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Skills and innovation

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Abstract

This study examines the complementarity between employees' skills and firms' innovation activities. It is argued that without sufficient skills, firms benefit less from innovation, because they do not have the requisite complementary capabilities or absorptive capacity. Results from a panel of manufacturing firms provide support for the hypotheses that high technical skills are complementary with R&D collaboration and product or process innovation. Human capital can thus be seen as an enabling factor in profitable innovation. Policy implications suggest that investments in skills help expand the group of firms in the economy that have the potential to innovate successfully.

JEL classification: O12; O15; O31; O32; O33

Keywords: Innovation; R&D collaboration; Skills; Complementarities

1. Introduction

The view of innovation as the main engine of long-run economic development is widespread. The social returns to innovation can be enormous, yet at the level of individual firms it is not evident that the returns to innovation investments are always positive. Teece (1986) documented this phenomenon with case studies of product innovations. He suggested that profiting from innovation depends on access to complementary capabilities, especially in marketing and distribution, without which the

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innovative idea cannot be profitably commercialized. On the other hand, employees' skills are found to be a significant factor in innovation. Statistical evidence of the importance of human capital for innovation is provided by Mohnen and Röller (2001). In their study, lack of skills was the single most important innovation obstacle in a wide range of industries and countries.

Collaborative arrangements such as research joint ventures and strategic alliances have become an integral part of firms' innovative activities (e.g., Mowery, 1989; Hagedoorn and Schakenraad, 1992). Empirical studies have observed that, despite the proliferation of these arrangements, it is difficult to benefit from joint innovation projects (Harrigan, 1988; Kogut, 1989). Theories of research joint ventures, however, do not generate insight into what might be driving the high failure rates. This paper investigates the proposition that an important but neglected explanatory factor is firms' existing base of skills and knowledge. Skills are an important component of absorptive capacity (Cohen and Levinthal, 1989) and complement both internal and collaborative research and development (R&D).

The need for skilled employees is not limited to the R&D function. The current view of innovation emphasizes information exchange and participation in innovation processes by different units within firms, including marketing, manufacturing, research, and design and development (see, e.g., Rothwell et al., 1974; Kline and Rosenberg, 1986; Rothwell, 1994; Iansiti and Clark, 1994). Thus, the entire innovating organization benefits from a strong skill-base. This proposition is examined here using broad-based innovation survey data and the employment register of the Finnish manufacturing sector that enable an explicit analysis of the relationship between skills and innovation.

The idea of complementarities related to the nature of the firm is new in neither strategic management (the notion of "synergy") nor business history (e.g., Chandler, 1962). However, organizational complementarities have not been a focus of inquiry in the economic theory of the firm, until Milgrom and Roberts (1990; building on Topkis, 1978; see also Holmström and Milgrom, 1994) introduced the concept in organizational economics. While Milgrom and Roberts' original idea concerned modern manufacturing processes that are based on information technology, innovation literature can also be interpreted through the lens of organizational complementarities. Interaction and feedback processes among activities within the firm as well as between the firm's internal and external sources of knowledge are argued to be the basis for successful innovation (e.g., Rothwell et al., 1974; Levin et al., 1985; Cohen and Levinthal, 1989). In this Schumpeterian view, innovation complementarities stem from the need to combine different kinds of knowledge in the innovation process. Veugelers and Cassiman (1999) have explored the complementarity between internal and external R&D activities using similar survey data as in this paper. However, the advantage of the current study is that the dataset contains longitudinal information about the firm's objective function and control variables and thus enables accounting for unobserved heterogeneity which has been a problem in previous empirical studies of complementarities (see Athey and Stern, 1998; Miravete and Pernias, 2000).

Other empirical studies provide evidence that the accumulation of knowledge may be a source of considerable variation in firms' behavior and performance (e.g., Geroski et al., 1993; Henderson and Cockburn, 1996; Klette, 1996). According to Geroski et al. (1993), a firm's innovation record affects its profitability. They contend that a time-series of