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Firm size and appropriability of the results of innovation

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ABSTRACT

This article studies the influence of four dimensions of knowledge (codifiability, observability, complexity and dependency) on two types of appropriation methods: secrecy and other alternative methods (constant incremental improvements, lead time, moving down the learning curve and control of complementary resources) and how the firms' size modifies these relationships.
Based on a sample of 670 innovations developed by Spanish industrial firms, codifiability, observability and dependency were found to be the attributes that marks the effectiveness of both secrecy and the other alternative methods. Dependency marked the effectiveness of alternative methods in large companies and observability and codifiability in small firms.

Introduction

Firms' innovative potential depends on their ability to create new knowledge and disseminate it throughout their organization so as to introduce it into new processes, products and services (Nonaka and Takeuchi, 1995, p. 3). Firms that can make use of and develop their innovative potential gain a competitive edge over competitors. Retaining that advantage over the long term largely depends on their ability to protect their knowledge from imitators. However, it is a fact that firms often encounter great difficulty in establishing ownership rights in some of their technological knowledge (Geroski, 1995, p. 92).

Most of the technological knowledge embodied in innovations has two components: a private one, which exclusively benefits the company that has developed it and a public component, which is

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difficult to appropriate and which may benefit other players in the field (Dosi, 1988). The conditions of appropriation of technological knowledge determine the percentage of each of these components. Such conditions depend on a range of factors. Some are exogenous, such as the institutional framework, the legal system, the structure of the industry in which the firm competes and the attributes of the technological knowledge itself. Other factors, such as decisions made by firms as to which means of protection to use, are plainly endogenous.

Companies have different mechanisms to appropriate the results of their innovative activities (Geroski, 1995; Levin et al., 1987; Teece, 1987), such as patents and other legal protection mechanisms, industrial secrecy, carrying out continuous improvement, exploiting their technological lead, moving quickly down the learning curve, and the suitable exploitation of the complementary resources needed for their commercialization.

Among exogenous factors, those connected with the attributes of technological knowledge have become especially significant in recent years. Evolutionist economics (Nelson and Winter, 1982) and the resource-based approach (Barney, 1991) have stressed that technologies emerging from the innovation process significantly involve an important component of learning and accumulated knowledge. Conceiving the technology as knowledge allows for a view of firms as learning organisms that accumulate knowledge in their 'memory', transformed into day-to-day routines in their organization (Nelson and Winter, 1982, p. 99). On this perspective, it has been found that certain attributes of technological knowledge (codifiability, teachability, complexity, observability, system dependence) play a key role in the process of creation (Nonaka and Takeuchi, 1995; Spender, 1996), transfer (Cummings and Bing-Sheng, 2003; Roberts, 2000; Zander and Kogut, 1995) and diffusion of innovations (Rogers, 1983).

There is a dearth of studies on how these knowledge attributes (exogenous factors) might affect the innovation protection mechanisms that firms decide to use (endogenous factors). To what extent does the nature of the knowledge influence a firm's protection decisions? What means of protection are more useful for protecting the different modes of knowledge?

Many authors have included firm size in their business innovation-related models. However, no studies have tried to relate company size with the attributes that influence the effectiveness of secrecy or of the alternative methods of appropriability. In this paper we also pose the following questions: Are big and small companies conditioned by knowledge attributes in a similar manner? Does firm size affect the effectiveness of such mechanisms?

This work will propose some answers to these questions. For this purpose, the following section explores the relationships between certain knowledge attributes and the main means of protecting innovations that firms use and the relationship of these two variables with firm size. In the third section, we assess these relationships based on a sample of 670 innovations developed by 367 Spanish firms. The fourth section presents the results of the previous analyses and, finally, the fifth section sets out the main conclusions.

Theoretical background and hypotheses

As already noted above, the model proposed in this paper examines how certain characteristics of technological knowledge influence the appropriation mechanisms that companies employ to protect their innovations from imitators and how the variable firm size influences the relationship between the characteristics of any innovations and the method chosen to protect them.

Means of protection

Firms innovate and try to create new knowledge to improve and develop new products and/or production processes, hoping to enhance future profits. Unlike most productive investments, investment in innovation (such as in R&D) is hard to protect. Some of the knowledge generated in innovative activities can be easily replicated at virtually no cost. The possibility that a rapid diffusion of results may diminish expected profits is a strong disincentive to innovative activities.

Means of appropriation are the mechanisms that firms use to protect their innovations against imitation by their competitors. Such methods can be classified into three groups. First, there are legal