

Proximity and localisation of corporate R&D activities

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Abstract

The present article is an attempt to analyse the geographical agglomeration of corporate research and development activities through the use of a desegregated sectorial approach. By focusing on those interfaces that are critical for the organisation of innovation-related activities, as well as on the degree of complexity of the knowledge base which is being mobilised, this study will seek to determine the exact nature, and the intensity, of the need for geographic proximity. The explanatory model will then be tested by an econometric analysis of the localisation and clustering of corporate R&D activities in France © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

One of the manifestations of the interplay of technological externalities is the strong propensity towards clustering that innovation-related activities often exhibit. Recent advances in the *geography of innovation* have highlighted those factors that can cause a spatial concentration of innovation-related activities. The principal explanatory factor revolves around the existence of *knowledge spillovers*; and it hones in on those attributes that typify the various types of knowledge (tacit versus codified) which are involved in the innovation process. Agglomeration is explained by the fact that distance hinders the exchange of tacit knowledge (Jaffe, 1989; Feldman, 1994). However, it is extremely difficult to ascertain how knowledge is really transferred, or to what extent it will be

codified during this transfer process; and as a result, any conclusions on this subject are often pure conjecture (Krugman, 1991). In fact, spatial concentration of innovation-related activities does not constitute a sufficient a posteriori validation for the existence of tacit knowledge.

For this reason, there is a need to improve upon the body of theories that purport to explain the agglomeration of corporate research activities. Moreover, if existing hypotheses are to be validated, further empirical research needs to be systematically carried out. Such is the purpose of the present article. To this end, we will rely on the progress that has been made by proponents of the functional approach to the spatial organisation of R&D (Malecki, 1985; Howells, 1990); and on recent developments in the field of geography of innovation (Feldman, 1998).

The localisation of research activities is partially determined by the specific function which this activity fulfils within a given firm. Moreover, the mechanisms which serve to co-ordinate a given body of knowledge, and the degree of proximity which is necessary

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for its diffusion, vary directly in function of the specific type of knowledge which is being developed. Nevertheless, our analysis will be focusing on the different modes of co-ordination that are present in those environments in which new knowledge is being created and by so doing, we are transforming the issue of diffusion into one of interactive learning (Lundvall, 1992; von Hippel, 1994).

The need for proximity that characterises the co-ordination of innovation-related activities can vary from one industry to another. This has two significant implications. Firstly, it becomes possible to identify firms that are most likely to derive efficient benefits from the effects of clustering. Secondly, the geographic concentration of R&D activities is not necessarily a given; rather, it is to be considered as a construct that varies from one industry to another. In light of this heterogeneity in different industries' spatial organisation of their innovation-related activities, we do not postulate a priori any pre-eminence of local-level considerations in the process of innovation (Rallet, 1993).

The present paper is organised as follows. In Section 2, we will be constructing a theoretical framework that explains the spatial agglomeration of corporate research and development activities both in terms of the nature of the critical interfaces, and the complexity of the knowledge bases, that are involved in R&D activities. In Section 3, we will be presenting the results of an econometric study of the geographical distribution of corporate R&D activities across France to test our theoretical framework. Section 4 is our conclusion.

2. Factors underlying the spatial clustering of corporate R&D activities

The highly localised dimension of the tacit knowledge involved in technological externalities causes R&D activities to agglomerate spatially. Analyses devoted to the effects of knowledge spillover, which attempt to assess the local intensity of these externalities, have stressed the impact of geographic proximity on R&D activities, at the same time, they have emphasised significant differences amongst the various technological fields, or amongst the different sectors of activity (Jaffe, 1989; Audretsch and Feldman, 1996).

The perspective which the present paper offers is an attempt to enhance this approach by highlighting two aspects which we consider paramount for any analysis of the localisation of R&D activities. On one hand, analysing the nature, and indeed the origins, of spillover effects (as derived from the definition of *critical interfaces*) makes it possible to identify the strategic activities that play a critical role in the innovation process. On the other hand, our analysis will also determine the need for geographical proximity that is associated with each research activity (measured by the *complexity of their knowledge base*), this will then allow us to deduce the local dimension of technological externalities. All in all, the principal aim of our analytical framework is to reintroduce the importance of co-ordinating mechanisms given that they are just as important as externalities in explaining the need for proximity. We will also attempt to evaluate the tacit nature of knowledge indirectly by using indicators which describe the complexity of the knowledge base.

2.1. The nature of critical interfaces and the complexity of knowledge base

Researchers have been using the concept of critical interfaces (von Hippel, 1994; Pavitt, 1998) so as to define the primary points of co-ordination within the research process. In order to design and nurture a research project, there needs to be a modicum of co-ordination either between the various economic agents involved in this process, or else between the different functions within a firm. As such, we can distinguish between research and production activities which occur within a single firm (the *internal interface*), between R&D activities in different firms (the *external research interface*), and between industrial R&D activities and academic research centres (*public research interface*). The external research interface could, if required, be subdivided into an intrasectorial interface (involving the ties between R&D centres of firms which operate within the same sector) and an intersectorial interface (involving the ties between R&D centres of firms which belong to different sectors). The purpose of including the adjective 'critical' in the name of this concept is to emphasise the role played by these interfaces in the formation of spillover effects; and to show how important it is for these same

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