

Study on Innovation Competence of Managers and Its Impact on Technical Innovation of IT SMEs in First-tier Cities, China

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Abstract. SMEs strongly contribute to economic development in China. In rapid changing context of technology and market, SMEs in IT industry more need to compete through innovation. Managers of SMEs play more dominant role to innovation than those in large companies. So, it's essential to examine the factors which effects innovation competence of managers and its impact on technical innovation of SMEs. This paper uses quantitative method to collect data through questionnaire survey from 146 SMEs of IT industry in first-tier cities, China. Data is processed with multilevel regression analysis and path analysis. As a result, a modal is tested to reflect the effect of self-efficacy, innovative organizational culture, affective and normative commitment on managers' innovation competence and their comprehensive impacts on technical innovation.

Keywords: Innovation competence, Technical Innovation, IT industry, SMEs

1 Introduction

Small and medium enterprises (SMEs) have a strong, positive association with GDP per capita growth (Beck et al., 2005; Motta et al., 2020)^{[4][14]}. In rapid changing technology and market environments in China, SMEs must compete on innovative products and services rather than on price (Loon & Chik, 2019)^[11], which lies on technical innovation. And technical innovation is the significant productive force of economic growth (Wang et al., 2019)^[18]. According to a speech of Director General of the State Intellectual Property Office in 2021, technological SMEs contribute more than 70 percent technical innovation as the most primary party to apply patent. Technical innovation is significant for maintaining SMEs' sustainable competitive advantage. Innovation as a competence of employees is pivotal to an organization's sustainable competitive advantage (Waychal et al., 2011)^[19]. In SMEs, the individual roles and professional level of the managers are more vital than those in large-sized companies (Garcia-Morales et al., 2007)^[6]. And IT technical talents demands in China are mostly from first-tier cities. Thus, it's valuable to examine the determinants of innovation competence of managers, and its impact on technical innovation of IT SMEs in first-tier cities, China.

The framework of innovation competence contains three characteristics of innovation ability, motivation and space (Li et al., 2016)^[10], which is more fit for enterprise scenario by reflecting the requirement of personal features and organizational environment.

Organizational culture is one of the key environmental factors which effect innovation of employees and facilitate innovation of companies. Organizational commitment and self-efficacy reflect personal factors which facilitate innovation work behaviors.

However, there are seldom study on the comprehensive effects of these factors on innovation competence of managers and technical innovation, especially in IT SMEs, China. The aim of this study is to test the effects of innovative organizational culture, organizational commitment, and self-efficacy on innovation competence of managers and technical innovation in IT SMEs, China.

2 Literature Review and Hypothesis

2.1 Innovative organizational culture and innovation

Innovative organizational culture is described as a social and cognitive environment that expects and guides employees to innovate (Jassawalla and Sashittal, 2002)^[7]. It's a climate which positively effects innovative behavior of employees (Chen, 2013)^[5]. Hence, the following hypothesis is proposed:

H1. Innovative organizational culture has significant positive relationship with innovation competence of managers in IT SMEs, China.

H2. Innovative organizational culture has significant positive relationship with technical innovation of IT SMEs, China.

2.2 Self-efficacy and innovation

Self-efficacy is a belief that a person can act to achieve an expected outcome in a specific situation successfully (Bandura,1995)^[3]. High self-efficacy is one of the leading predictors of innovation as a competence for individuals (Waychal et al., 2011)^[19]. Self-efficacy is one of the key determinants of innovation (Sethumadevan et al., 2020)^[16]. So, it comes the following hypothesis:

H3. Self-efficacy has significant positive relationship with innovation competence of managers in IT SMEs, China.

H4. Self-efficacy has significant positive relationship with technical innovation of IT SMEs, China.

2.3 Organizational commitment and innovation

Organizational commitment is a state of psychological aspect that the employees attach to their organization (Allen & Meyer, 1990)^[1] which includes three dimensions: affective commitment, continuance commitment and normative commitment. Organizational commitment has significant relationship with employees' innovation capacity (Rostami et al., 2012)^[15]. It is found that affective commitment has significant and positive effects on technical innovation, so does normative commitment (Ming and Ying, 2010)^[13].

So, we propose the following hypothesis:

H5. Affective and normative commitment has significant positive relationship with innovation competence of managers in IT SMEs, China.

H6. Affective and normative commitment has significant positive relationship with technical innovation of IT SMEs, China.

2.4 Innovation competence and technical innovation

Organizational innovation is a combination of innovative culture, technical innovations and administrative innovations (Kerlavaj et al., 2010)^[8]. Since the individual innovation competence facilitate the organization innovation, it should facilitate technical innovation, too. Hence, the following hypothesis is proposed:

H7. Innovation competence of managers has significant positive relationship with technical innovation of IT SMEs, China.

H8. innovation competence mediates the relationship between innovative organizational culture, self-efficacy, affective and normative commitment, and technical innovation.

The conceptual framework of this research is shown in Fig. 1.

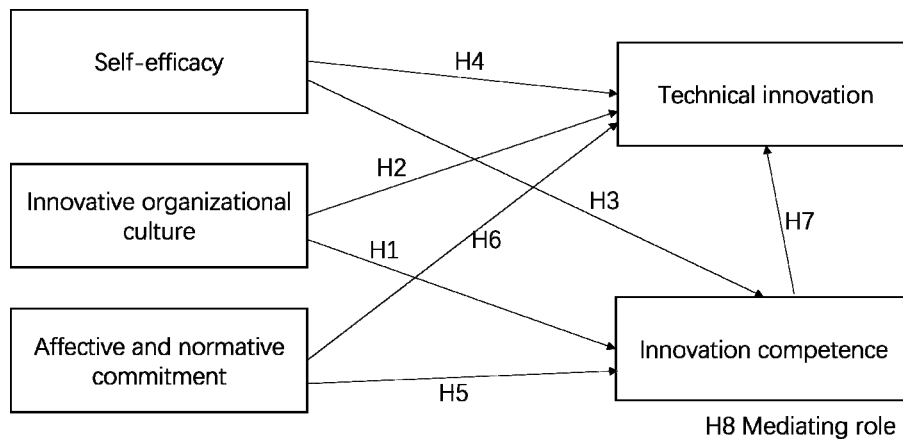


Fig. 1. Conceptual framework

3 Methods

3.1 Sample

The population of this research is managers in SMEs of China. The survey questionnaire was sent to respondents of enterprise employees in 4 first-tier cities in China. We received 146 valid questionnaires of junior (24%), middle (37%) or senior (39%) managers from different IT SMEs. There are innovative activities or needs for innovation in all these SMEs with 17.8% of efficiency-driven innovation, 35.6% customers-centered innovation, 24.7% of engineering technology innovation and 21.9% scientific research innovation. Most of the sample managers (around 90%) have worked in current enterprise for more than three years so that their answers relevant to the enterprise are relatively reliable.

3.2 Measures

To assess innovation competence at individual level, technical innovation, innovative organizational culture, organizational commitment, and self-efficacy, we referred to several scales used by former researchers (see Table 1). Items were rated by five-point Likert scale and “1-5” representing from “strongly disagree” to “strongly agree”. The English questionnaire was translated into Chinese.

Table 1. Measurement scales for reference

Variable measured	Scales referred	Source
Innovation competence	FINCODA model including five dimensions: Creativity, Critical Thinking, Initiative, Teamwork and Networking, measured with several behavioral indicators respectively.	Andreu-Andres, et al., (2018) ^[2]
Technical innovation	Product and service (technical) innovations scale	Škerlavaj & Lee (2010) ^[17]
Innovative organizational culture	Innovative culture scale	Škerlavaj & Lee (2010) ^[17]
Organizational commitment	Organizational commitment scale (including membership focus and performance focus)	Meyer & Herscovitch (2001) ^[12]
Self-efficacy	Self-efficacy scale	Sethumadevan et al., (2020) ^[16] Kinard & Webster (2010) ^[9]

Reliability analysis was conducted. Cronbach α coefficient value is 0.9, which indicates that the overall reliability is high. According to “Item deleted α Coefficient value” and “CITC value”, some items are deleted. The Cronbach α coefficient value of items increases to 0.902.

Validity analysis was conducted. Those items with common factor variance less than 0.4 were deleted, then validity analysis was conducted repeatedly until common factor variance of the rest of items are all more than 0.4. Through analyzing the correspondence of items and factors, those with serious deviation were deleted. Then, confirmatory Factor Analysis was conducted to the remained 30 items which measure 5 factors. The result showed good discriminant validity. 7 items were deleted with common factor variance less than 0.4. The remained 23 items show high validity with KMO=0.810.

3.3 Multiple regression analysis and Path analysis

First, path analysis was conducted on all the variables to examine their mutual relationship of innovation competence, technical innovation, innovative organizational culture, self-efficacy, affective and normative commitment. Then the mediating role of innovation competence was examined by multiple regression.

4 Results and Discussion

The path analysis result shows in Table 2. Innovative organizational culture has significant positive relationship with innovation competence ($\beta = 0.31$, $SE = 0.044$, $p < 0.01$), supporting

Hypothesis 1 (H1). Self-efficacy has significant positive relationship with innovation competence ($\beta = 0.275$, $SE = 0.046$, $p < 0.01$), supporting Hypothesis 3 (H3). Affective and normative commitment has significant positive relationship with innovation competence ($\beta = 0.205$, $SE = 0.050$, $p < 0.01$), supporting Hypothesis 5 (H5). Innovative organizational culture has significant positive relationship with technical innovation ($\beta = 0.266$, $SE = 0.041$, $p < 0.01$), supporting Hypothesis 2 (H2). Self-efficacy has significant positive relationship with technical innovation ($\beta = 0.332$, $SE = 0.042$, $p < 0.01$), supporting Hypothesis 4 (H4). Affective and normative commitment has significant positive relationship with technical innovation ($\beta = 0.223$, $SE = 0.045$, $p < 0.01$), supporting Hypothesis 6 (H6). Innovation competence has significant positive relationship with technical innovation ($\beta = 0.250$, $SE = 0.072$, $p < 0.01$), supporting Hypothesis 7 (H7). All p value < 0.01 which means every path are effective and significant in statistics.

The effects modal of mutual relationship of all the variables is shown in Fig.2. Among these factors, Innovation organization culture effects the most on innovation competence of managers in SMEs. And self-efficacy effects the most on technical innovation of IT SMEs.

Table 2. Path analysis results

X	→	Y	SE	z (CR)	p	β
Innovative organizational culture	→	Innovation competence	0.044	4.383	0.000	0.310
Self-efficacy	→	Innovation competence	0.046	3.664	0.000	0.275
Affective and normative commitment	→	Innovation competence	0.050	2.690	0.007	0.205
Innovative organizational culture	→	technical innovation	0.041	4.395	0.000	0.266
Self-efficacy	→	technical innovation	0.042	5.259	0.000	0.332
Affective and normative commitment	→	technical innovation	0.045	3.551	0.000	0.223
Innovation competence	→	technical innovation	0.072	3.758	0.000	0.250

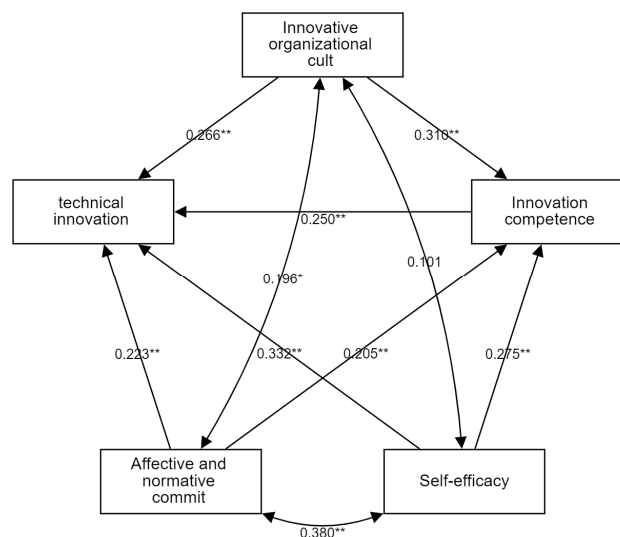


Fig. 2. Effects Modal

Then the mediating role of innovation competence was tested by multiple regression (see Table 3). Innovation competence of managers was tested to play part mediating role on the relationship between innovative organizational culture, self-efficacy, affective and normative commitment and technical innovation with effects proportion of 22.535%, 17.158%, 18.667% respectively. So, Hypotheses 8 is approved. It means that enhancing innovation competence of managers not only directly helps with technical innovation but also helps with the positive effects of innovative organizational culture, affective and normative commitment, and self-efficacy on technical innovation. In return, these three factors don't mediate the effects of managers' innovation competence on technical innovation as tested. Thus, innovation competence of managers is the essential factor in the effects modal in this research.

Table 3. Mediating effects analysis result

Item	Result	c	a*b	c'	a * b / c
Affective and normative commitment=>Innovation competence=>technical innovation	Partly mediating	0.195	0.036	0.159	18.667%
Self-efficacy=>Innovation competence=>technical innovation	Partly mediating	0.267	0.046	0.221	17.158%
Innovative organizational culture=>Innovation competence=>technical innovation	Partly mediating	0.231	0.052	0.179	22.535%

	technical innovation	Innovation competence	technical innovation
<i>B</i>	1.077** (5.324)	1.740** (7.811)	0.608** (2.624)
Affective and normative commitment	0.195** (4.215)	0.135** (2.652)	0.159** (3.492)
Self-efficacy	0.267** (6.247)	0.170** (3.613)	0.221** (5.167)
Innovative organizational culture	0.231** (5.689)	0.194** (4.322)	0.179** (4.323)
Innovation competence			0.269** (3.688)
<i>R</i> ²	0.502	0.298	0.545
Adjusted <i>R</i> ²	0.491	0.283	0.533
<i>F</i> Value	<i>F</i> (3,142)=47.638, <i>p</i> =0.000	<i>F</i> (3,142)=20.115, <i>p</i> =0.000	<i>F</i> (4,141)=42.301, <i>p</i> =0.000

* *p*<0.05 ** *p*<0.01

5 Conclusion

This paper tests the positive effect of innovative organizational culture, self-efficacy, affective and normative commitment on innovation competence of managers and technical innovation in IT SMEs, China. Innovative organizational culture works the most in effects on innovation competence of managers. And self-efficacy works the most in effects on technical innovation of managers. Innovation competence mediates the relationship between three variables (innovative organizational culture, self-efficacy, affective and normative commitment) and technical innovation. In conclusion, it's effective for IT SMEs in first-tier cities of China to improve innovation competence of managers by building tolerant and encouraging climate to innovate and enhancing self-efficacy, commitment of employees, especially affective and normative commitment. The positive effects will transfer via innovation competence enhancement of managers to technical innovation increment, which contributes to organization innovation.

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