

Research on the Influence of Open Innovation on Quality Performance---- Absorptive Capacity Is the Regulation of Intermediaries and Environmental Turbulence

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Abstract

In this study, 263 manufacturing enterprises were selected as samples. For the first time, the effect of open innovation on quality performance was studied by regression analysis under the regulation of environmental instability. The results show that the quality performance of the enterprise is positively influenced by the introversion open innovation and the extraversion open innovation. Absorptive capacity plays a mediating role in the relationship between open innovation and quality performance, and environmental instability has a positive regulating effect on the impact of introversion open innovation, extraversion open innovation and quality performance. It is pointed out that open innovation helps to improve the quality performance of enterprises, absorption capacity is a key intermediary, and environmental instability is also an important factor in its impact path.

Keywords

Open innovation; Quality performance; Absorptive capacity; Environmental instability.

1. Introduction

Under the background of China in the new era, domestic enterprises need to adopt the concept and application of open innovation for practice. The goals of made in China 2025 and the rapid development of informatization make "open innovation" gradually become the leading mode of enterprise innovation. There is a multidimensional nature of open innovation performance, and the current research on open innovation brings the economic performance of the lack of a comprehensive, research mainly focused on the different dimensions of open innovation and the relationship between the corporate performance, quality performance as a indispensable part of the enterprise performance, rarely involed the study of the relationship between open innovation and quality performance, it is necessary to carry out studies on the influence of the open innovation on quality performance, mechanism, Which is not only beneficial to broaden the research field of open innovation, but also on how to use the open innovation to guide enterprises to improve quality performance to provide new ideas.

2. Theoretical Basis and Research Hypothesis

2.1. Impact of Open Innovation on Quality Performance

Chesbrough H[1] believed that open innovation is a mode for enterprises to achieve market goals and comprehensively apply internal and external thoughts and methods, and divided open innovation into inward open innovation (ETA) and outward open innovation (ETE) Quality performance is to obtain high-quality enterprise performance at a low cost: it refers to the excellent performance achieved by enterprises or organizations operating in accordance with the advanced quality standard system [2].

It can bring enterprises a particular technology or knowledge externalization through external cooperation benefit, to build with internal technology as a benchmark industry standards, and then move into new products and profits increase the performance for the enterprise strategic benefits of the enterprise, to improve the quality performance of enterprises has certain help [3]. Based on this assumption:

H1: introverted open innovation has a positive impact on enterprise quality performance

H2: export-oriented open innovation has a positive impact on enterprise quality performance

2.2. Mediating Effect of Absorptive Capacity

Of the application of perception, digestion and absorption capacity is the ability of external knowledge [4], absorptive capacity in the process of open innovation is crucial to have a higher level of absorptive capacity of companies tend to have greater ability to innovate, and only by cultivating and enhance the absorptive capacity of the enterprise itself can benefit from these external knowledge flow [5], companies benefit from external knowledge flow of more and less have decisive relationship with the strength of the absorptive capacity of enterprise, thus affect the quality of the enterprise performance. Therefore, this paper proposes the following hypotheses:

H3: absorptive capacity plays an intermediary role in the relationship between open innovation and quality performance

2.3. Regulating Effect of Environmental Turbulence

Volatility environment can be divided into technical and market volatility [6], volatility technology refers to the industry of technological change and the development speed, volatility technology make the enterprise in the past have the technical knowledge in the context of open innovation has been unable to adapt to, and it is difficult to through the organization of research and development ability to master cutting-edge knowledge and technology industry development, in order to improve the business performance, often need to pass with external cooperation for more innovative resources [7]. Based on this assumption:

H4: technological volatility positively moderates the relationship between introverted open innovation and quality performance

H5: technological volatility positively moderates the relationship between export-oriented open innovation and quality performance

Market turbulence refers to the continuous change of customer preference or demand and the composition of competitors, which is characterized by the constant breaking of traditional industrial boundaries and the change of customer composition and preference [8]. Increasingly complex market environment and customer preferences or demand rapid changes make enterprises must actively adapt to the development of technological change, adopt open innovation enterprises are more likely to adjust technical knowledge actively, so as to quickly create new products and meet the needs of potential customers[9], the development of unique competitiveness, thus improve the quality performance of enterprises. Based on this assumption:

H6: market volatility positively moderates the relationship between introverted open innovation and quality performance

H7: market volatility positively moderates the relationship between export-oriented open innovation and quality performance

3. Research Methods

3.1. Research Samples

A total of 287 questionnaires were sent out in this study, of which 273 were sent by mail, accounting for 95.12%. 14 questionnaires were distributed through field visits, accounting for 4.89% of the questionnaires. After careful screening, 263 valid questionnaires were obtained, with an effective rate of 91.64%.

3.2. Measurement Tools

In order to ensure the credibility of measurement tools, this study tried to use mature scales confirmed in previous literature, and fine-tuned them as a tool for collecting empirical data considering the purpose of this study and the particularity of the coal industry. Two control variables, enterprise scale and enterprise scale, are introduced. Except for control variables, other variables are measured using Likert scale, where 1-5 represents the degree of "strongly disagree" to "strongly agree".

Open innovation. This study drew on Chesbrough H[1] 's research and development, including two dimensions of introverted open innovation (ETA) and extroverted open innovation (ETE), and included 10 items in total. The Cronbach's value of this scale was 0.902.

Quality performance. Referring to the research results of quality performance indicators, the measurement indicators of enterprise quality performance were sorted and adjusted [10]. Finally, it was decided to measure the scale from the two dimensions of product quality performance and process quality performance. The Cronbach's value of the scale was 0.789.

The environment is volatile. The Cronbach's value of this scale is 0.875. Absorption capacity. In this study, the absorptive capacity was divided into four dimensions by referring to Zahra and George, and the scale developed by Jansen et al. for the absorptive capacity dimension and its development and published in the Academy of Management Journal as the measurement index. The Cronbach's value of the scale was 0.831.

4. Result Analysis

4.1. Confirmatory Factor Analysis

In order to investigate the convergent validity and discriminant validity of the four major latent variables, namely, open innovation, quality performance, absorptive capacity and environmental turbulence, this study used spss24 software to conduct confirmatory factor analysis on the measured data. The results of the nested model fitting degree were shown in table 1, and the results showed that the four-factor model fitted the data best ($\chi^2=682.74$; Chi square/df = 1.91; NNFI = 0.93; CFI = 0.94; RMSEA=0.076), indicating that the variable measurement has good discriminative validity. Factor load and t value of each factor reached the significance level of 0.05, and all of them were properly solved, indicating that the variables in this paper had good convergent validity.

4.2. Analysis of Test Results

Enterprise quality performance of the model of multifactor regression analysis results are shown in table 2 M1 - M7, in order to avoid Multi-collinearity problem effectively, this paper when calculating the interactive items refer to previous scholars experience will be centralized regulation variables and independent variables and are first and then multiply, and interactive items one by one put into effect in the model, and through the model the M4 - M7 to various regulating effect test, respectively.

Table 1. Confirmatory factor analysis of variables at the individual level

model	χ^2	df	χ^2/df	NNFI	CFI	RMSEA	Model comparison test		
							Model to compare	$\Delta\chi^2$	Δdf
1.Four factor model	692.32	342	2.02	0.93	0.94	0.081			
2.Three factor model one	847.89	351	2.41	0.91	0.92	0.089	2 vs.1	155.57**	9
3.Three factor model two	1096.30	360	3.05	0.89	0.90	0.097	3 vs.1	376.98**	18
4.Three factor model three	1567.19	369	4.25	0.86	0.88	0.121	4 vs.1	847.87**	27
5.Single factor model	1806.38	371	4.87	0.82	0.83	0.129	5 vs.1	1114.06**	29

(1) analysis of the direct impact of open innovation on quality performance.

The results of multi-factor regression analysis of enterprise quality performance show that all variables are significantly correlated and all are at the moderate correlation level, which is suitable for regression analysis, as shown in table 2. Model 2 results show that in the control variables are added on the basis of open innovation and repressive extroverted open innovation two independent variables, because $\Delta R^2 = 0.611$, $p < 0.01$, so the explanatory power of the model significantly increased; In addition, $\beta = 0.469$, $p < 0.01$, there is a significant positive correlation between introverted open innovation and quality performance, which supports H1. Since $\beta = 0.491$, $p < 0.01$, there is a significant positive correlation between export-oriented open innovation and quality performance, and H2 is supported.

(2) analysis of the regulatory effect of environmental turbulence

By volatility model 3 result, increase the technology and market volatility 2 adjustment variables, $\Delta R^2 = 0.201$, $p < 0.01$, the explanatory power of the model significantly increased; 4 result by the model, on the basis of the three main effect model to increase volatility open innovation and technology repressive interactions, $\Delta R^2 = 0.022$, $p < 0.01$, significantly higher explanatory power of the model, and $\beta = 0.149$, $p < 0.01$, so the technology significant volatility to adjust the relationship between open innovation and quality performance repressive, support H4.

Model 5 results show that on the basis of the three main effect model to increase the interaction of export-oriented volatility open innovation and technology, $\Delta R^2 = 0.030$, $p < 0.01$, significantly higher explanatory power of the model, and because the $\beta = 0.317$, $p < 0.01$, so the volatility technology significant positively regulate outbound open innovation and the relationship between the quality performance, so as to support H5.

The results of the model 6, on the basis of the three main effect model of increasing inbound interaction of open innovation and market volatility, $\Delta R^2 = 0.014$, $p < 0.05$, significantly higher explanatory power of the model, because the $\beta = 0.104$, $p < 0.05$, so the market volatility significantly positive adjustment introverted relationship between open innovation and quality performance, so as to support H6.

Model 7 results show that on the basis of the three main effect model to increase the interaction of export-oriented open innovation and market volatility, $\Delta R^2 = 0.026$, $p < 0.01$, the explanatory power of the model significantly increased, due to the $\beta = 0.231$, $p < 0.01$, so the market volatility is significantly positive adjust export-oriented relationship between open innovation and quality performance, assumes that the H7.

Table 2. Results of multilayer multifactor regression analysis

variable	Quality performance						
	M1	M2	M3	M4	M5	M6	M7
The enterprise scale	-0.019	-0.136	-0.121*	0.102*	-0.136-	-0.118	-0.127
Enterprise age	-0.002	-0.019	-0.188*	-0.127	-0.085	-0.135*	-0.011
ETA	0.469***	0.218***	0.258***	0.413***	0.209***	0.241***	
ETE	0.491***	0.314***	0.207***	0.364***	0.014*	0.308***	
Technical volatility			-0.091**	0.351***	0.211***	0.291***	0.203**
Market volatility			-0.167**	0.232***	0.217***	0.139***	0.375***
ETA×Technical volatility				0.149***			
ETE×Technical volatility					0.317***		
ETA×Market volatility						0.104**	
ETE×Market volatility							0.231***
R2	0.051	0.723	0.815	0.837	0.845	0.829	0.841
Adjust the R2	0.035	0.714	0.804	0.821	0.826	0.818	0.832
ΔR2		0.611***	0.201***	0.022***	0.030***	0.014**	0.026***

Note: the standardized regression coefficients are listed in the table. R2 in model m4-m7 refers to that in comparison with that in M3 model, ** means $p < 0.05$, and *** means $p < 0.01$.

(3) test of the mediating effect of absorptive capacity

In this study, the path analysis method bootstrap adopted by scholars Edward and Lambert was used to test the significance of indirect effects of absorptive capacity. The results show that open innovation has a direct and significant impact on enterprise quality performance (direct effect is 0.14, 95% confidence interval is [0.03, 0.22]), and it can have an indirect and positive impact on enterprise quality performance through the intermediary effect of absorptive capacity (indirect effect is 0.08, 95% confidence interval is [0.02, 0.15]). It indicates that absorptive capacity plays an intermediary role between open innovation and enterprise quality performance, thus supporting H3.

5. Conclusion

The results show that both dimensions of open innovation have a significant positive correlation with the quality performance of coal mining enterprises, and that introverted open innovation positively regulates the relationship between extroverted open innovation and product quality competitiveness of coal mining enterprises. Absorptive capacity plays an intermediary role in the relationship between open innovation and quality performance. Technology volatility and market volatility in the introverted open innovation and extroverted open innovation to the coal mine enterprise quality are positively regulating role in the performance impact, environmental volatility is the power of improve quality performance of coal mining enterprises, coal mining enterprises under the environment will be more tends to grasp the opportunity and the external organizations work together to overcome the difficulties to create more value.

(2) Enterprises should actively exchange information with the outside world, build internal and external two-way open innovation related platforms, give full play to the dual role of R&D and absorption and utilization of innovative knowledge, and pay attention to the synergy between environmental fluctuations and open innovation; When the environment is highly volatile, enterprises should actively carry out the cooperation mode of innovative knowledge sharing and impart experience to each other to improve the quality performance of enterprises. In a

relatively stable environment, enterprises should find the balance between internal and external environment and try to avoid adverse factors.

(3) Absorption capacity was studied as a whole in this study. In the future, absorption capacity can be discussed or extended to other factors affecting the path in a multi-dimensional way and the collected questionnaires are cross-sectional data, thus resulting in the difference between the actual index and the baseline index. More accurate empirical analysis is needed to provide reference for further understanding the impact mechanism of open innovation on the quality performance of enterprises.

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