



# University–industry collaborations in Japan: The role of new technology-based firms in transforming the National Innovation System

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## Abstract

This paper examines the role of new technology-based firms in university/industry collaborative (UIC) activities in Japan. UIC activities have been widely diffused into small startup firms over the past 5 years, according to quantitative analysis of RIETIs UIC Survey. In this paper, it is found that these smaller firms achieve higher productivity through UICs than large firms. In light of the findings of this paper, it appears that UICs are gaining momentum and are likely to play a strong role in reducing the dependence of Japan's system of innovation on in-house R&D conducted within large corporations.

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## 1. Introduction

This paper examines the role of small firms in university/industry collaboration (UIC) activities in Japan. Promoting UIC activities is a major policy priority in Japan, as demonstrated by a series of legislative actions, such as the 1998 Technology Licensing Organization (TLO) Promotion Law and the 2000 Law to Strengthen Industrial Technological Capabilities. A major motive behind such policy initiatives lies in the desire to make Japan's system of innovations more dynamic, shifting

the system from domination by in-house R&D conducted at major corporations toward one based on a network of active interactions between various innovators, including universities and enterprises. Within the latter system, small firms, or new technology-based firms (NTBFs), which are new, relatively small firms seeking to commercialize innovative ideas, will play a central role (Audretsch, 1999).

UIC activities can take various forms, from informal technology consultations to collaborative R&D performed on a contractual basis. In addition, the nature of such efforts varies widely across technological domains. In February 2003, the RIETIs Survey of UIC Activities, a wide-ranging survey of businesses,

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investigated this heterogeneity to provide a clear picture of such efforts in Japan (RIETI, 2003). Based on company-level data from this survey, we examine the differences among these efforts by the size of the various enterprises. By linking this data set with data from the Basic Survey of Japanese Business Structures and Activities of the Ministry of Economy, Trade, and Industry (METI), we also analyze determinants of university/industry collaborations and the impact of such efforts on the innovation and business performance of private companies.

This paper is structured as follows. First, in the next section, we discuss the differences in university/industry collaborations between large enterprises and SMEs, i.e., small and medium enterprises, using RIETI's Survey of UIC Activities. We then provide the results of quantitative analysis of determinants of UICs and the impact of such efforts on a firm's innovation and business performance, linking data from the RIETI Survey with data from METI's Basic Survey of Japanese Business Structure and Activities. In the final chapter, we summarize the results of this study and conclude with a discussion on the role of technology intensive SMEs, or NTBFs in changing Japanese national innovation system from large firm centered in-house development model toward network based system with active collaborations among innovation players.

## 2. University/industry collaboration activities by size of firm

University/industry collaboration (UIC) activities can be investigated from either the university or industry side. In Japan, several surveys have already investigated this topic. One example is a survey conducted by Mitsubishi Research Institute (MRI, 2002). Examples of surveys of the industry side include METI (2003a, 2003b), and Japan Finance Corporation for Small Business (JFS, 2002). Additionally, RIETI (2001) obtained data from both universities and industries on UIC projects receiving subsidies from the New Energy and Industrial Technology Development Organization (NEDO). These surveys show the level of UIC activities, as well as their objectives, obstacles, and effects. In addition, some studies have examined UIC activities by investigating the number of companies involved, the geographical expansion of such efforts, and the

numbers of projects by technology in detail (Wen and Kobayashi, 2001). However, these examples provide only qualitative information concerning UIC activities and are unsuitable for quantitative analyses, such as examinations of annual budgets for collaborative research and number of joint research contracts. Another issue with prior surveys includes a problem of sampling scope: these surveys are limited to publicly supported UICs, or cover only UICs involving large enterprises.<sup>1</sup>

RIETI's survey of UIC activities does not suffer from such sampling bias problems. It surveys almost all firms engaging in R&D activities in Japan (7442 firms). As a sample base, METI's Basic Survey of Japanese Business Structure and Activities, which covers all firms active in manufacturing, wholesale, or retail industries with 50 or more employees and capital of 30 million yen, is used. In addition, RIETI's survey covers quantitative information on UIC activities, such as annual budgets and number of UIC projects. The survey was conducted in February 2003 for information for the 2002 fiscal year, compiling valid responses from 802 firms. The survey consisted of the following three major components: (1) overall information on R&D collaboration with external bodies, including other firms, universities and public research institutes; (2) a detailed survey of UIC activities, including quantitative information on the scope and scale of activities; (3) qualitative information on objectives, assessments, and obstacles involving UIC activities.<sup>2</sup> This section provides observations based on this survey, focusing on the dimension of variations with respect to size of firm.

Fig. 1 provides an overview of R&D collaborations by size of firm. Approximately 70% of firms engaging in R&D activities engage in R&D collaborations of some form. Approximately 40% of firms engaging in such collaborations engage in UIC activities. Although Japan's system of innovation is said to be characterized by a focus on in-house R&D, these figures show that external collaborations in R&D efforts is fairly widespread. This survey also compared such

<sup>1</sup> One of exceptions is the statistical analysis conducted for the White Paper on Small and Medium-Sized Enterprises in Japan, which covers extensive number of firms (METI, 2003b).

<sup>2</sup> Refer to the RIETI (2003), for details of survey methodology including sampling methods and response rates. Although this survey's valid response rate of 10.8% is low, we simultaneously conducted a follow-up survey on non-response samples, which indicated that the effects of the non-response bias on the results were relatively small.

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