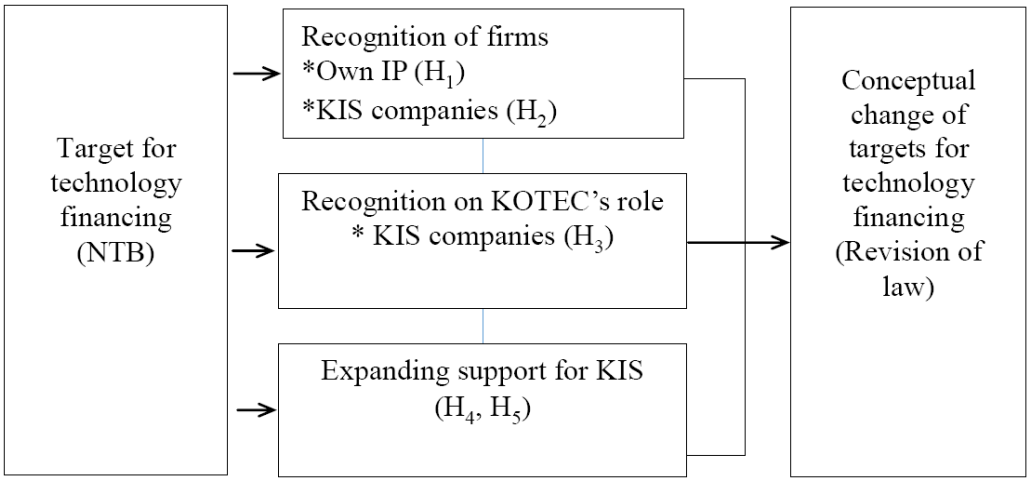

FIGURE 1. Research model

grounds for supporting KIS industries. For this, authors have set following research hypothesis and conducted a survey over companies that are the beneficiaries for technology guarantee.

Hypothesis 1. *The ratio of company which recognizes it as NTB is higher when that company has intellectual property (IP).*

Hypothesis 2. *The ratio of company which recognizes itself as NTB is higher when that company is in non-KIS industries.*

Hypothesis 3. *The ratio to choose KOTEC as 'the most appropriate organization for financing NTBs' is higher than the ratio to choose KOTEC as 'the most appropriate organization for financing KIS firms'.*

Hypothesis 4. *The ratio to choose KOTEC as 'the most appropriate organization for financing KIS firms' is higher between KIS firms than the others.*

Hypothesis 5. *The technology financing proportion of KOTEC is relatively high in KIS firms.*

To test above hypotheses, authors e-mailed to 542 ventures that have relationship with KOTEC, and received 111 replies. The differences in ratio between two populations (KIS and non-KIS) are examined for 'Hypothesis 1', 'Hypothesis 2', 'Hypothesis 4', 'Hypothesis 5'. For 'Hypothesis 3', the differences in ratio are tested for all responded firms.

As the result, companies which own IPs and non-KIS firms recognized themselves as NTBs more than the others (Hypotheses 1 and 2 are accepted), and the ratio to choose KOTEC as 'the most appropriate organization for financing NTBs' is higher (Hypothesis 3 is accepted). The technology financing proportion of KIS firms from KOTEC is high (Hypothesis 5 is accepted). In case of Hypothesis 4, it is higher to choose KOTEC as 'the most appropriate organization for financing KIS firms' between KIS firms, but not significant enough. Meanwhile, the proportion to choose KOTEC as 'the most appropriate organization for financing KIS firms' is over 85%. Through this, authors can find that there exists a perception gap for NTBs due to their character, and a lack of institutional foundation can be constraints for expanding support toward KIS. Authors also have identified the demands from the companies to expand the role of KOTEC for KIS support.

For institutional improvement to extend financing for KIS firms, first, applicable law that defines the target for technology financing as NTBs should be revised to include KIS industries. Current law was enacted in December 1986, and has not been revised yet. Therefore, it is the right time for reviewing the statement from the perspective of policy effectiveness whether it reflects the recent changes of industrial structure.

TABLE 1. Result of hypothesis verification

	Hypothesis	P_1	P_2	P-Value*
H_1	NTB recognition rate (Own IP, Not)	0.6857 (48/70)	0.4146 (14/41)	0.002
H_2	NTB recognition rate (Non-KIS, KIS)	0.7353 (50/68)	0.3488 (15/43)	0.000
H_3	KOTEC for NTB, KOTEC for KIS	0.9459 (105/111)	0.8828 (98/111)	0.045
H_4	KOTEC for KIS (KIS, Non-KIS)	0.9302 (40/43)	0.8529 (58/68)	0.091
H_5	KOTEC's Support (KIS, Non-KIS)	0.9070 (39/43)	0.5588 (38/68)	0.000

* h_0: $P_1 = P_2$, h_1: $P_1 \neq P_2$,
Abbreviations: NTB, New Technology Business;
KOTEC's support, first on total amount

Second, if it is hard to shortly revise the law, then amending enforcement decree to consider KIS firms as NTBs can be tried. Current enforcement decree of 'Financial Assistance to New Technology Business Act' defines 26 types of NTBs as legitimate financing industries.

5. **Conclusions.** According to the superior performance on financial records and R&D investment for companies with KOTEC guarantee, it can be assumed that technology guarantee facilitates companies' innovative operations. By surveying companies, authors have found that there exists a perception gap to NTBs between companies, and there also exists a demand to expand financing for KIS firms. To cope with this, revision to current law and enforcement decree is needed to explicitly include KIS firms as the possible targets for technology financing.

This study is based on the survey for ventures that have business with KOTEC in particular region. Thus, the result can be different when the target region is widened or when non-guaranteed companies are included in the study. There also should be a further study that assesses direct and indirect effects of expanding the institutional foundations for supporting KIS industry.

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