Research on the Impact of Environmental Uncertainty on Business Model Innovation of Technology-based Enterprises
A Moderated Chained Mediating Effect*

Jianing Liu[1,a,*], Tao Guo[1,b]

[1]School of Economics and Management, Harbin Engineering University
[a]liujianing815@163.com, [b]heugt@163.com
*Corresponding author Email:liujianing815@163.com

Abstract. Starting from the theory of organizational environment, combined with the network embedded theory and resource-based view, this paper conducts in-depth research on business model innovation and its mechanism around environmental uncertainty. Based on the questionnaire survey of 199 technology-based enterprises as samples. In this paper, the hierarchical regression analysis method is used, and the empirical research uses AMOS23.0 and SPSS23.0 software for empirical analysis.

Keywords: Environmental Uncertainty, Structure Embedding, Explore Ability, Business Model

1   Introduction

In recent years, the rapid development of the digital economy represented by big data and cloud computing has set off a series of changes in the enterprise field. More and more technology-based enterprises are applying digital technology to enterprise management practices and business model innovation. How to realize business model innovation of technology-based enterprises has attracted increasingly attention from the academic circles. The 1688 mall launched by Alibaba combines product source factories and various forms of proxy distribution to supplement the simple chain of Taobao's from offline physical stores to customers, and uses online apps to connect more stakeholders in a more convenient form. Expand business along the industrial chain and value chain, innovate the acquisition process of value creation internally, and realize business model innovation. Martins pointed out that whether to correctly grasp and effectively adapt to the uncertainty of the external environment has gradually become an important prerequisite and key factor for the success of business model innovation [1]. What intermediary mechanism is used to transmit between environmental uncertainty and business model innovation?

2   Research Design

2.1   Data Sources

The questionnaire adopts various mature sub-scales of previous research, and is filled out by middle and senior managers of technology-based enterprises. The questionnaire is officially distributed and entrusted to a professional research company. A total of 349 questionnaires were distributed, of which 199 were valid, and the rate of effective questionnaires was 57.02%. Environmental uncertainty is based on Jansen [2] and Ducan [3] scale. Structural embedding combined with Zheng Ye measurements. Resource patchwork employs a scale developed by Senyard [4] et al. The exploratory ability was mainly borrowed from the scale of Chandrasekaran et al. Business model innovation draws on Zott [5] research. Considering that the basic characteristics of a firm have an impact on its innovation actions, this study uses firm age and industry sector as control variables.

2.2   Research Hypothesis

The innovation of environment and business model is actually the process of realizing dynamic matching. Especially the pressures of the current COVID-19 shock, have prompted companies to view business models from a dynamic perspective. However, it can be combined with a static perspective to analyze the process of enterprises realizing business model innovation according to the characteristics of the environment. Structural embedding is mostly regarded as a static perspective, which refers to the position of the organization in the embedded network from the overall network of the enterprise. Its change is relatively slow, and it can reflect the change of the centrality and importance of the enterprise. For a complete product value chain, the output of a technology-based enterprise may be a link in the product chain, which is easily restricted by other industrial chain links, especially the resource constraints caused by the complex development of the external environment. However, most of the existing researches focus on new ventures, and there is no reasonable explanation for how to explore the dynamic process of interaction between internal and external resources of technology-based enterprises from the perspective of resource patch-work, and to promote business model innovation. And the effective play of embedded value is mainly affected by environmental characteristics [6]. The ability to explore reflects the ability to follow changes in the external environment. Enterprises with strong exploration ability often go beyond the existing foundation of the enterprise and cross organizational and technological boundaries, so that the position of the enterprise in the network changes, that is, the change of structural embedding. Despite their enormous potential, they are high risk and destructive. Therefore, under the environment of uncertainty, the higher the exploration ability, may be counterproductive to the enterprise, which is not conducive to the effect of structural embedding, and then induces the rigidity of business model innovation. Based on this, the following assumptions are made:

H1: Environmental uncertainty has a positive impact on business model innovation.

H2: Structural embedding and resource patching have a mediating role between environmental uncertainty and business model innovation.

H3: Exploration ability moderates the relationship between environmental uncertainty and structural embedding.

3   Empirical Research

3.1   Reliability and Validity Test and Correlation Analysis

In order to ensure the validity of the study and conduct reliability and validity tests, Cronbach's alpha coefficient is often used to evaluate the internal consistency of the sample, that is, the reliability of the measurement results. As shown in Table 1, the Cronbach's α values of the variables are all greater than the minimum standard of 0.7, which shows that of each variable have good internal consistency. Using AMOS23.0 confirmatory factor analysis, the factor loading of each variable is greater than 0.6, and the AVE and CR values of each latent variable are calculated. The AVE value is greater than or equal to 0.5, and the CR value is greater than 0.8, the internal consistency of each scale is good, with a high level of reliability and validity.   Environmental uncertainty and structural embedding, resource patching, and business model innovation were all significantly positively correlated (r=0.326, p<0.01; r = 0.425, p < 0.01; r = 0.456, p < 0.01 ;). Structural embedding, resource patching and business model innovation were all significantly positively correlated (r=0.420, p<0.01; r=0.688, p<0.01). Structural embedding was significantly positively correlated with resource patching (r=0.360, p<0.01). There is a significant correlation between the main variables, which provides a basis for further empirical analysis.

Table 1. Credit validity test

Subactive variables	factor loading	Cronbach's α	AVE	CR
EU	0.648～0.800	0.755	0.515	0.808
SE	0.688～0.732	0.852	0.500	0.800
RP	0.607～0.818	0.897	0.521	0.896
EA	0.653～0.802	0.821	0.538	0.822
BMI	0.649～0.827	0.809	0.592	0.811

Original: Author

Note: EU→environmental uncertainty, SE→Structural embedding, RP→Resource patchwork, EA→Explore Ability, BMI→business model innovation

3.2   Main and Mediating Effects Tests

Hierarchical regression method was used to verify the main effect and mediating effect, and environmental uncertainty had a significant positive impact on business model innovation (r=0.501, p<0.001). Environmental uncertainty has a significant

positive impact on structural embedding and resource patching (r=0.366, p<0.001; r=0.398, p<0.001). The H1 was verified. Structural embedding has a significant positive effect on business model innovation(r=0.288, p<0.001).

Table 2. Main effect and intermediary effect regression

variable	Structural embedding		Resource patchwork		business model innovation			
	model1	model2	model3	model4	model5	model6	model7	model8
Age	0.105*	0.070	0.028	-0.010	0.049	0.002	-0.018	0.009
Industry	0.007	0.013	0.011	0.017	-0.014	-0.007	-0.010	-0.019
EU		0.366***		0.398***		0.501***	0.396***	0.214***
SE							0.288***	
RP								0.722***
R^2	0.025	0.118	0.004	0.184	0.008	0.209	0.292	0.509
ad R^2	0.015	0.105	-0.006	0.171	-0.002	0.197	0.277	0.499
F	2.497	8.725***	0.396	14.625***	0.760	17.141***	20.010**	50.236***

Original: Author

*** p<0.001, **p<0.01, *p<0.05

3.3   Chain Mediation Test

Bootstrap [7] analysis was used to verify whether structural embedding and resource patching played a chain mediating role between environmental uncertainty and business model innovation, and a 95% confidence interval was used to judge whether the mediation effect was significant. With the help of the process plug-in in SPSS, the data were repeatedly sampled 5000 times with replacement. In the path "environmental uncertainty → structural embedding → business model innovation", the 95% confidence interval is [0.006, 0.127], excluding 0, indicating that the mediation effect is significant. In the path "environmental uncertainty → resource patchwork → business model innovation", the 95% confidence interval is [0.107, 0.341], excluding 0, indicating that the mediating effect is significant. In the path "environmental uncertainty → structural embedding → resource patching → business model innovation", the 95% confidence interval is [0.015, 0.089], excluding 0, indicating that structural embedding and resource patching are closely related to environmental uncertainty and business model. The H2 hypothesis was verified.

Table 3. Bootstrap test of chain mediation effect (standard coefficient)

path	Effect	Boot	95% confidence inter-	Effect

	value	standard error	val		ratio%
			upper limit	lower limit	
Total indirect effect	0.323	0.060	0.209	0.444	64.47
Ind1：EU→SE→BMI	0.057	0.032	0.006	0.127	11.38
Ind2：EU→RP→BMI	0.218	0.061	0.107	0.341	43.51
Ind3：EU→SE→RP→BMI	0.048	0.019	0.015	0.089	9.58

Original: Author

3.4   Moderating Effect Test

Decentralize the environmental uncertainty, exploration ability to obtain the interaction term, and perform hierarchical regression. The results are shown in Table 4. The interaction term of environmental uncertainty and exploration ability has a significant negative impact on the structural embedding. ($r=-0.149$, $p<0.05$), indicating that exploratory ability plays a negative moderating role between environmental uncertainty and structural embedding.

Table 4. Regression analysis of the regulatory effects

variable	Structural embedding			
	model9	model10	model11	model12
Age	0.105*	0.070	0.070	0.071
Industry	0.007	0.013	0.012	0.010
EU		0.366***	0.174*	0.161
EA			0.401***	0.361***
EU*EA				-0.149*
R^2	0.025	0.118	0.004	0.184
Ad R^2	0.015	0.105	-0.006	0.171
F	2.497	8.725***	0.396	14.625***

Original: Author

Select the model 83 in the PROCESS plug-in to test the moderated chain mediation effect. In the action path of "environmental uncertainty → structural embedding → resource patchwork → business model innovation", the low exploration ability supports the chain mediation effect of 0.041, 95 % confidence interval does not contain 0, the chain mediation effect is significant. At the same time, check that the index value of the adjusted mediation test index is -0.020, and its 95% confidence interval is [-0.045, -0.002], excluding 0. The H3 hypothesis was verified.

4   Conclusion

The main conclusions are as follows:(1) Environmental uncertainty positively affects structural embedding, resource patching, and business model innovation; (2) Structural embedding positively affects resource patching, and forms a chain intermediary between environmental uncertainty and business model innovation; (3) exploration ability weakens the positive effects of environmental uncertainty, structural embedding, and resource patchwork on business model innovation.

When technology-based companies perceive environmental uncertainty, they tend to innovate business models innovation. From the research results, for technology-based enterprises, attention should be paid to the compatibility of business models and external environment, so that business model innovation is always in a process of dynamic adjustment. When the enterprise's exploration ability is too high, the enterprise itself tends to carry out highly risky breakthrough innovation activities. If the enterprise faces high environmental uncertainty again, it may also lead to the rigidity of enter-prise decision-making and induce the rigidity of the business model.

Acknowledgements

References

1. Martins L L, Rindova V P, Greenbaum B E. Unlocking the hidden value of concepts: A cognitive approach to business model innovation [J]. Strategic Entrepreneurship Journal, 2015, 9(1):99-117.
2. Jansen J P, Van Den Bosch F J, Volberda H W. Exploratory innovation, exploitative innovation and performance: Effects of organizational antecedents and environmental moderators [J]. Management Science, 2006, 52(11):1661-1674.
3. Ducan R B. Characteristics of organizational environments and perceived environmental uncertainty [J]. Administrative Science Quarterly, 1972, 17(3):313-327.
4. Zhenduo Zhu. Entrepreneurial orientation, entrepreneurial patchwork and new enterprise performance: an empirical study of a regulatory effect model [J]. Management Review, 2015, 27 (11): 57-65.
5. Zott C, Amit R. The fit between product market strategy and business model: implications for firm performance [J]. Strategic Management Journal, 2008, 29(1):1-26.
6. Koka B R, Prescott J E. Designing alliance networks: The influence of network position, environmental change, and strategy on firm performance [J]. Strategic Management Journal, 2008, 29(6):639-661.
7. PREACHER K J, HAYES A F. Asymptotic and Resampling Strategies for Assessing and Comparing Indirect Effects in Multiple Mediator Models [J]. Behavior Research Method, 2008, 40(13):879-891.