

# An Empirical Research on the Influence of Strategic Flexibility and Information Synergy on Nuclear Power Affiliated Enterprise's Innovation Performance

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**Abstract**—Flexibility is an important factor affecting technology innovation. Information synergy also influences the process of enterprise technology innovation. Based on a literature review and previous work, this study aims to investigate the influence of Strategic Flexibility and Information Synergy on Technology Innovation Performance and to explore how do they affect each other. Samples for this study were randomly selected from 105 Nuclear Power Affiliated enterprises in China. A total of 260 questionnaires were issued and 189 valid replies were received. This paper used multivariate regression analysis and statistical software SPSS17.0. The findings of this study provide evidence that strategic flexibility and information synergy have significantly positive influence on nuclear power affiliated enterprise's innovation performance. Besides, it examined the interaction mechanism between them. This study provides guidance for improving Strategic Flexibility and enhancing Nuclear Power Affiliated Enterprise's Innovation Performance.

**Keywords**- *Strategic Flexibility; Information Synergy; Nuclear Power Affiliated Enterprise; innovation; Technical Innovation Performance*

## I. INTRODUCTION

Along with the rapid progress of technology and the drastic competition among enterprises, the environment which the enterprises faced with has changed a lot and will continue to change. In this dynamic environment, it has been a key issue for companies that how to deal with the challenges and take advantages of the opportunities to improve innovation performance, gain competitive advantage and achieve sustainable development, especially under the current open economic background, the research of enterprise technological innovation has gradually

focused on open innovation model which emphasizes more partners to take part in the technological innovation. As a result, strategy, organization, information, and other collaborations play more and more important roles for the enterprise in the process of technical innovation. Meanwhile, in this turbulent environment, companies must be able to adjust their strategies and enhance the company's strategic flexibility in time according to the needs of the market, which is good for product innovation and technological innovation. Thus, it has been a very important problem for companies that how to promote the technological innovation by enhancing the company's strategic flexibility and improving the degree of information synergy.

Most studies indicated that strategic flexibility plays an important role in the process of technological innovation (Teece, 1986). Lieberman and Montgomery (1988) pointed out that with the increasing of flexibility, it is easier for enterprises to use existing resources to innovate, which is good for innovation. At the same time, information synergy is also regarded as an important factor that may influence the innovation of enterprises. Especially in this competitive market, companies want to get to upgrade their technological innovation capability, and thus gain a competitive advantage, they must focus on information collaboration. Many companies failing in technological innovation is due to lack of information exchange and communication. Therefore, it is important for current businesses to create better conditions for technological innovation by studying strategic flexibility and information synergy. However, here is a lack of studies that examine how strategic flexibility and information synergy affect technical innovation performance.

These are some of the traditional factors that contribute to technical innovation. This study is meant to serve as a

preliminary model and a guide to explain how strategic flexibility and information synergy can affect innovation. A further purpose is to examine how strategic flexibility and information synergy positively relate to technology innovation performance and a model is proposed (see Fig.1).

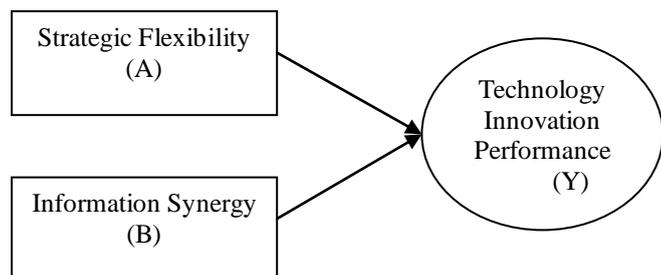


Figure 1. The conceptual model

## II. THEORETICAL BACKGROUND AND HYPOTHESES

### A. The relationship between Strategic Flexibility and Technical Innovation Performance

In a dynamic environment, strategic flexibility plays a very important role in the technology innovation process for enterprises<sup>[1]</sup>. The enterprises need to continuously acquire new resources, capabilities and competitive advantage in order to achieve long-term development. However, under the objectives of profit maximization, the enterprises always adjust themselves to internal and external changes to enhance their competitiveness (Hamel & Heene, 1994; Hamel & Prahalad, 1994). Strategic flexibility can just expand the scope of corporate resources and respond to the changing environment. For enterprises, strategic flexibility is the best choice for enterprises to adapt to the dynamic environment, and more importantly, strategic flexibility is the key factor to gain competitive advantage (Meyer et al, 1989; Koste et al, 2004; Nadkarni, S.,2007; Llore' ns -Montes et al., 2005)<sup>[2-4]</sup>. it is the strategic choice for the enterprise when facing an uncertain situation in the future (Volberda, 1998)<sup>[5]</sup>. It has an important influence on technological innovation and performance (Abbott and Banerji, 2003; Nadkarni and Narayanan, 2007; Nadkarni, S., 2010)<sup>[6-7]</sup>. strategic flexibility can enhance innovation capability (Utterback and Abernathy,1975). When companies invest innovation resources, priority should be given to the strategic flexibility. Other researchers have stressed the importance of strategic flexibility on the enterprise innovation ability (Freemand, 1982 ; Kevin et al. 2010 )<sup>[8]</sup>.

Sanchez raised that strategic flexibility depended on the company's ability to obtain resources and serving capabilities (Sanchez, 1995, p.138)<sup>[9]</sup>. he further stated strategic flexibility included resource flexibility and coordination flexibility. Besides, Buzacott (1982)<sup>[10]</sup> considered resource flexibility may improve the ability to respond to changes in the external business environment by adjusting the part of the production plan. In addition, Ireland et al (2003)<sup>[11]</sup> pointed out that it is a part of dynamic capabilities to solve existing problems, which is also the key factor for enterprises to gain competitive advantage. Thus, according to the dynamic capability

perspective, it is very important to integrate these resources and to make full use of strategic flexibility for technological innovation. For these reasons, we propose the first hypothesis:

Hypothesis 1: strategic flexibility will have a significant and positive effect on technology innovation performance.

### B. The relationship between Information Synergy and Technical Innovation Performance

Experts and scholars have studied the relationship between information synergy and business technology innovation performance from different perspectives, and most of the research findings indicate that information synergy has an impact on the performance. Adler (1992), Gerwin and Moffat (1997), Bailey (1999) believe that poor communication is a major factor affecting the enterprise collaborative innovation process. Rhonda R. et al (1999) through multi-agent simulation experiment examined the impact of information sharing on firm performance, saying that in a dynamic environment, information sharing can contribute to enhance corporate performance [12]. The study of Zhao et al (2002) showed that the higher the level of information sharing between enterprises is, the higher their performance levels were [13]. Xiong Li, Meng Qingguo, Yan Bing et al (2007) considered enterprises could effectively reduce the uncertainty from the outside through the information collaboration. Form these views, we can see that it would be bad for technology innovation without information synergy. The information, technology and other resources not only have an impact on the business itself, but also make difference outside the enterprise by the positive and negative externalities. So companies selectively cooperate with competitors or its collaborative partners to get the accurate and effective information in time, which is conducive to enterprise technological innovation. It can be seen that information synergy is the inevitable requirement for technology innovation capability. Thus the following hypothesis is proposed:

Hypothesis 2: Information synergy will have a significant and positive effect on technology innovation performance.

## III. METHOD

### A. Sample and Procedures

Empirical research was used in this study to explore how strategic flexibility and information synergy affect technological innovation performance. Meanwhile, this study adopts questionnaire investigation method to verify the above hypothesis. Samples for this study were randomly selected from 105 nuclear power affiliated enterprises in China. This study sent 260 formal investigation questionnaires and got 206 questionnaires back. The recovery rate is 79.23%. In the 206 questionnaires, there are 17 invalid questionnaires. Therefore, the effective questionnaire was 189 copies, and the effective recovery rate is 91.74%.

According to the related concept, variable measure adopted Likert's measurement of the five dimensions as given a proposition, the respondents are asked to give comment. We deal with the collected data using the

statistical software SPSS17.0. Connected with the statistical analysis of the data, we verify the model and test the hypothesis in this paper.

### B. Measures

Strategic flexibility is the management ability of developing and cultivating strategic resources and dynamic capability at present or in the future, it is used to adapt to change, using change and manufacture changes to improve their core competencies and developing a set of rules to improve the adaptability and efficiency of the organization. It includes resource flexibility and coordination flexibility. In this paper, strategic flexibility was measured by the scales developed by Sanchez<sup>[9]</sup>, Wang Yonggui and Wang Tienan. The strategic flexibility scale consisted of ten items.

Meanwhile, information synergy is a management ideology by effectively organizing, harmonious using all kinds of information to eliminate "islands of information" in the process of completing a variety of business activities. It includes information quality and information acquisition. It was measured by the scales developed by Mehmet, Zhao Yunpeng, Zhu Wenping and Chen Guoping. The scale comprises ten items.

Besides, technology innovation performance includes the indexes to measure efficiency of the innovation process and outputs or outcomes contributing to business success. It includes output performance and process performance of technical innovation. Generally speaking, foreign scholars always consider patent number as the proxy variable to measure the technology innovation performance. For examples, McFetridge (1987) measured the speed and scope of achieving patent to measure the technology innovation performance. Hagedoom and Cloudt (2003) took the number of new products and patent applications as a proxy variable to measure the technology innovation performance. From the perspective of innovation efficiency, Zhang Fanghua (2006) used the five indexes (the speed of development of new products, the number of new products, product innovation success rate, number of patents, the percentage of new products on sales) to measure the technology innovation performance. Based on a review of the literature and previous research, technology innovation performance was measured by the scales developed by Zhang, Y.,<sup>[14]</sup> and Li, H., Zhang Lixin, Liu Changyong, Zhang Fanghua and Wei Ying. All items used a five-point Likert scale anchored from 1, strongly disagree to 5 strongly agree. The scale comprises five items

### C. Control variables

At the individual level, manager's gender and age were controlled because it has been found that manager's gender (female=0; male=1) and age exert confounding effects on firm performance in the previous research (Reynolds, 2000). Age was measured with five categories: (1) <25; (2) 25–34; (3) 35–44; (4) 45–54; and (5) >55 years old. At the firm level, Lee et al. (2001) pointed out that firm size has a significant impact on innovation performance. Moreover, Baron and Tang's research also showed that firm size influence innovation (Baron and Tang, 2009;

Ucbasaran et al., 2009). Firm size was measured by the number of current employees in the firm.

## IV. DATA ANALYSIS

### A. The reliability test

Reliability coefficient is a reflection of the reliability of the data. In this paper, we take Cronbach's ( $\alpha$ ) coefficient as reliability criteria. The standards are as follows:  $0.5 < \alpha < 0.7$ , credible;  $0.7 \leq \alpha < 0.9$ , very credible;  $\alpha \geq 0.9$ , completely credible.

TABLE I. CRONBACH'S ALPHA COEFFICIENT TABLE

variable	Cronbach's Alpha	N of Items
Strategy Flexibility	0. 878	10
Information Synergy	0. 855	10
Technology Innovation Performance	0. 802	5

Generally speaking, it can be accepted in basic research if the reliability is over 0.7. In this study, the Cronbach's coefficient of each variable were 0.878, 0.855 and 0.802. It shows that the consistency of questionnaire is good and of high reliability. It meets the requirements of internal consistency for the social science research.

### B. Test of validity

Before the issue of questionnaires, we try to ensure that the questionnaire has certain content validity through discussing repeatedly and preliminary examination in small range. Exploratory factor analysis method is adopted to test the questionnaire structural validity.

#### 1) Factor analysis of Strategic Flexibility

Kaiser-Meyer-Olkin Measure and Bartlett's Test were made on each measuring item of Strategic Flexibility by the SPSS17.0. The result is that KMO value is 0.882 and the significant level of X<sup>2</sup> statistical value in Bartlett's Test is 0.000, which means the statistic data is fit for factor analysis.

#### 2) Factor analysis of Information Synergy

We made KMO measure and Bartlett's Test to test information synergy, the inspection results show that the KMO value is 0.874, between 0.8 and 0.9, which means the structural validity is good. Meanwhile, in Bartlett's Test, the significant level is 0.000, which is less than 0.01, showing that this group of variable data is fit for factor analysis once again

#### 3) Factor analysis of Technology Innovation Performance

We made KMO measure and Bartlett's Test to test of Technology Innovation Performance. The KMO value is 0.820, between 0.8 and 0.9, which means the structural validity is good. Meanwhile, in Bartlett's Test, the significant level is 0.000, which is less than 0.01, showing that this group of variable data is fit for factor analysis once again.

### C. Validation of proposition

Correlation analysis is often made to study the degree of the correlation between two variables. In order to further understand the relationship between each variable, we carried on the correlation analysis. The following is the result.

TABLE II. PEARSON CORRELATION COEFFICIENT MATRIX

Correlations		A1	A2	B1	B2	Y
A1	Pearson Correlation	1				
A2	Pearson Correlation	.612**	1			
B1	Pearson Correlation	.504**	.372**	1		
B2	Pearson Correlation	.273**	.207**	.693**	1	
Y	Pearson Correlation	.753**	.675**	.682**	.574**	1

\*\* Correlation is significant at the 0.01 level (2-tailed).

A1: Resource flexibility A2: Coordination flexibility  
B1: Information Quality B2: Information Acquisition  
Y: Technology Innovation Performance

From the table above, it is seen that the strategic flexibility, information synergy and technology innovation performance are positively correlated. In order to further understand the relationship between them, we put the strategic flexibility and information synergy as independent variables, the technology innovation performance as the dependent variable, using multiple step-wise regression method to analyze and verify the possible relations. Form the table, we can see that each significant level is less than 0.01, which means the introduction of strategic flexibility and information synergy has a significant effect on the dependent variable.

TABLE III. RESULT OF OLS ANALYSES WITH TECHNOLOGY INNOVATIONBB PERFORMANCE AS THE DEPENDENT VARIABLE

Variables	Model 1	Model 2	Model 3	Model 4
gender	.044	.060	.083	.070
age	.062	.015	.039	.016
firm size	.060	.072	.038	.061
strategic flexibility		.892***		.801***
information synergy			.593***	.176***
R2	.009	.803	.358	.826
Δ R2	-.021	.795	.331	.817
Δ F	.301	100.095***	13.640***	91.914***

\*\* Correlation is significant at the 0.01 level (2-tailed).

Regression analysis results confirm the hypothesis 1 and 2 proposed. At the same time, it proves that strategic flexibility and information synergy has a significant effect on technology innovation performance.

### V. CONCLUSIONS AND INSPIRATIONS

With the deepening of economic development, technological innovation capability is increasingly becoming a symbol of the strength of the core business<sup>[15]</sup>. If someone has strong technical innovation ability, then he will be able to occupy a favorable position in the market competition. Therefore, how to enhance the technological innovation capability of enterprises and performance has a crucial effect on businesses. More importantly, to some

extent, it determined the sustainable development of enterprises.

As can be seen from the results of the analysis in this article, strategic flexibility and information synergy have a significant and positive impact on technology innovation performance. In a dynamic economic environment, the stronger the corporate strategic flexibility is, the better technological innovation performance improvement is. Meanwhile, the increasingly competitive market environment requires enterprises to strengthen collaboration capabilities to provide better conditions for enterprises technological innovation. Therefore, in this competitive environment, we need to focus on strategic flexibility, information synergy and technology innovation as well as other factors that may affect the business enterprise development, so as to promote the sustainable development of enterprises. Meanwhile, there are many factors that may affect enterprises' technological innovation performance, strategic flexibility and information collaboration are just two of them. The paper also attempts to analyze how they affect innovation performance from these two unique perspectives. In future studies, we should also consider more factors, the first is the impact of corporate culture. Corporate culture in different regions may have different impact on corporate strategy and technology innovation. Besides, in the relationship of strategic flexibility, information synergy and technology innovation performance, maybe there are other potential mediating variables influencing the process of technology innovation. Thus, this issue remains to be done further research in the future.

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