Research on the Relationship between Supply Chain Integration, Innovation Capability and Financing Performance of Technological SMEs

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Abstract—This paper conducts an in-depth study on the relationship between supply chain integration, innovation capabilities and the financing performance of technology-based SMEs. Therefore, it uses MPlus7.4 software and structural equation model as the basic elements. Taking value co-creation as the clue, it can take the enterprise's internal innovation ability and open collaborative innovation ability as the core. Only the detailed discussion about the internal and external integration activities and innovation ability of technology-based SMEs can promote financing performance path. It can take 245 high-tech SMEs as the research sample is an empirical analysis. The final research conclusion is that supply chain integration and innovation capabilities are the main factors to alleviate the funding problems of technology-based small and medium-sized enterprises and improve their market competitiveness.

Keywords-supply chain integration; innovation ability; technology and medium-sized SMEs; financing performance

1 INTRODUCTION

The development of small and medium-sized enterprises has been plagued and restricted by problems such as financing difficulties and expensive financing. In particular, some high-tech SMEs lacking physical assets often fail to meet bank loan requirements due to low credit ratings or fewer mortgageable assets. But from another perspective, although most of the small and medium-sized enterprises are facing such a dilemma, there are still some small and medium-sized enterprises that can successfully win the investment of external financing institutions, especially trade credit and other financing services. It can be seen that improving the innovation capabilities of small and medium-sized enterprises is the main way to break the financial constraints.

2 LITERATURE REVIEW AND HYPOTHESES

Since the internal innovation potential of technology-based SMEs has always been regarded as an important basis for companies to carry out closed innovation or collaborative innovation activities. The following hypotheses can be put forward.

Hypothesis 1: High-tech SMEs have internal innovation potential and help improve the open collaborative innovation capabilities of enterprises [1].

For high-tech SMEs, internal integration is an important basis for promoting their participation in external integration activities, which can promote the gradual difference of knowledge elements in different industrial chains towards synergy. Therefore, the following hypotheses are proposed:

Hypothesis 2: Technology-based SMEs actively start internal integration is conducive to the smooth development of the entire external activities.

Based on the existing research, launching the internal integration work of the enterprise is an important means to promote the development of the enterprise and enhance the ability of enterprise product innovation. Therefore, the following assumptions are made.

Hypothesis 3: Internal integration is conducive to improving the internal innovation potential of technology-based SMEs [2].

External integration can be said to be the main way for SMEs to obtain innovative resources. As far as large enterprises are concerned, the external knowledge network is of greater significance to the innovative practice of SMEs. Therefore, the following hypothesis is proposed.

Hypothesis 4: External integration is conducive to improving the internal innovation potential of high-tech SMEs.

Internal integration can provide a more important interface for interactive activities between enterprises to a certain extent. It is also an important foundation for building effective organizational relationships in the process of collaborative activities. Therefore, the following assumptions are made.

Hypothesis 5: Internal integration has a certain positive impact on the open collaborative innovation capabilities of technology SMEs [3].

Knowledge transfer and the follow-up process of knowledge cross-organization integration-creation have a positive effect on the innovation of small and medium-sized technology-based small and medium-sized enterprises. Therefore, the following assumptions are made.

Hypothesis 6: External integration is conducive to the improvement of open system innovation capabilities of technology-based SMEs.

Effective innovation can help companies stand out from many competitors and can also help companies obtain trade credit. Therefore, small and medium-sized enterprises with innovative capabilities are more likely to obtain supply chain financial services. Therefore, the following hypotheses are proposed.

Hypothesis 7: The internal innovation potential of high-tech SMEs has a positive effect on financing performance.

The main purpose of open collaborative innovation activities is to be able to optimize the capital operation efficiency of the system, and improve the financing possibilities while reducing system financing costs. Therefore, the following hypotheses are proposed.

Hypothesis 8: Open collaborative innovation has a positive impact on the financing performance of technology-based SMEs.

For SMEs, financial performance and market competitiveness are important indicators in the evaluation of corporate financing, so based on this, the following assumptions can be made.

Hypothesis 9: Internal integration has a positive impact on the financing performance of technology-based SMEs [6].

External integration can not only promote the efficiency of internal and inter-organizational cooperation among SMEs, but also strengthen the flexibility of funds. Therefore, the following assumptions are made:

3 STUDY DESIGN AND HYPOTHESIS TEST

3.1 Data Collection

This study collects empirical data through questionnaire surveys, and further uses structural methods to verify the research hypotheses. Related items of the questionnaire were randomly distributed to 20 business managers for testing.

This research involves many aspects of enterprise operation management, research and development, innovation management and financial management.

After excluding invalid questionnaires, 754 valid questionnaires were obtained. After comparative analysis of information, 248 companies finally entered the research sample, and there were 732 valid sample questionnaires.

3.2 Reliance Analysis

When testing the quality of questionnaires and data, reliability and validity analysis can be used to achieve this goal. The specific measures of this study are shown in table 1.

TABLE 1.   RESULTS OF THE RELIABILITY AND VALIDITY ANALYSIS (N=732)

Variable	Item test	Factor load	Cronbach's α	CR	AVE
Financing performance	Financing costs are more reasonable.	0.798	0.887	0.878	0.707
	Credit line is more flexible.	0.857			
	Financing term is more flexible.	0.864			
Internal integration	The internal unified information system works well.	0.801	0.897	0.852	0.659
	Ability to integrate inventory management.	0.785			
	Establish cross-functional teams for process optimization and new product development.	0.847			
External integration	Actively participate in and cooperate with the construction of the integrated information system platform of the ecosystem.	0.815	0.893	0.874	0.641
	Actively establish strategic partnerships with key partners in	0.852			

	the ecosystem.				
Internal innovation potential	Proactively share information with partners in the ecosystem.	0.727			
	Try new methods and use new technologies.	0.807			
	Try new ways of doing things very often.	0.812	0.923	0.901	0.686
	Try new ways of doing things very often.	0.866			
Open-ended collaborative innovation	Work with key partners in the ecosystem for production process design / improvement / Innovation.	0.842			
	Work with key partners in the ecosystem for product innovation / design.	0.854	0.932	0.903	0.698
	Working with key partners in ecosystems for technology innovation / research and development.	0.841			

The fitting indicators of this model are ： $x^2 = 305.79$, $df = 142$, RMSEA=0.067, TLI=0.956, CFI=0.947. It can be seen that the model has good fitting results, and the construction validity of each variable is good. The measurement of each variable has good convergence validity (see table 2).

TABLE 2. DESCRIPTIVE STATISTICS OF THE VARIABLES (N=732)

Variable	Average value	Standard deviation	1	2	3	4	5	6	7	8	9
Internal integration	3.797	0.687	0.811								
External integration	3.962	0.689	0.600***	0.801							
Internal innovation potential	3.581	0.815	0.529***	0.465***	0.828						
Open-ended collaborative innovation	3.463	0.854	0.411***	0.479***	0.540***	0.835					
Financing performance	3.703	0.818	0.328***	0.391***	0.477***	0.480***	0.841				
Operating years	4.429	0.938	-0.052	-0.096	-0.091	-0.058	0.142*	1			

Number of employees	5.049	2.610	0.037	0.042	0.035	0.110	0.212***	0.422***	1		
Annual sales	6.669	2.036	0.051	0.036	-0.102	0.112	0.073	0.426***	0.557***	1	
Total assets	6.749	1.924	0.037	0.04	-0.081	-0.035	0.068	0.348***	0.534***	0.723***	1

Note: The diagonal is the square root of the AVE value of each variable; * * *, * * and * are P<0.001; P<0.01; P<0.05, the same below.

It can be seen from Table 1 and Table 2 that the square root of the correlation coefficient between the variables in this study is less than the AVE value. The variables in this study have good discriminant validity.

3.3 Data Analysis and Hypothesis Verification

This study assumes that the overall fit of the model is good $\left(x^2 = 404.966, df = 214, RMSEA = 0.060, TLI = 0.942, CFI = 0.950\right)$, so hypothesis testing can continue.

- Direct effect test

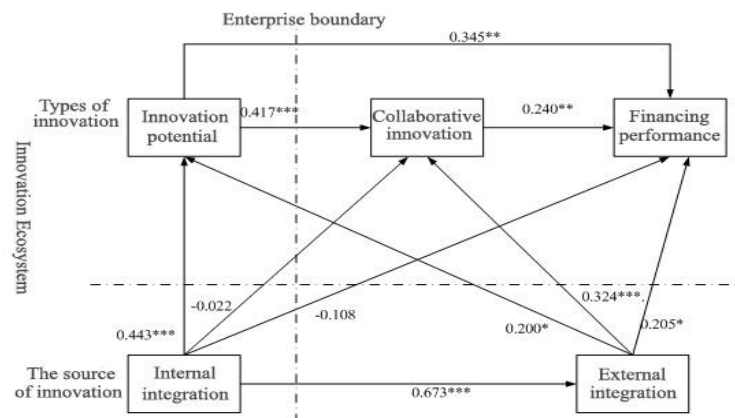Results of the direct effect test model are shown in Figure 1.

Figure 1. Direct-effect model

It can be seen from figure 1 that, from the perspective of the interaction of the company's internal-out, external-in capabilities and practical activities, the coefficient value of hypothesis 1 is 0.418 and P<0.001. It shows that hypothesis 1 has been verified. The coefficient of hypothesis 2 A value of 0.674 and P<0.001 indicates that Hypothesis 2 has been verified. Similarly, Hypothesis 3: b=0.004, P<0.001, Hypothesis 4: b=0.200, P<0.05 and Hypothesis 6: b=0.325, P<0.001 all passed the verification. Hypothesis 5 believes that the internal integration activities of enterprises can improve the collaborative innovation ability of small and medium-sized enterprises, but the test results show that the above relationship is not significant (b=-0.022, n.s).

From the perspective of the interaction between corporate innovation capabilities, integration activities, and financing performance, all have been verified except Hypothesis 9, where Hypothesis 7 (b=0.346, P＜0.01); Hypothesis 8 (b=0.240, P＜0.01)); Hypothesis 10 (b=0.205, P<0.05). Although Hypothesis 9 believes that the internal integration activities of technology-based SMEs can improve financing performance, the test results show that (b=-0.108, n, s).

- Indirect effect checksum

In order to verify whether the internal and external integration activities of the innovation ecosystem can mediate between the innovation capacity and financing performance, this study chose to test using the Bootsteapping method (see table 3).

TABLE 3. RESULTS OF THE INDIRECT EFFECT TEST

Direct path	Direct path	Standardized path coefficients	Deviation	T
II→FP	/	-0.108	0.11	-0.991
	II→COI→FP	-0.005	0.02	-0.185
	II→IIP→FP***	0.152	0.051	2.927
	II→EI→FP	0.134	0.071	1.948
	II→IIP→COI→FP	0..44	0.028	1.541
	II→EI→COI→FP*	0.052	0.021	2.405
	II→EI→IIP→COI→FP	0.013	0.011	1.187
	II→EI→IIP→FP	0.046	0.028	1.620
II→COI	/	-0.022	0.11	-0.207
	II→IIP→COI*	0.185	0.071	2.562
	II→EI→COI***	0.218	0.06	3.683
	II→EI→IIP→COI	0.055	0.034	1.592
II→IIP***	/	0.443	0.098	4.497
	II→EI→IIP	0.134	0.070	1.902

In short, the overall effect of internal integration activities of technology-based SMEs on financing performance is 0.338 (0.152+0.134+0.052). The total effect of internal integration on open collaborative innovation capability is 0.403 (0.1.84+0.218). The total effect of internal integration activities of technology-based SMEs on internal innovation potential is 0.577 (0.443+0.134)

- Robustness test

To ensure the robustness of the study conclusions, this study replaces the variables and re-examines the whole model (see table 4)

TABLE 4. RESULTS OF THE ROBUSTNESS TEST

Ensemble	Specific path	Standardization coefficients	Deviation	T
II→FP 0.314（0.156+0.158）	II→FP	-0.137	0.107	-1.279
	II→OI→FP	0.026	0.025	1.065
	II→IIP→FP**	0.156	0.052	2.938
	II→EI→FP*	0.158	0.069	2.258
	II→IIP→OI→FP	0.039	0.025	1.528

	II→EI→OI→FP*	0.030	0.017	1.731
	II→EI→IIP→IIP→FP	0.046	0.029	1.605
	II→EI→IIP→OI→FP	0.011	0.010	1.176
	II→OI	0.129	0.101	1.283
II→OI	II→IIP→OI**	0.191	0.069	2.721
0.340（0.191+0.149）	II→EI→OI*	0.149	0.058	2.519
	II→EI→IIP→OI	0.057	0.035	1.601
II→IIP	II→IIP***	0.443	0.097	4.506
0.577	II→EI→IIP+	0.133	0.070	1.901
II→EI	EI→II***	0.673	0.054	12.237
EI→FP	EI→FP*	0.234	0.101	2.305
IIP→FP	IIP→FP**	0.352	0.101	3.450
OI→FP	OI→FP*	0.209	0.087	2.394
EI→OI	EI→OI*	0.221	0.092	2.398
IIP→OI	IIP→OI***	0.431	0.098	4.383
EI→IIP	EI→IIP*	0.198	0.101	1.971

4 CONCLUSION

In summary, it is not a sufficient condition, which indirectly shows that the value co-creation path plays an extremely important role in improving the competition of SMEs. Secondly, innovation potential and open collaborative innovation are key factors to improve corporate financing capabilities with certain complementary effects between the two. Thirdly, internal integration activities cannot help external financing institutions reduce the risk of information asymmetry. It means that internal integration will not have a significant impact on corporate financing performance. As a consequence, supply chain integration and innovation capabilities are the main factors to alleviate the funding problems of technology-based small and medium-sized enterprises and improve their market competitiveness.

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