



Importance of inclusive service for corporate use of university research infrastructure in Japan



Yuko Ito*

National Institute of Science and Technology Policy, Kasumigaseki, Chiyoda-ku, Tokyo, Japan

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ABSTRACT

Research infrastructure, especially research equipment is essential to perform R&D activities. To promote innovation, universities are increasingly expected to make their research equipment available as shared core facilities not only on campus but also to other universities or private companies. However, private companies' current utilization of Japanese universities' research equipment is very low. Therefore, this study aims to identify hidden barriers to corporate utilization of core facilities in Japan, and proposes ways to overcome them. To accomplish this, an online questionnaire survey was conducted to R&D personnel ($n = 926$) in 2012. Results revealed that purpose of use, respondent age, and price of research equipment in daily use, differed significantly depending on whether or not the respondent used neighboring universities' research equipment in the workplace. Further, on-site interviews with core facility management staff, indicated that corporate users often needed technological advice that facilities could not provide due to skilled staff shortages. These results indicated that universities cannot attract corporate users without provide more inclusive service according to users' needs.

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1. Introduction

R&D infrastructure, such as research facilities and equipment, is essential to creative and unique research and development activities. Consequently, R&D activities, especially, in natural sciences and engineering fields, can be very costly [25]. According to the National Science Foundation's (NSF) Science and Engineering Indicators 2012 [19], about \$2.0 billion of the United States' 2009 R&D budget was spent on academic research equipment (movable items), of which 55% was paid by the federal government [19]. In Japan, 2012 intramural expenditure on research equipment (machinery, equipment, etc., valued at 100 thousand yen or more) for academic R&D was about 219.6 billion yen (approximately \$2.8 billion) [24], of which 62.7% was paid by national universities [24].

University researchers who receive many research grants frequently mark equipment in their laboratories for their exclusive use. In Japanese government-funded research equipment has begun to take up space in laboratories due to the difficulty of discarding or transferring it. Furthermore, university researchers in Japan often take some time to begin work after transferring from

another institution because they attempt to stock the laboratory with the necessary equipment by themselves. As such, sharing university research infrastructure could be an effective way to use research funds and space more efficiently.

In the U.S., the Human Genome Project (1990–2003) [16] (a collaborative international research project supported by the Department of Energy and the National Institutes of Health to fully sequence the human genome) is a prominent example of a major research endeavor that employs research facility with centralized equipment [12]. Another example is the National Nanotechnology Infrastructure Network (NNIN) [18]; supported by the NSF since 2003, the NNIN employs advanced shared nanotechnology user facilities at 14 universities across the U.S. to serve the needs of nanoscale science, engineering, and technology.

Given the recent economic downturn, academic R&D is not expected to increase significantly in the coming years. Universities must therefore use their R&D budgets more effectively, particularly with regard to management of core facilities – that is, the centralized sharing of research resources that provide access to equipment, technologies, and services, including expert consultation [7–9].

In Japan, many university researchers have had to use facilities and/or equipment that they or their research group did not own [11]. Indeed, the number of core facilities in Japanese universities

* Current address: Research Institute of Science and Technology for Society, Japan Science and Technology Agency, Yonbancho, Chiyoda-ku, Tokyo, Japan.

E-mail address: yuko.ito@jst.go.jp.

that are open to external academic institutions is gradually increasing. For example, in 2010, MEXT (Japan's Ministry of Education, Culture, Sports, Science and Technology) established the "Kyoyo Navi" web portal, a general navigation site for the shared use of research facilities that supplies basic utilization information (location, utilization fields, usable time, etc.) to promote shared use. In 2013, the web site reported 34 shared core facilities across the country.

While one might expect private companies to take advantage of these shared core facilities to conduct R&D activities, private companies in Japan are actually unlikely to use such facilities, as they are not well known outside of the academic community [6]. As such, academic-corporate research partnerships could promote innovation and contribution to local and national economies [10].

Therefore, this paper examines barriers to corporate utilization of core facilities at universities, and proposes ways to resolve them.

2. Literature review

One barrier to academia-corporate partnerships is their differing R&D needs. Such differences, including the orientation of the university and its researcher(s), and the attitudes and behavior of the university administration and technology transfer office, can represent serious obstacles to academia-corporate collaboration [3].

However, a survey of individual determinants of university researchers working with private companies, has suggested that a wide range of traditional academic activities, roles, and interactions work synergistically with the private sector [2]. Further, it has been reported that inter-organizational trust is one of the most important mechanisms for lowering the barriers to academic-corporate interaction [3]. Building this trust requires a long-term relationship; such a long-term relationship could be initiated through the corporate use of a university's research infrastructure (i.e., a shared core facility).

Meanwhile, in the U.S., the Indiana Clinical Translational Sciences Institute (CTSI) in the Indiana University attempted to improve clinical research infrastructure through a partnership with Indiana University School of Business [23].

The acceleration of university research has increased the importance of effective, proactive, and strategic management of core facilities [8]. To maximize return on resource use during the economic downturn, institutions may market their core facility services outside of the university, especially to private industry, to generate additional revenue [9]. Furthermore, it has been suggested that the core facility is itself an ambassador of the university, acting as a service provider or potential collaborator with external commercial customers, which provides an opportunity to demonstrate the university's strength to private clients [10].

However, the relational success factors on university-industry linkage were indicated not only trust but also communication, understanding, and interrelationship between individuals [22], and individual behavior of academics was reported to be influenced by their local context such as colleagues' behavior on engagement with industry [26].

From the perspective of promotion of local innovation, the provision of university graduates positively was suggested to affect neighboring industry firm performance rather than scientific research [13], and a university's success in commercializing science was shown to impact on the quality of a university's regional environment [5]. Further, knowledge flows from university inventions were represented to be more geographically localized through market transactions than through nonmarket spillovers [15]. In science park, university-industry collaborations show the on-park firms tend to collaborate with partner beyond their local

region rather than the local universities [14].

Thus, it is still unclear how much core facilities at universities contribute to promotion of university-industry relationship or regional innovation.

3. Methodology

An online questionnaire targeting private company experts among monitors engaged in R&D (13,812 people as of October 2011) was conducted in cooperation with SpiRE, Inc. from September 24 to October 5, 2012. The questionnaire comprised 20 items covering areas such as respondent characteristics (age, specialty, seniority, and occupation), affiliation characteristics (organization type and size), and attitudes (purpose, mindset etc.) toward using equipment (Table 1). Of 13,812 total possible respondents completed questionnaires were collected from 926 (response rate: 6.7%) monitors who were engaged in R&D at private companies and used equipment in the workplace.

To better understand core facility management issue in Japan, on-site interviews were conducted from January to March 2013 with 16 people engaged in management of core facilities at five universities (four public and one private university) in Japan. Participants were interviewed regarding each core facility's management system, aim, external user, strengths, and weaknesses.

4. Results

Mann–Whitney U test (Table 2) showed significant differences in the responses to five survey items: "purpose," "purchase," "price," "collaboration," and "age."

In response to the question "Have you ever used neighboring universities' equipment," 17.5% ($n = 162$) answered affirmatively and 82.5% ($n = 764$) answered negatively. While this disparity may seem unusual, a relatively common answer for why respondents did not use such equipment was lack of information about or absence of a relationship with a neighboring university.

Respondents who used neighboring universities' equipment at their workplace identified most of their R&D activity as applied research. Conversely, respondents, who did not use neighboring universities' equipment tended to favor trial manufacture. Further, respondents who used neighboring universities' equipment found

Table 1
Definition of variables.

Variables	Description
Organization	Universities or colleges, companies, public research institutes, local municipalities, medical institutions, and other.
Preferences	Latest model available, short distance to access, cheap to use, good service, availability of acquaintance, and other.
Purpose	Basic research, applied research, trial manufacture, clinical research, and other.
Purchase	Easy to purchase, difficult to purchase, and impossible to purchase.
Price	Less than 5 million yen (\$50,000), or 5 million yen or more.
Collaboration	Has collaboration been initiated with external organizations through equipment sharing? (Yes or No.)
Neighboring Universities	Has your organization used equipment belonging to neighboring universities? (Yes or No.)
Occupation	Engineering, information systems, research and development, manufacture and design, management, and other.
R&D Fields	Natural sciences, engineering, agriculture, health, other health, and other.
Age	Respondent's age.
Seniority	Years of service at current workplace.
Company Size	Number of employees at current workplace.

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