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The role of intermediation and absorptive capacity in facilitating university–industry linkages—An empirical study of TAMA in Japan

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ABSTRACT

This paper analyzes two elements necessary for building an efficient regional technology-transfer system between universities and firms, namely, an intermediary organization and regional firms that have a developed 'absorptive capacity', touching in particular upon the tacit knowledge aspects. Based on an empirical study of the TAMA cluster project (in the western part of the Tokyo Metropolitan Area), which is a model project of the 'Industrial Cluster Plan' in Japan, we examine the intermediation effect of the TAMA Association and the 'absorptive capacity' of various product-developing SMEs. These two elements are interrelated because the participation of the product-developing SMEs is a prerequisite for the effective functioning of an intermediary such as the TAMA Association. Our analysis also shows that university–industry linkages and inter-firm linkages lead to different outcomes.

1. Introduction

In Japan's national innovation system, large industrial firms have taken the initiative to apply scientific research results to commercial products, while universities have mainly focused on higher education and basic research. However, since the latter half of the 1990s, the long economic stagnation and a decrease in the competitiveness of leading industries in Japan have spurred efforts to diffuse scientific knowledge, especially the research results of universities, to a much wider sphere of industrial activities as a means of revitalizing the Japanese economy. Consequently, since the enactment of the Basic Law on Science and Technology in 1995, various institutional reforms, such as the enactment of the TLO (technology licensing offices) Law in 1998 and the introduction of the Japanese version of the Bayh-Dole Act in 1999, have been introduced to facilitate university–industry linkages. The conversion of national universities to independent entities in 2004 is also expected to reinforce this tendency. Accordingly, in the regional policy field, the Ministry of Economy, Trade and Industry (hereafter referred to as METI) launched the 'Industrial Cluster Plan' in 2001, and the Ministry of Education, Culture, Sports, Science and Technology (hereafter referred to as MEXT) launched the 'Knowledge Cluster Initiative' in 2002. For both of these, university–industry linkages are an important element.

However, university–industry linkages require not only university-specific reforms but also an efficient technology-transfer system in the region for transferring or applying the scientific knowledge and research results of universities to industrial firms. The university–industry linkages in urban or metropolitan areas require a particularly efficient technology-transfer system to intermediate between many universities (or university researchers) and a large number of firms.

This paper focuses on two elements necessary for building an efficient regional technology-transfer system

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between universities and the firms. The first element involves the intermediary function between universities and the firms. The second element is the absorptive capacity of the firms that enables efficient technology-transfer between universities and the firms, and allows intermediaries work for that purpose. Both the intermediary function and the absorptive capacity are particularly important to facilitate the transferring of tacit knowledge, which is a crucial part of the technology to be transferred.

This paper analyzes empirically the importance of these two elements for building up an efficient regional technology-transfer system based on data and information gathered from an industrial cluster project in a region called the Technology Advanced Metropolitan Area (TAMA), located in the western part of the Tokyo Metropolitan area.[1] The TAMA cluster project is a model case of the projects launched under the 'Industrial Cluster Plan'.[2]

In the next section, we present a conceptual framework to define the role of intermediaries for university–industry linkages with reference to the existing literature. Section 3 introduces basic information on the TAMA cluster project and key terminologies used in the paper. In Section 4, we examine the intermediary function of the TAMA Association, which is a core organization promoting the TAMA cluster project. In Section 5, we present product-developing SMEs as typical regional firms that possess a measure of absorptive capacity. Sections 4 and 5 employ econometric as well as descriptive analysis based on questionnaire survey data to test the proposed hypotheses. Section 6 concludes and suggests some policy implications with reference to other industrial cluster projects in Japan.

2. Conceptual framework

2.1. Intermediaries

This section explores the reasons why an intermediary is necessary and what should be the key role of intermediaries in promoting university–industry linkages.

2.1.1. Literature on intermediaries

According to the theoretical literature, intermediaries such as wholesalers, retailers and financial institutions emerge because they reduce search and other transaction costs for sellers and buyers. Gehrig (1993) compares intermediated markets, where intermediaries purchase products from sellers and sell them to buyers, and search markets, where sellers and buyers meet and negotiate directly. Although intermediaries charge a fee for their services, they can reduce the transaction costs associated with search and bargaining. Several other aspects of intermediation are also discussed in the literature. For example, Garella (1980) emphasizes the role of a middleman in mitigating market failures caused by asymmetric information (Gehrig, 1993). Rubinstein and Wolinsky (1987) analyze the function of intermediaries, using a search–theoretic model where intermediaries are viable when they increase the chances of a seller finding a customer. This literature also implies that intermediaries have an advantage in reducing search costs.

The general intermediary literature has relatively little to say on intermediaries that mediate between invention creators such as universities and invention users such as firms. Hoppe and Ozdenoren (2005) offer a framework to analyze the reason why such innovation intermediaries may emerge and what role they can play. Using technology-transfer offices (TTOs) in the U.S. as typical examples of the innovation intermediaries, they highlight the role of the innovation intermediaries to mitigate uncertainty about the profitability of inventions. Their theoretical model deals with an innovation intermediary investing in expertise to evaluate the commercial value of inventions and to assess the efficiency level of potential licensees. Such an intermediary is viable when the investment cost in developing expertise is smaller than the largest possible social gain from innovation. However, the uncertainty over the profitability of inventions is just one specific aspect to be dealt with by technology intermediaries in addition to general problems confronting all intermediaries.

The issue of tacit knowledge is germane both with respect to technological and financial intermediation. Aoki (2001) points out that venture capitalists in Silicon Valley are functioning as financial intermediaries, who can assess how tacit knowledge may influence the successful commercialization of innovation by entrepreneurial start-up firms.

2.1.2. Intermediating university–industry linkages

In Japan, the basic role of intermediaries in the context of university–industry linkages is to provide firms and universities with information about potential partners to collaborate with, to provide opportunities for meeting the potential collaboration partners, and sometimes to coordinate joint research projects and other collaborative activities. For example, the results of a questionnaire survey by the Kanto Regional Bureau of International Trade and Industry (1997), which will be described later, indicate that a lack of information on which universities or university researchers undertake relevant research and a lack of opportunities to meet potential collaboration partners were identified as serious obstacles for firms, especially for small and medium-sized enterprises (SMEs), to enter into university–industry linkages.

In this paper, we draw upon not only the literature on innovation intermediaries but also the literature on intermediaries in general to arrive at a conceptual basis for understanding intermediaries that facilitate university–industry linkages (hereafter referred to as 'UIL

[1] The analysis of the TAMA case is based on Kodama (2003b), and Kodama (2005), but incorporating new analytical results.

[2] The 'Industrial Cluster Plan' is a policy program by METI to promote industrial clusters in various regions in Japan. The notion of an 'industrial cluster' in the Plan can be summarized as an industrial agglomeration with a developed network of university-industry linkages and inter-firm linkages that generate new technologies, new products and new businesses. See, for example, Regional Economic and Industrial Policy Group, Ministry of Economy, Trade and Industry (2006). At present, there are 18 industrial cluster projects ongoing. Among these, the 'Regional Industry Vitalization Project' in the Kanto region has six components, including the TAMA project and the 'Hokkaido Area Industrial Cluster Project', with two separate components, which are operated independently of each other. Therefore, the actual number of industrial cluster projects is 24.