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The impact of a firm's internal control mechanisms on the choice of innovation mode

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Abstract A firm's internal control mechanisms may have a significant influence on the choice of innovation mode. Therefore, based on the research on the internal control mechanisms of companies, we developed a model to explore the relationship between a firm's internal control mechanisms and the choice of innovation mode. Using a sample of 585 Chinese firms, this study tests the proposed model. Results show that strategic control has a positive relationship with radical innovation, but a negative relationship with incremental innovation, while financial control has a negative relationship with radical innovation, but a positive relationship with incremental innovation.

Keywords strategic control, financial control, radical innovation, incremental innovation

1 Introduction

In a dynamic environment, a firm is inevitably confronted with a lot of uncertainties in the process of making and executing innovation decisions. The risks of innovation are directly related to the degree of novelty in the innovation.

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The success of an innovation requires the firm to carry out an effective control over the risks through regular checking, modifying and optimizing the innovation project. Although the management of static risks has become one of the critical components of a firm's management systems, and firms have rich experiences in handling financial risks and ratio conversion risks, they have not worked out effective approaches to manage the risks of innovation. It is believed that the firm that can choose an effective control mechanism to reduce the risks of innovation will gain competitive advantages. Therefore, how to choose an effective control mechanism to reduce the risks of innovation is not only a new interest for researchers, but also a critical problem in a firm's management.

So far, there is little research on the relationship between a firm's internal control mechanisms and the choice of innovation mode. Hitt et al. (1996) found that strategic control is positively related to internal innovation and financial control is positively related to external innovation. Radical innovation runs more risks than incremental innovation does, and the firm is likely to choose different control mechanisms in line with its capability of handling risks. Therefore, a firm's internal control mechanisms will have different influence on its choice of innovation mode between radical innovation and incremental innovation. Unfortunately, the influence of a firm's internal control mechanisms on the choice of the mode of innovation has been ignored. This is undesirable for firms to reduce the risks of innovation and further benefit from their innovation. To fill this gap, we develop a model to explore the relationship between a firm's internal control mechanisms and the choice of innovation mode.

2 Concepts and hypothesis development

2.1 Radical innovation and incremental innovation

Innovations are technical inventions and discoveries by innovators, containing all kinds of activities to transform production factors and technologies and to ensure that the transformation leads to business success (Li, 1994). Innovation is characterized by regularity, subjectivity, risk, continuity, periodical progression and novelty (Li, 1994). It varies in degree of the change of technology, risk and periodicity. Based on the degree of technology change, innovation can be categorized into radical innovation and incremental innovation.

Radical innovation refers to the innovation that results in fundamental or obvious changes in input, output and the process of manufacturing (Hage, 1980). Radical innovation will change the structure of an industry and replace an old industry (e.g., vacuum tube) with an entirely new one (e.g., micro-electronics). Meanwhile, the risks of radical innovation are greater than those of incremental innovation. Apparently, the management of radical innovation differs enormously

from that of incremental innovation. It requires a long-time and thorough strategic planning, huge investment in research and development (R&D), a practical plan and an effective management (Xu, 1989).

Incremental innovation is the innovation that brings about gradual and continual improvement in technology. Although the benefit of incremental innovation in a short time is not obvious, the outcomes of incremental innovations in the long term are huge. Moreover, incremental innovation can strengthen an enterprise's production and technology, consolidate the ties among enterprises, customers and markets, and maintain its competitive advantage. Finally, incremental innovation will produce outstanding effects through continual perfection of the organization and the improvement of management. The risks of incremental innovation are small.

2.2 Financial control and strategic control

As one of the basic functions of management, control is a process of regulation where the essential elements of a system are predictable through the standards established in the process of achieving a goal (Leifer and Mills, 1996). Based on the information held by the managers, control can regulate the operations of an organization according to the standards. It is further employed to routinize the behaviors of an enterprise and facilitate activities such as learning, undertaking of risks and innovation (Das and Teng, 1998). In this study, we will focus on two internal control mechanisms—financial control and strategic control.

Hoskisson and Hitt (1988) argued that two types of major internal controls associated with the management of firms have an important effect on firm innovation: strategic control and financial control. Strategic control is competition- and benefit-oriented. A benefit-oriented competition places more emphasis on the sustaining of innovation and the long-term performance (Hitt et al., 1996). Strategic control emphasizes largely subjective and sometimes intuitive criteria for evaluation. The judgment of strategic control is not based upon the objective financial indices, but on the indices closely related to the purpose—the satisfaction of customers, the number of patents, and the introduction of new products and manufacturing processes within a specific period, and the standards of quality control (Hoskisson and Hitt, 1988). The use of strategic controls requires that corporate managers have a deep understanding of business-level operations. Such controls also require a rich information exchange between corporate and divisional managers (Hoskisson, Hitt and Ireland, 1994).

Alternatively, financial control entails objective criteria such as return on investment (ROI) in the evaluation of business-level managers' performance (Hitt et al., 1996). They are similar to outcome controls. While keeping in sight business returns and its intervals as well as the accrument of capital, the examination of

financial control is conducted in line with the objective indices, including net income, capital returns and profit ratio of marketing (Hitt et al., 1990), much in the manner of result control (Hitt et al., 1996). Since financial control is aimed at the final outcome, an enterprise has to make sure that it is able to achieve its short-term goals. Thus, top managers establish financial targets for each business and measure the business-level managers' performance according to those targets.

2.3 Relationships between financial control and innovation mode

Financial control does not provide enough financial support for radical innovation. Financial control evaluates the performance of the managers based on financial index such as investment returns ratio. To achieve the short-term financial objective, the manager will reduce the long-term investment (Hayes and Aberbathy, 1980). Therefore, financial control might affect the investment in radical innovation. Much research (Hitt et al., 1996; Hoskisson et al., 1991) has found that financial control in M-organizations would compel the managers to pursue short-term benefits and avoid any risk by reducing the expenditures on R&D. In the 1970s, American enterprises that valued financial performance invested much less in R&D than their counterparts in other countries did, and those enterprises that based their awards on short-term financial performance endured a low number of radical innovations because of the limited expenditure on R&D.

Financial control encourages the top managers to set up different financial objectives for department managers whose performance is completely independent from the others'. Consequently, a department shares few, if any, of its resources with other departments, let alone cooperates with others (Goold and Campbell, 1987). Therefore, financial control is likely to bring problems when departments are highly dependent on each other. On the contrary, radical innovation needs the sharing of resources and risks between departments (Dewar and Jane, 1986). As a result, financial control does not facilitate radical innovation.

Financial control is unfavorable to innovations with great risks. If the compensations and other awards such as promotion are tied with short-term performance, the staff will do their best to realize such objectives (Hoskisson, Hitt and Hill, 1991). Therefore, it is obvious that the staff will be risk-averse, which will go against radical innovation. To reduce the potential losses and the negative effects of innovation, the firm is reluctant to choose an innovation with higher risk. Instead, it will embark on incremental innovation, which requires small changes in resource allocation. Meanwhile, radical innovation requires a longer time and more investment, and it needs a long time to show its benefits. However,

the tenure of the manager is not long enough for them to wait for the award produced through radical innovation. Hence, financial control is not conducive to radical innovation. Based on the above analysis, we propose:

Hypothesis 1: financial control is negatively related to radical innovation.

Financial control is conducive to incremental innovation. As an outcome control, it requires relative independence on the part of each department. With the least interference in departmental affairs, the top managers are only responsible for the evaluation of the staff in line with financial indices. In such circumstance, to promote short-term financial achievements, incremental innovation is preferable for its small scale, low risk and immediate returns.

Financial control is capable of creating a favorable environment for incremental innovation. As the market changes rapidly, the firm has to carry out innovation to achieve competitive advantage. A financial performance-oriented control system creates much pressure, which forces an enterprise to take a practical approach in its management when time and/or budget limit must be taken into consideration (Marginson, 2002). A long-term innovation leads to more uncertainties, particularly in terms of income, so financial control encourages an enterprise to speed up its innovation to avoid the risks of innovation and reduce its losses. It is justified to conclude that incremental innovation satisfies an enterprise's demand for rapid progress in innovation. So we suggest that:

Hypothesis 2: financial control is positively related to incremental innovation.

2.4 Relationships between strategic control and innovation mode

Strategic control provides a more friendly environment for radical innovation. Strategic control is committed to development instead of evaluation, which allows the supervisors to make subjective judgment of performance with qualitative and quantitative indices. In other words, strategic control is designed to promote long-term performance and develop essential business activities by varied incentives to encourage innovations (Goold and Campbell, 1987; Hoskisson et al., 1991). Since strategic control focuses on an enterprise's strategic behaviors rather than its immediate outcome (Chandler, 1991), it is very critical for radical innovation, which requires a longer time to show its returns and face a lot of impediments and risks (Dewar & Jane, 1986). Therefore, strategic control is helpful for the firm to create a favorable atmosphere for innovation (Drucker, 1985; Kanter, 1989), and strategic control can encourage the staff to engage in a time-consuming, slow return but important innovation (Goold and Campbell, 1987; Hoskisson et al., 1991). Strategic control is conducive to the establishment of a system by which an enterprise can share its risks with all of its departments. This system can reduce the risks of radical innovation. If an enterprise adopts financial control, it cannot stand to allow its cash to flow out without any benefit for a long time, which is quite normal with radical innovation.

Since the evaluation of departmental managers in the case of strategic control is conducted on the top leaders' subjectivity or even intuition, the top leaders must be distinguished in macro-control capability and well informed of the managerial behaviors and the operation of business and market situation on different levels. Meanwhile, managers are required to make frequent communications with their subordinates (Hoskisson et al., 1994). Accordingly, with their knowledge of the strategic behaviors being understood, evaluated and awarded in line with their excellence rather than short-term financial performance, departmental managers are willing to take on risky projects (Hitt et al., 1996), and motivate their subordinates to be innovative and seize all opportunities. In contrast, incremental innovation could not win the favor of an enterprise that is bent on strategic control, for it fails to produce prominent effects on the long-term development of an enterprise, especially its pivotal business operation. Therefore, we suggest:

Hypothesis 3: strategic control is positively related to radical innovation.

Hypothesis 4: strategic control is negatively related to incremental innovation.

3 Methods

3.1 Sample and data collection

To test the hypotheses of the study, the questionnaire survey research method was used to seek responses from some typical firms in China. The samples contain state-owned enterprises, private enterprises, and foreign-invested enterprises in Shaanxi, Henan, Shanghai, Guangdong, Liaoning, Sichuan, Shandong and Shanxi provinces. To achieve an overall view of the enterprises in China, the following principles are considered for selecting the samples: (1) enterprises in the same industry should be no more than 15%; (2) enterprises of different scales should be in equal proportion; (3) private enterprises, state-owned enterprises and limited liability corporations should account for 20–30%, 35% and 40–45%, respectively; (4) enterprises with histories of no more than 5 years, above 10 years and above 20 years, should account for less than 10%, over 50%, and over 15%, respectively; (5) the questionnaire is answered under the guidance of the investigator; (6) the collected questionnaire with less than 95% of its content answered is invalid; (7) the questionnaire must be filled out on the first thought; and (8) the collected questionnaires whose 70% of answers are identical are invalid.

A total of 850 enterprises were approached, 607 copies were collected, and 585 firms provided the full data. The return rate was 71.41% (607 out of 850), and the effective response rate was 96.38% (585 out of 607), which is quite high, given that the surveys were completed by CEOs or their designees whose time is often

scarce. First, we developed a questionnaire following several previous studies and modified it according to the actual conditions that firms face in China through consulting extensively with executives of firms. Using a preliminary draft questionnaire, a pilot test was conducted with five enterprises in each province, whose responses were excluded from the final study. The questionnaire was revised using the feedback from the pilot study.

To discover the potential deviations of the ordinary method, we collect the data of different periods to ensure the reliability of the survey search. During an interval of more than one year, 303 copies of questionnaires similar in content were provided to the same person in the same enterprise. Analyses have disclosed that in two different periods, the indices of those questionnaires are closely related to each other, with the significance level below 0.05 (the Pearson correlation coefficient: 0.362–0.792). To further verify the representativeness of our sample, we compared the sample's firm size, ownership status and sales with those of the national population using information from the China Statistical Yearbook. None of the t-statistics were significant, suggesting no significant difference between our sample and the national population. We also compared the data from the 40 respondents in our pilot study with those in our final sample to check the accuracy of their responses, and none of the t-statistics were found significant.

3.2 Variables and measures

3.2.1 Radical innovation and incremental innovation

Following the research of Dewar and Jane (1986), radical innovation is measured by a seven-point Likert scale, from 1 (lowest) to 7 (highest), with four items: (1) the creation and marketing of products with completely new functions; (2) the introduction of new concepts in developing products; (3) the introduction and development of completely new technology; and (4) the development of new manufacturing process and technology (see Table 1). The coefficient alpha for this scale was 0.74. Incremental innovation is measured by three dimensions: (1) the creation and marketing of products either new in form or service; (2) the improvement of the technology in use; (3) the improvement and innovation of the manufacturing process in use (see Table 1). The coefficient alpha for this scale was 0.66.

3.2.2 Financial control and strategic control

The financial control factor was composed of four items modified from a scale reported in Hill and colleagues (1992). These items assessed the importance of financial control measures and procedures in evaluating divisional managers'

Table 1 Results of chief variables rating

Variables	Items	Loading	Certainty factors
Radical innovation	(1) Creation and marketing of products with completely new functions;	(1) 0.741	0.74
	(2) Introduction of new concepts in developing products;	(2) 0.736	
	(3) Introduction and development of completely new technology;	(3) 0.760	
	(4) Development of new manufacturing process and technology.	(4) 0.746	
Incremental innovation	(1) Creation and marketing of products either in new form or service;	(1) 0.635	0.66
	(2) Improvement of the technology in use;	(2) 0.845	
	(3) Improvement and innovation of the manufacturing process in use.	(3) 0.831	
Financial control	(1) Realization of financial objectives;	(1) 0.738	0.78
	(2) Rapid growth of the company;	(2) 0.782	
	(3) Optimizing shareholders' interests;	(3) 0.672	
	(4) Enhancing short-term competitive capability.	(4) 0.785	
Strategic control	(1) Sharing information of competitors' strategies;	(1) 0.830	0.72
	(2) Regular discussions among managers about the strengths and strategies of competitors;	(2) 0.852	
	(3) Information exchange between managers and employees about competitors.	(3) 0.820	

performance on a seven-point Likert scale. The four items were: (1) the realization of financial objectives; (2) the rapid growth of the enterprise; (3) the optimization of shareholders' interests; and (4) the enhancement of short-term competition (see Table 1). The coefficient alpha for this scale was 0.78. Following the research of Hitt et al. (1996), we measured strategic controls used by top management to process external and internal information in order to evaluate business unit strategy and allocate resources using survey items. These items indicate the emphasis on using strategic controls in evaluating division managers' strategies and performance on a seven-point Likert scale. The strategic control variable is composed of three survey items: (1) the sharing of information about the competitors; (2) the discussion of the strengths and strategies of the competitors; and (3) the exchange of information about the competitors between managers and the working staff (see Table 1). The coefficient alpha for this scale was 0.72.

3.2.3 Control variables

Firm size has been shown to influence both R&D expenditures (Baysinger and Hoskisson, 1989) and product innovation (Chaney and Devinney, 1992;

Chaney, Devinney, and Winer, 1991). Much research has found that firm size has an influence on the choice of the innovation mode (e.g., Dewar and Jane, 1986), so we chose firm size as a control variable.

4 Analysis and result

Using the software Amos4.0, this study calculates the path coefficient and explains the covariance while solving the coupled equations to incorporate the four hypotheses into a structural equation model. Such model helps evaluate multi-relations and correlations, brings out implicit relations within the model, and explains in the course of evaluation the rating errors. The ultimate goal of this study will be reached if the model advanced is proved to be workable.

The result of the analysis is shown in Table 2. The result suggests that financial control has a negative correlation with radical innovation ($\beta = -0.264$, $p < 0.05$), but positive relationship with incremental innovation ($\beta = 0.442$, $p < 0.05$), supporting Hypotheses 1 and 2; and strategic control has a positive correlation with radical innovation ($\beta = 0.205$, $p < 0.05$), but a negative correlation with incremental innovation ($\beta = -0.337$, $p < 0.05$), supporting Hypotheses 3 and 4.

Table 2 Result of analysis

	Hypotheses			COEF	P	Results
H1	Financial control	→	Radical innovation	-0.264	0.023	Supported
H2	Financial control	→	Incremental innovation	0.442	0.040	Supported
H3	Strategic control	→	Radical innovation	0.205	0.042	Supported
H4	Strategic control	→	Incremental innovation	-0.337	0.042	Supported

5 Discussion

The conclusion that strategic control has a positive correlation with radical innovation, but a negative correlation with incremental innovation; and that financial control has a negative correlation with radical innovation, but a positive correlation with incremental innovation, has successfully furthered the study of Hitt et al. (1996). Strategic control can facilitate a firm's innovation through long-term evaluation of non-financial performance, risk-sharing mechanism and innovation incentives; and financial control is more favorable for innovation with the efforts of enhancing short-term financial performance and reducing innovation risks. While Hitt et al. (1996) have offered an analysis of the relationships between financial control and external innovation, and strategic control and internal innovation, this study has gone further by studying the relationships between

financial control and incremental innovation, and strategic control and radical innovation. In fact, the majority of enterprises have adopted varied control mechanisms, which are different from each other in importance—some playing a major role while others a minor one. Strategic control and financial control are not necessarily mutually repulsive; instead they could enjoy a peaceful coexistence in the same enterprise. All this brings out the significance of this study in examining their influences over innovation.

The conclusion of this study offers a new perspective for an enterprise to manage risks in the course of innovation. It shows that strategic control is conducive to radical innovation, while financial control to incremental innovation. It is advisable that further studies should take advantage of the findings of static risk management research—experiences in managing financial risks and conversion ratio risks—for innovation risks management. Besides, strategic control should be taken to facilitate radical innovation by creating a favorable environment, while financial control to facilitate incremental innovation by avoiding possible risks. Financial control in the case of radical innovation would turn out to be short-sighted and spoil the effort, and strategic control in the case of incremental innovation would result in loose management, leaving the objectives of both innovation and short-term project untouched.

Furthermore, the introduction of control mechanisms into the discussion of an enterprise's innovation contributes to deepening the research of Marginson's (2002). He suggested that control mechanisms exert an overwhelming influence on innovation, and that it enables an enterprise to establish a control system to ensure the achievement of a preset objective through strategic control. This study provided a strong support for Marginson's theory. Further, the conclusion of this study has offered not only a new insight into an enterprise's innovation efforts, but also different choices to control innovation risks to ensure the realization of innovation.

6 Conclusion

As shown above, a firm's internal control mechanisms and innovation are related, the requirements of each innovation could be satisfied with a different control mechanism. Based on the samples and data from eight provinces, this study proved that strategic control has a positive correlation with radical innovation, but a negative correlation with incremental innovation; while financial control has a negative correlation with radical innovation, but a positive correlation with incremental innovation.

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