

IT SMEs' External Information Network Diversity and Product Quality Improvement in the Era of Technology Convergence: The Mediating Role of the Production Process Improvement

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기술 융합 시대에 IT 중소기업의 외부 정보 네트워크의 다양성과 제품 품질 개선: 생산 공정 개선의 매개적 역할

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Abstract Good product quality is so essential to enabling firms to succeed that how to make the product quality better through technology development is one of the most important issues that many CEOs think over. With regard to the product quality improvement from firms' technology development, this study has made an attempt to empirically investigate the effect of the external information network diversity on the product quality improvement of the small and medium-sized enterprises (SMEs) in the information technology (IT) sector, mediated by their production process improvement. This research illuminates the following two points by empirically analyzing the 310 IT SMEs through the ordinary least squares regression analysis. First, IT SMEs' external information network diversity has a positive influence on their product quality improvement from technology development. Second, IT SMEs' production process improvement partially mediates the impact of their external information network diversity on the product quality improvement.

Key Words : Product Quality Improvement, Production Process Improvement, External Information Network Diversity, IT SMEs, Technology Convergence

요약 좋은 제품 품질은 기업의 성공을 가능하게 하는 데에 매우 필수적이기 때문에 기술 개발을 통한 제품 품질 개선 방안은 많은 최고경영자들이 숙고하는 가장 중요한 문제들 중 하나이다. 기술 개발을 통한 제품 품질 개선과 관련하여, 본 연구는 정보 기술 분야의 중소기업들의 외부 정보 네트워크의 다양성이 생산 공정 개선을 통해 제품 품질 개선에 미치는 영향에 대한 실증 분석을 시도 하였다. 본 연구는 최소자승 회귀분석을 통해 310개의 IT 중소기업을 실증 분석하여 다음과 같은 2가지 중요 사항을 조명한다. 첫째, IT 중소기업의 외부 정보 네트워크의 다양성은 기술 개발을 통한 제품 품질 개선에 정(+)의 영향을 미친다. 둘째, IT 중소기업의 생산 공정 개선은 외부 정보 네트워크의 다양성이 제품 품질 개선에 미치는 정(+)의 영향을 부분 매개 한다.

주제어 : 제품 품질 개선, 생산 공정 개선, 외부 정보 네트워크의 다양성, IT 중소기업, 기술 융복합

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1. Introduction

Good product quality is so essential to enabling firm to successfully formulate and implement their differentiation strategy [1, 2, 3] that how to make the product quality better through technology development is one of the very important issues to firms [3, 4, 5].

With regard to the product quality improvement from firms' technology development, this study makes a meaningful attempt to empirically investigate the effect of the external information network diversity on the product quality improvement of the small and medium-sized enterprises (SMEs) in the information technology (IT) sector, mediated by the production process improvement in order to provide useful implications about the significant factors increasing the product quality improvement of IT SMEs.

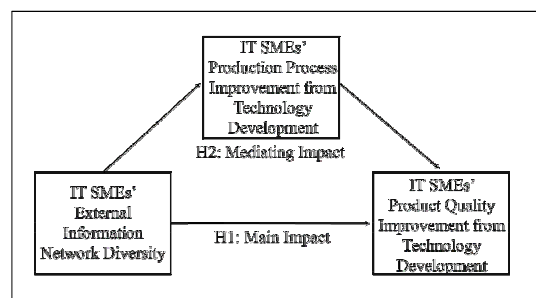
Firms' desire to make successful differentiation in response to the rapidly growing competition in the market makes their product quality improvement from technology development more and more important [1, 2,]. However, in the era of technology convergence like today, it is not easy for IT SMEs with meager in-house technology R&D resources and capacities to make successful product quality improvement from technology development [6, 7, 8], which seems to make the IT SMEs suffer from the issue concerning how to improve the product quality from technology development. As an effective solution to this issue, Chesbrough [9, 10] suggests that the companies short of in-house technology R&D resources and capacities strategically try to receive the external information transfusion so as to increase the success rate of their product quality improvement from technology development. Furthermore, the direct ties which a firm makes and sustains through its interfirm networks play a significant role in increasing its innovation performance [18]. Therefore, this study pays a special attention to the influence of IT SMEs' external information network diversity on their product quality

improvement, examining the mediating role of the production process improvement between the external information network diversity and product quality improvement. In accordance with the special attention paid by this study, this study attempts to provide the answers about the research questions as follows;

- (i) What is the impact of IT SMEs' external information network diversity on their product quality improvement from technology development?
- (ii) What is the role of the production process improvement between IT SMEs' information network diversity and product quality improvement from technology development?

2. Research Model and Hypothesis

This study develops the research model consisting of two hypothesis as illustrated in the [Fig. 1]. The hypothesis 1 is concerned with the main impact of IT SMEs' External Information network diversity on their product quality improvement from technology development and the hypothesis 2 is related to the mediating impact of IT SMEs' production process improvement from technology development on the main impact of their external Information network diversity on the product quality improvement from technology development. This study uses IT SMEs' technology R&D investment as a control variable.



[Fig. 1] Research Model

It requires diverse information or expertise from various areas for firms to successfully make their products better [5, 9, 10, 12]. For example, the information or expertise from not only science and engineering but also art and management plays a significant role in improving the product quality of firms from technology development [3, 4, 5]. Moreover, the various external information from diverse external sources can exert a positive influence on SMEs' product innovation [8, 9, 10, 11]. Therefore, this study generates the following hypothesis 1 about the positive effect of the IT SMEs' external information network diversity on their product quality improvement.

H1: IT SMEs' external information network diversity has a positive influence on their product quality improvement from technology development.

Firms' production process improvement requires not only the coordination among firms' different functional departments but also technological knowledge and information which can be beyond their limited internal knowledge [5, 13, 14]. In this sense, the various external information from diverse external sources can help such firms as IT SMEs with limited internal knowledge to successfully make their production process improvement [3, 5, 8, 11, 13, 14], which can make IT SMEs' external information network diversity positively influence their production process improvement. Furthermore, good production process is the backbone of the good product quality [13, 14]. Firms' production process with the high defect rate can hardly make their product quality good but improved production process with the low defect rate can make their products better [13, 14], which can make the production process improvement have a positive impact on IT SMEs' product quality improvement. Therefore, this research constructs the following hypothesis 2 about the mediating role of IT SMEs' production process improvement between their external

information network diversity and product quality improvement.

H2: IT SMEs' production process improvement mediates the positive influence of their external information network diversity on the product quality improvement from technology development.

3. Research Methodology

3.1 Data and Measurement

This research used the 310 data of South Korean IT SMEs from the 2013 SMEs' Technology Statistics (2013 SMETS). It is a survey on SMEs' technology development and commercialization from 2011 to 2012. The Korea Federation of Small and Medium Business (KBIZ) and the Small & Medium Business Administration jointly ran the 2013 SMETS in 2013.

This research measured IT SMEs' external information network diversity with the adapted Watson (2007)[15]'s measurement for South Korean IT SMEs' context for technology R&D, through which this study measured how many different external information sources each IT SME used to get the information or idea for technology development from 2011 to 2012 among the eight heterogeneous sources such as (i) consulting enterprises or private research institutes (ii) special books or journals (iii) competitors (iv) public research institutes (v) universities (vi) suppliers (vii) conferences, seminars, and expositions, and (viii) customers. This study measured the degrees of IT SMEs' production process improvement and product quality improvement from technology development from 2011 to 2012 by using the five point scale ranging from one (= very low degree including no degree) to five (= high degree). The total amount of the IT SMEs' technology R&D investment from 2011 to 2012 was measured for the control variable. The <Table 1> reports the descriptive statistics of the analyzed

samples in regard to all of the variables in the research model including the total sales of the IT SMEs from 2011 to 2012.

<Table 1> The descriptive statistics of the samples

Variable	Average	Standard Deviation	Max	Min
External Information Network Diversity	1.874	1.393	8	0
Production Process Improvement from Technology Development	1.622	1.144	5	1
Product Quality Improvement from Technology Development	2.664	1.431	5	1
Total Sales	29,124	84,973	974,942	312
Technology R&D Investment	1,528	3,581	41,452	13

Note: The unit for the total sales and technology R&D investment is the million South Korean Won.

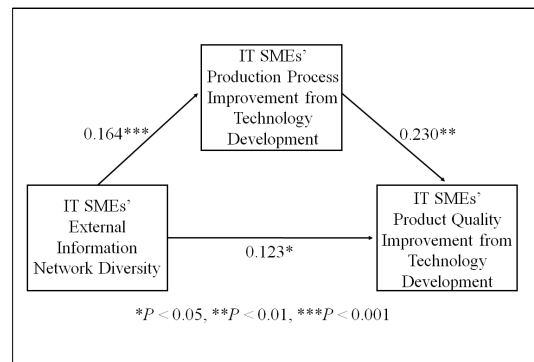
3.2 Analysis Method and Tool

This study made use of the ordinary least squares (OLS) regression analysis to test the hypotheses 1 and 2. This research used the Sobel (1982)[16]’s and the Baron and Kenny (1986)[17]’s way of testing the mediating impact to empirically examine the mediating impact in the hypothesis 2. This research adopted the IBM SPSS version 23 as the analysis tool.

4. Research Model Testing Results

According to the OLS regression analysis results for this study in the [Fig. 2], the hypotheses 1 and 2 were supported at the significant level of 0.05. When the main effect of IT SMEs’ external information network diversity was examined, the OLS regression analysis results empirically proved that the external information network diversity significantly and positively influenced IT SMEs’ product quality improvement from technology development (regression coefficient = 0.160 t-value = 2.755), supporting the hypothesis 1.

When the mediating impact of IT SMEs’ production process improvement was checked, the production process improvement turned out to play a significant mediating role between IT SMEs’ external information network diversity and product quality improvement from technology development (the z-value from the Sobel (1982)[16] = 2.397), supporting the hypothesis 2 as shown in the [Fig. 2]. Moreover, the production process improvement proved to be a partial mediator. The regression coefficient of the main effect of the external information network diversity on the product quality improvement was 0.160 (t-value = 2.755) but this was reduced to 0.123 (t-value = 2.099) after the mediator was considered, meaning that the production process improvement was the partial mediator according to the Baron and Kenny (1986)[17]’s way of testing the mediating impact.



[Fig. 2] Research Model Testing Results

5. Conclusion

This research deepens the research stream on the SMEs or the quality reflected in the prior studies including [19, 20, 21, 22, 23, 24, 25, 26] by illuminating the following two meaningful points in accordance with the research questions which this study have tried to provide the answers about.

First, IT SMEs’ external information network

diversity has a positive influence on their product quality improvement from technology development. This means that IT SMEs' making use of the external information for technology development from various external sources is a useful way of increasing their product quality improvement.

Second, IT SMEs' production process improvement partially mediates the direct impact of their external information network diversity on the product quality improvement from technology development. This reveals that IT SMEs' production process improvement plays a significant role in not only increasing their product quality improvement but also linking the direct impact of the external information network diversity to the product quality improvement.

6. Suggestions for Future Research

This study possesses a few limitations which future research needs to get over in order to make better implications. First, this study is based on the context of IT SMEs. It will make more generalizable implications for future study to conduct their empirical analyses based on the context of more various technology sectors. Second, extending the scope of the research to other types of firms such as SME ventures will be another way of making better implications. Third, reflecting more control variables including the technology levels of SMEs will be useful to producing more rigorous analysis results.

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