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# The Locus of Innovation: A Literature Review

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**Abstract**

The most commonly asked question in the research of innovation is: what type of firms can innovate more productively, startups or established firms? A related question is: does the nature of innovation affect the comparative advantages of startups versus established firms? This paper reviews the literature on the locus of innovation from multiple perspectives, including explanations based on organizational capabilities, incentives and agency costs, transaction cost economics, and property rights theory. It seeks to provide an integrative view of the comparative advantages of startups versus established firms when handling innovation. Prior research on the locus of innovation has significant implications not only for the theory of innovation, but also for the theory of the firm. Most notably, integration is primarily motivated by coordination benefits and improved incentives for investment in non-human assets (Williamson, 1985; Grossman & Hart, 1986; and Hart & Moore, 1990). However, integration suffers from weaker incentives to invest in human assets (Holmstrom, 1989).

**Keywords:** innovation, organizational capabilities, agency costs, incentives, transaction cost economics, property rights theory.

## I. INTRODUCTION

A central issue in the research of innovation is its locus. The most commonly asked question is: what type of firms can innovate more productively, startups or established firms? The second question is: does the nature of innovation affect the comparative advantages of startups versus established firms?

Schumpeter (1942) argued that new technologies create market opportunities while simultaneously damaging or destroying demand in many existing markets. Moreover, incumbent firms often experience great difficulty adapting to the changes brought about by a new technology. When confronted with a technological discontinuity, incumbent firms often succumb to internal inertia and suffer years of severe financial dislocation, or even go out of business (Foster, 1986; Rothaermel & Hill, 2005).

Holmstrom (1989) argues that small firms have been responsible for a disproportionate share of significant innovations in the past. Similarly, Zenger and Lazzarini (2004) argue that small firms are more efficient at innovation, particularly radical forms of innovation (Scherer, 1965; Kamien & Schwartz, 1982). Henderson (1993) shows that as neoclassical theory predicts, established firms invested more than entrants in incremental innovation, but that in agreement with organizational theory, the research efforts of incumbents seeking to exploit radical innovation were significantly less productive than those of entrants.

However, the above statements are far from indisputable. Schumpeter initially suggested that small, entrepreneurial firms were likely to be the source of most innovation (Schumpeter, 1934), but he subsequently claimed that large established firms possessing some degree of monopoly power were likely to be the driving force behind

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technical progress (Schumpeter, 1950). He suggested that their superior access to capital and skilled labor, in combination with their ability to effectively appropriate innovation, gave them considerable advantages over small firms and new entrants (Henderson, 1993).

Subsequent research in this field has had contradictory or fragile results. Cross-sectional studies of the relationship between firm size, market power, and innovative activity have in general found no systematic relationship (Baldwin & Scott, 1987; Cohen & Levin, 1989), and theoretical work in the area has been similarly inconclusive, generating results that are extraordinarily sensitive to the core assumptions of the model employed (Henderson, 1993).

## II. EXPLANATIONS OF THE LOCUS OF INNOVATION

Various economists and organizational theorists have attempted to explain the locus of innovation from different perspectives, among which the most prominent ones are reviewed in this section.

### 2.1. Organizational Capabilities

Argyres & Liebeskind (2002) study the persistent fragmentation of the biotechnology industry. They find that one approach that has been used to explain the differential organizational costs associated with undertaking new activities is based on the idea that organizations are heterogeneous in their capabilities, including their capabilities for conducting research (e.g., Arrow, 1974; Nelson & Winter, 1982; Henderson, 1993; and Kogut & Zander, 1996). According to this view, the fragmentation of the biotechnology industry may be explained by the fact that large incumbent pharmaceutical firms may possess organizational routines and communication channels that are ill suited to the requirements of biotechnology research (e.g., Gambardella, 1995).

Similarly, Henderson (1993) suggests that large established firms have an advantage over entrants in the pursuit of incremental innovation because incremental innovation builds upon their existing knowledge and capabilities, but these assets can simultaneously reduce substantially the effectiveness of their attempts to exploit radical innovation. Specifically, as Henderson (1993) explains, information is costly to acquire and use (Simon, 1955, 1959). Firms facing repetitive tasks develop assets that reduce this cost (Cyert & March, 1963). Arrow (1974) suggests that in stable environments, firms will rationally invest in "communication channels" and "information filters" that reduce the cost of processing routine information. Nelson and Winter (1982) suggest that firms develop "routines" or "procedures" in response to their experience, and these codify the knowledge of the firm. Similarly, contingency theorists such as Burns and Stalker (1966), Galbraith (1973), and Daft (1982) have suggested that large firms in stable environments develop "mechanistic" organizational structures that enable them to cope quickly and effectively with their environment.

As Henderson (1993) explains, the organizational procedures and routines and the information filters that guide the established organization allow it to exploit incremental innovation faster and more effectively than is possible for entrants or for less-experienced firms. The same assets, however, may significantly reduce the research productivity of established firms attempting to exploit innovation that is "radical" in the sense of "competence destroying." The information filters and organizational procedures and routines that have developed through the firm's experience with a sequence of incremental innovations founded upon quite different scientific or technological principles become partially obsolete. If this obsolescence goes

unrecognized, or if the costs of developing a more appropriate set of assets are greater than the costs of using an existing set, then the research productivity of established firms pursuing radical innovation will be significantly lower than that of entrants (Burns & Stalker, 1966; Clark & Fujimoto, 1991). Henderson (1993) has found support for this argument. For example, Arrow (1974) suggests that established firms may continue to use existing information-processing assets, despite their lower efficiency, because the cost of developing a new set is greater than the penalties of using less-efficient assets. Thus Arrow's work suggests that incumbent productivity may be lower than entrant productivity for any particular project, but that the incumbent will avoid the setup costs incurred by new entrants. Nelson and Winter (1982) and a number of the organizational theorists, in contrast, have suggested that incumbents continue to use unsuitable information-processing assets because organizational change is difficult to effect and very risky (Hannan & Freeman, 1984).

Zenger & Lazzarini (2004) argue that large firms often have sizable investments in existing technology. New technological or radical innovation may cannibalize these existing investments and, thus, dampen incentives to innovate (Foster, 1986). By contrast, upstart small firms with no significant presence in the industry do not face such a tradeoff.

### 2.2. Incentives and Agency Costs

As firms carrying out innovative projects are among the most human capital intensive organizations in an economy, incentives naturally play a prominent role in motiving key personnel.

Incentives and agency costs are inseparable. Holmstrom (1989) argues that agency costs associated with innovation are likely to be high. Milgrom and Roberts (1988, 1990) argue that differentiation efforts fail because some internal parties in a firm will persistently seek to influence top management to favor their own interests, at the expense of other internal parties whose interests differ from their own. Argyres and Liebeskind (2002) predict that influence activity will be observed predominantly when a new activity threatens a firm's outstanding contractual commitments. They further argue that to the degree that a new business venture's governance arrangements will dilute or abrogate a firm's commitments to its managers and/or workers, the latter will act to protect their interests by either stifling the new venture altogether, or by forcing it to conform its governance arrangements to those that govern the other activities of the firm.

Holmstrom (1989) argues that subjective monitoring would be particularly valuable for innovation, since success is so uncertain. Exceptional tolerance for failure is essential. But such performance cannot be checked by conformance to organizational rules or by evaluation reports that can be readily substantiated. Therefore, the integrity of subjective evaluations of performance in an organization is a function of the monitor's incentives. Consequently, monitoring limitations suggest that the firm seeks out activities which are more easily and objectively evaluated. Assignments will be chosen in a fashion that are conducive to more effective control. Eventually the internal labor market in hierarchies will be pushed towards bureaucratic manners as a rational response to monitoring and influence problems. All these are barriers to innovation, especially the radical type.

Holmstrom (1989) further points out that agency problems derived from the pressure in the capital market also play a role in reducing an established firm's motivation to pursue radically innovative ventures. He argues that a concern for

reputation in the capital market will lead a large firm to act more cautiously in taking risks.

Williamson (1985) argues that low-powered incentives come to replace high-powered incentives upon integration. He explains that corporate management cannot sustain high-powered incentives for a venture internal to the firm, because venture managers know that corporate management can always abrogate those incentives in the future and may do so if it becomes in its economic interest. As a result, those ventures often fail or never initiated. He further argues that incentives within firms become increasingly attenuated as the size of a firm increases. Consequently, beyond a certain size, the costs of incentive attenuation within a firm will outweigh the benefits of hierarchical governance.

Manso (2011) argues that incentive schemes that motivate innovation should be structured differently from standard pay-for-performance schemes used to induce effort or avoid tunneling. Standard pay-for-performance schemes that punish failures with low rewards and termination may in fact have adverse effects on innovation. In contrast, the optimal incentive scheme that motivates innovation exhibits substantial tolerance (or even reward) for early failure and reward for long-term success. He further argues that under this incentive scheme, compensation depends not only on total performance, but also on the path of performance; an agent who performs well initially but poorly later earns less than an agent who performs poorly initially but well later or even an agent who performs poorly repeatedly. In a similar vein, Argyres and Liebeskind (2002) argue that for new ventures to succeed, a new set of organizational arrangements will typically be desirable, because the arrangements in place of an established firm are ordinarily not well suited to innovative activity. For instance, a new venture may need to reward its employees differently because the firm's existing arrangements would be inefficient—from an incentive point of view—for the new venture's progress.

Zenger and Lazzarini (2004) offer an explanation that small firms enjoy advantages over large firms in crafting effective, incentive-intensive employment contracts that spur innovation (Kamien & Schwartz, 1982; Holmstrom, 1989; and Zenger, 1994). Specifically, small firms are able to offer higher-powered incentives merely by rewarding individuals for firm performance. Relative to large firms, fewer individuals and subunits influence the performance of R&D in small firms. More aggressive performance-based contracts offer higher expected return relative to contracts that pay a fixed amount reflecting some average level of performance. Therefore, firms competing for top talent confront strong pressure to escalate incentive intensity in order to lure top talent from those firms that more weakly reward performance (Zenger & Lazzarini, 2004).

On the empirical side, as Argyres and Liebeskind (2002) point out, studies of internal business venturing reveal that established firms frequently fail in their efforts to establish new ventures (Hlavacek, 1974; Burgelman & Sayles, 1986). Lerner and Wulf (2007) find that more long-term incentives to the heads of research and development departments are associated with more heavily cited patents, which short-term incentives are unrelated to measures of innovation. Zenger and Lazzarini (2004) have discovered that previous empirical work largely outside R&D suggests that small firms possess distinct advantages in crafting powerful performance incentives; small firms more closely link pay and performance (Rasmusen & Zenger, 1990). These higher-powered incentives of smaller firms may motivate superior effort (Williamson, 1985;

Holmstrom, 1989), attract top talent (Hamberg, 1963), and lure valuable capabilities from competing firms (Zenger, 1994).

In order to motivate innovation, Holmstrom (1989) suggests that if one side has human or other non-transferrable assets that are instrumental to realizing the surplus, then that side should be given all assets. This is based on his argument that human capital is an asset that cannot be transferred and therefore incentives for effort may be significantly diluted by removing title to transferrable assets from those whose efforts are central to production. Manso (2011) suggests that commitment to a long-term compensation plan, job security, and timely feedback on performance are essential to promote innovation.

In a similar vein, Manso (2011) points out that the managerial short-termism literature also suggests that managers are biased toward short-term projects due to career concerns (Narayanan, 1985), takeover threats (Stein, 1988), concerns about near-term stock prices (Stein, 1989), the presence of noise traders (Shleifer & Vishny, 1990), and herding behavior (Zwiebel, 1995). In a survey of financial executives, Graham et al. (2005) find that the majority of managers would pass on a positive net present value (NPV) project to avoid missing the current quarter's consensus earnings forecast.

## III. IMPLICATIONS

Prior research on the locus of innovation has significant implications not only for the theory of innovation, but also for the theory of the firm. According to transaction cost economics and the property rights theory, integration is primarily motivated by coordination benefits and improved incentives for investment in non-human assets (Williamson, 1985; Grossman & Hart, 1986; and Hart & Moore, 1990). Holmstrom (1989) argues that large scale production and marketing activities are the main beneficiaries. Innovation, being a small scale activity initially at least, will not gain much by this argument. He further argues integration suffers from weaker incentives to invest in human assets. These are the incentives most essential for successful innovation.

Manso (2011) suggests that nurturing a corporate culture that allows freedom to experiment and tolerates failures is essential to motivate innovation among employees of large corporations. Farson and Keyes (2002) and Sutton (2002) provide several examples of innovative corporations, such as IBM and 3M, that adopt such a culture. However, the effectiveness of such a culture as well as other mechanisms in promoting innovation remains to be tested.

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