



Vertical integration and innovative performance: The effects of external knowledge sourcing modes

Hsiu-Ling Li*, Ming-Je Tang

Department of International Business, National Taiwan University, Taipei 106, Taiwan

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ABSTRACT

We set out in this study to analyze the impact of vertical integration on the innovative performance of a firm and to explore the interaction between vertical integration and different modes of external knowledge sourcing. Our empirical results reveal an initial increase in the effect of vertical integration on innovative performance up to a certain level of integration, although this is subsequently followed by a decline; that is, the relationship is characterized by an inverted U-shape. The results further reveal that external knowledge sourcing is positively related to the innovative performance of a firm, albeit with a negative interaction with the level of vertical integration. In other words, firms with higher levels of vertical integration may be faced with barriers to the acquisition of external knowledge. Our findings suggest that firms should be cautious in their pursuit of a strategy of vertical integration, given the non-monotonic impact on innovative performance, whilst an increase in the level of vertical integration is also likely to diminish the effectiveness of the external knowledge sourcing.

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1. Introduction

An area of particular interest in the field of strategic management is the analysis of the underlying reasons for the differences in the investment choices made by firms and their subsequent performance (Rumelt et al., 1994). In their pursuit of the answers to this extremely intriguing issue, many researchers have attempted to provide empirical evidence on whether the allocation of resources is affected by firm boundaries (Mullainathan and Scharfstein, 2001), or whether the firms' investment decisions may be affected by its organizational form (Ciliberto, 2006). Despite the widespread consensus on the importance of the decision by a firm to pursue vertical integration, it remains unclear as to whether, or the way in which, these vertical boundary decisions affect the various dimensions of firm performance (Harrigan, 1985a; Martin, 1986; D'Aveni and Ravenscraft, 1994; Leiblein et al., 2002).

The empirical evidence in the prior studies is rather mixed, with some studies suggesting that a strategy of vertical integration does not induce performance differentials (Reed and Fronmueller, 1990), some reporting that vertical mergers have a negative impact on profits due to the failure of such mergers to create differential advantages for the integrated firm (Bhuyan, 2002), and some noting that whilst vertical integration is

associated with lower transaction and overhead costs, this is nevertheless accompanied by higher production costs (D'Aveni and Ravenscraft, 1994).

Peyrefitte et al. (2002) argue that a better understanding of the relationship between vertical integration and performance may be achieved by considering the role of managerial capabilities in directing such integration; they note that a lack of understanding of non-core businesses as well as a lack of the necessary managerial approach to the management of the activities being integrated both contribute to inferior performance. From an examination of the issue of costs after firms changed their vertical integration strategies, Mpyoi and Bullington (2004) found that such strategic changes significantly reduced production costs, although these changes did not affect inventory costs. Thus, the relationship between vertical integration and performance remains both inconclusive and unpredictable.

As a result of this rather ambiguous relationship between vertical integration and performance, the extant empirical literature has tended to focus mainly on issues relating to economic or financial performance. However, faced with such a rapidly changing environment and advancing technology, innovation has clearly become a prerequisite for any firm hoping to develop or maintain its competitive advantage. Thus, some of the more recent studies have begun to focus more on firm performance through the measurement of innovative capability.

Although the benefits and costs of vertical integration have been debated for several decades, few studies have gone on to link a firm's vertical integration strategy with technological

* Corresponding author. Tel.: +866 2 29731820; fax: +886 2 29759375.
E-mail address: d91724008@ntu.edu.tw (H.-L. Li).

innovation. Armour and Teece (1980) argue that vertical integration and R&D expenditure are positively correlated, suggesting that vertical integration can facilitate the transfer of technical information, and that when complex inter-stage interdependencies are involved, this can also facilitate the implementation of new processes or the introduction of new products.

Amongst the more recent studies, Jacobides and Winter (2005) argue that the scope of a firm is related to the process of capability development, whilst Macher (2006) undertakes a comparative analysis of the ways in which firms efficiently organize themselves to solve different types of problems relating to technological development. These studies highlight a very interesting and potential direction for further study aimed at clarifying the relationship between vertical integration and the innovative performance of a firm.

The need for flexibility in organizational capabilities has also emerged as a critical issue with regard to firm boundaries and the choices made by a firm between internal and external knowledge integration (Grant, 1996a), particularly in conditions of dynamically competitive markets. In such cases, the optimal growth of the firm involves a fine balance between the exploitation of existing resources and the development of new resources and capabilities (Penrose, 1959; Wernerfelt and Montgomery, 1988).

Firms are thus forced to search for external sources of knowledge in order to diversify their research portfolios and to broaden their knowledge base. Any increase in the technological diversification of a firm can promote the cross-fertilization between different areas of technological expertise whilst simultaneously reducing the lock-in effect in those technologies with low profitability (Garcia-Vega, 2006). This thereby highlights the importance of external knowledge sourcing with regard to the development of the innovative capability of a firm.

However, we still know relatively little about whether, or the ways in which, organizational structure interacts with the external knowledge sourcing modes with regard to determining the innovative performance of a firm. As noted earlier, vertical integration is likely to influence the potential returns to R&D investment, which determines the firm's absorptive capacity, and which in turn influences the effectiveness of external knowledge sourcing. We therefore set out in this study to explore the ways in which the innovative performance of a firm interacts with its vertically-integrated structure and its external knowledge sourcing modes.

Using the 'quality of innovation output' and the 'technological scope' of a firm as the intermediate measures of innovative performance, the main contribution made by the present study is its clarification of the relationship between the level of vertical integration and the innovative performance of a firm. We also provide some contribution to the literature on organizational learning. Vertical integration and external knowledge sourcing modes are beneficial for firms with regard to enhancing their level of innovativeness; however, it should be noted that for firms with higher levels of vertical integration, a negative correlation is found in the interplay between vertical integration, external knowledge sourcing modes and innovative performance.

The remainder of this paper is organized as follows. Section 2 provides a brief review of the extant literature on vertical integration and technological innovation and discusses the relationship between vertical integration and innovative performance; the role of external knowledge sourcing and its impact on the relationship between vertical integration and innovative performance is also discussed in this section. Section 3 provides information on the data and methodology used to test our hypotheses, as well as our data analysis, with the results subsequently being presented in Section 4. Section 5 provides a discussion of our results, as well as a review of the limitations and

recommendations for future research. Section 6 provides the conclusions drawn from this study.

2. Theoretical background and hypotheses

From a resource-based perspective, both vertical integration and diversification can be viewed as ways of capturing rents on scarce, firm-specific assets (that is, services which are difficult to sell in intermediate markets) (Penrose, 1959; Wernerfelt, 1984; Teece, 1986; Williamson, 1991) and of developing new capabilities (Wernerfelt, 1984). Although firm performance is measured in many of the prior studies by observing the innovative capability of a firm, the relationship between a strategy of vertical integration and innovative performance has still to be broadly discussed; thus, as noted above, the findings remain inconclusive. The present study sets out to clarify the relationship between vertical integration and a firm's innovative performance in order to fill this gap. We also examine the ways in which vertical integration interacts with external knowledge sourcing modes in determining a firm's innovative performance.

2.1. Vertical integration and innovative performance

From a knowledge-based perspective, the development of new knowledge by firms, a process that is clearly vital to their sustainable competitive advantage, arises from unique combinations of existing knowledge (Nelson and Winter, 1982; Fleming, 2001). It is argued in some studies that when complex interdependencies are involved, vertical integration can enhance technological innovation through the sharing of technological information common to the separate stages of the development of an industry; this can be achieved by facilitating the implementation of new technologies and through the formulation of more astute research objectives (Armour and Teece, 1980; Monteverde, 1995). Vertically-integrated firms with many of relevant complementary assets under control (Teece, 1986) would have better opportunities for internal application of knowledge generated by R&D and then facilitate appropriability of R&D (Kumar and Saqib, 1996).

Chesbrough and Teece (1996) offer a case for retaining new technologies in-house, since vertically-integrated firms have established processes for settling conflicts and coordinating their innovation activities; in other words, vertical integration facilitates systemic innovations by facilitating information flows and the coordination of investment plans (Teece, 1996). Afuah (2001) also suggests that in the early days of a new technology, a 'make' decision is better than a 'buy' decision, essentially because the firm's communication channels are the key to the success of the innovation.

In more specific terms, due to the lock-in effect on downstream firms arising from vertical integration, and since such vertical integration increases the expected value of the firm's R&D activities because of better appropriability (Kumar and Saqib, 1996), upstream firms will tend to be more innovative, thereby raising the likelihood of attracting other downstream firms (Brocas, 2003). As such, vertical integration, which serves as an internal mechanism for knowledge transfer and integration, is positively related to innovation. In contrast, however, in one particular earlier study, it was demonstrated that a high degree of vertical integration raises the height of a firm's exit barriers and also gives rise to greater inflexibility (Harrigan, 1980).

According to Abernathy and Wayne (1974), the "relentless pursuit of learning curve economies", with the attendant vertical integration implications, has a negative effect on technological innovation. The areas covered by a firm's core competences are

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