Open Innovation and the Emergence of a New Type of University–Industry Collaboration in Japan

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Abstract: From the mid-1990s to the mid-2000s, major institutional reform was undertaken in Japan to promote university–industry collaboration. The term “university–industry collaboration” appeared frequently in the media and became a fad. However, this did not last long, and it peaked in 2003. University–industry collaboration entered the spotlight again after 2010, when “open innovation” (Chesbrough, 2003) became popular in Japan. At that time, a new type of university–industry collaboration emerged. University–industry collaboration in Japan has traditionally taken the form of “small-scale, short-term, individual” contracts. In contrast, this new type of collaboration features “large-scale, long-term, comprehensive” contracts.

Keywords: university–industry collaboration, open innovation, pharmaceutical industry

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Introduction

The use of external resources is critical to corporate research and development and innovation (Chesbrough, Vanhaverbeke, & West, 2006; Vega-jurado, Gutiérrez-Gracia, & Fernández-de-Lucio, 2009). There are various ways in which firms can acquire external resources, and university–industry collaboration is one of the main means (Adams, Chiang, & Starkey, 2001; D’Este & Patel, 2007; Fontana, Geuna, & Matt, 2006; Lee, 2000; Owen-Smith, Riccaboni, Pammolli, & Powell, 2002; Perkmann & Walsh, 2006). Japanese firms have long been collaborating with universities in various fields, including research and education. However, it was not until the mid-1990s that university–industry collaboration became a topic of public interest, with frequent mentions in the media. As “open innovation” (Chesbrough, 2003) has become popular in the 2010s, a new type of university–industry collaboration that differs from the traditional collaboration has emerged and is gathering attention.

This paper summarizes the history of university–industry collaboration in Japan from the mid-1990s to the present and identifies the characteristics of the new type of university–industry collaboration that appeared in the 2010s.

The First Boom: Reform of the Legal System as a Trigger

University–industry collaboration in Japan has a history of more than 100 years (Sawada, 1990; Tamai & Miyata, 2007). Corporations and universities have had close relationships with one another in various forms, both formal and informal (Baba & Goto, 2007; Branscomb, Kodama, & Florida, 1999). However, it was in the early 2000s that the term “university–industry collaboration” became a buzzword in industry, academia, and government consequent to the
Science and Technology Basic Plan formulated in July 1996.¹ At the time, Japan was in an economic slump, and there were growing expectations that technological innovation would revitalize the economy and create economic growth (Baba & Goto, 2007; Harayama, 2003). To accomplish this on the basis of the Science and Technology Basic Plan, various institutional reforms were implemented, including the enactment of the Act on Special Measures Concerning Revitalization of Industry and Innovation in Industrial Activities (Japan’s version of the Bayh–Dole Act); the creation of technology licensing organizations (TLOs)² and intellectual property offices at

| Year | Legal Reform                                                                 |
|------|------------------------------------------------------------------------------|
| 1995 | The Science and Technology Basic Law                                         |
| 1996 | The Science and Technology Basic Plan                                        |
| 1998 | The Act to Facilitate Technology Transfer from Universities to the Private Sector |
| 1999 | The Small Business Innovation Research (SBIR) program                        |
|      | Act on Special Measures Concerning Revitalization of Industry and Innovation in Industrial Activities (Japan’s version of the Bayh–Dole Act) |
| 2000 | The Industrial Technology Enhancement Act                                    |
| 2002 | The 1st Conference on the Promotion of Industry–University–Government Collaboration |
| 2003 | The Intellectual Property Basic Act                                           |
|      | The School Education Act (reform)                                             |
| 2004 | The National University Corporation Act                                      |

Source: Prepared from “Genealogy of industry–university–government collaboration,” Ministry of Economy, Trade and Industry.

¹ The Science and Technology Basic Plan was formulated in accordance with The Science and Technology Basic Law enacted the prior year.
² Takahashi and Nakano (2003) discuss technology transfer in Japan.
universities; the loosening of restrictions on university teachers working in private enterprise; and the incorporation of national universities (Table 1). University–industry collaboration became a fad that was frequently discussed in newspapers, magazines, and other media.

These institutional reforms greatly promoted university–industry collaboration in Japan. According to a survey by the National Institute of Science and Technology Policy (NISTEP), the number of collaborative studies between national universities and private

**Figure 1.** Collaborative research between national universities and private enterprises

*Source:* Prepared from “Status of implementation of industry–university collaboration at universities, etc.,” Ministry of Education, Culture, Sports, Science and Technology (annual editions).
enterprises before 1990 totaled less than 1,000; however, by 1996, it exceeded 2,000, and by 2000, it reached 4,000 (Nakayama, Hosono, Fukukawa, & Kondo, 2005). This number continued to increase from 2001 onward, reaching 10,000 in 2008. In 2009, the pace temporarily slowed, most likely due to the impact of the financial crisis; however, it later resumed an upward trend. The trend is similar for the amount of research funding received by national universities to conduct collaborative research (Figure 1).

However, it is interesting to note that even as the number of university–industry collaborations and the amount of research funding have increased, the media have not talked much about

![Figure 2. Appearance of the term “university–industry collaboration”](image)
university–industry collaboration since the enactment of the National University Incorporation Act in 2004. Figure 2 shows the number of times the term “university–industry collaboration” appeared in the Nihon Keizai Shimbun and the Nikkei Sangyo Shimbun, Japan’s major business newspapers. According to Figure 2, (1) the use of the term “university–industry collaboration” peaked in 2003 (“the first boom of university–industry collaboration”), before dropping off, and then (2) it began to increase again after 2010.

The Second Boom: “Open Innovation” as a Trigger

Why did university–industry collaboration become popular again in the 2010s? One reason is the popularity of “open innovation,” a concept first proposed by Chesbrough (2003), emphasizing the use of external resources in corporate activities. University–industry collaboration is an effective way for companies to obtain external resources for their research and development activities and is closely related to “open innovation” (McAdam & Debackere, 2018; Miller, McAdam, & McAdam, 2018; Perkmann & Walsh, 2006). The concept of “open innovation” has had a major impact on academic and business communities not only in Japan but also around the world. However, in Japan, it was in the 2010s that the topic was published in special issues of major academic journals. The Journal of Science Policy and Research Management published a special issue on open innovation in 2010, and the Hitotsubashi Business Review

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3 This count was taken from the Nikkei Telecom 21 database.
4 More precisely, Chesbrough defines open innovation as follows: “Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology” (Chesbrough, 2003). “Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough, 2006).
published a special issue in 2012.

Since the publication of Chesbrough (2003), many Japanese firms have implemented the managerial concept of “open innovation” and adopted various initiatives. In what is similar to Figure 2, Figure 3 shows the number of times that the term “open innovation” appears in the *Nihon Keizai Shimbun* and the *Nikkei Sangyo Shimbun*. According to Figure 3, the term “open innovation” took hold in Japanese business after 2010.

This paper focuses on the relationship between “open innovation” and “university–industry collaboration.” Figure 4, which combines Figure 2 and Figure 3, shows that the number of times the term “university–industry collaboration” appeared in the *Nihon Keizai*
Shimbun and Nikkei Sangyo Shimbun rapidly declined after 2004 but rose again around the time that the appearance of “open innovation” began increasing in the 2010s. In other words, a “second boom in university–industry collaboration” was created (or is being created) in conjunction with the trend of “open innovation.”

Figure 4. The number of times “university–industry collaboration” and “open innovation” appear

Characteristic of the New Type of University–Industry Collaboration

What kind of university–industry collaboration constitutes the second boom of recent years? As we noted in the previous section, the number of cases of university–industry collaboration and the money
invested in such collaboration have been steadily increasing since 2000 (except during the financial crisis). Despite there being no major change (in this upward trend), in the 2010s, the media began to focus again on university–industry collaboration because some kinds of qualitative changes had been made.

The most striking change was the appearance of a new type of university–industry collaboration. Traditionally, such collaboration in Japan tended to be in the form of “small-scale, short-term, and individual” contracts. In contrast, the new type of university–industry collaboration features “large-scale, long-term, and comprehensive” contracts (Table 2).

Collaboration between Takeda Pharmaceutical Company and Kyoto University (contracted in April 2015) and that between Chugai Pharmaceutical Co., Ltd. and Osaka University (contracted in May 2016) are the two cases in the pharmaceutical industry that are most frequently highlighted by the media as the new type of university–industry collaboration.5 These joint research contracts were of the

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Table 2. Characteristics of the “new type” of university–industry collaboration

|                     | New type                                      | Conventional type |
|---------------------|-----------------------------------------------|-------------------|
| Amount              | Large (1 billion yen or more per year)        | Small             |
| Term                | Long (10 years)                               | Short             |
| Type of contract    | Comprehensive                                 | Individual        |

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5 For example, the August 13, 2016, issue of the *Nihon Keizai Shimbun* covered “open innovation” as its “word for the day” and introduced both of these cases in the article.
order of 20 billion yen over 10 years in the case of Takeda and Kyoto University and of 10 billion yen over 10 years in the case of Chugai and Osaka University. In their annual reports, both Takeda and Chugai emphasized that they had initiated joint university–industry research as open innovation for the purpose of developing new drugs (Chugai, 2017; Takeda, 2015). According to data from the Ministry of Education, Culture, Sports, Science and Technology, the amount of research funding received by universities from corporations as part of university–industry joint research (between private enterprises and national, public, or private universities) in Japan exceeded 100 million yen annually in 18 cases, which was a mere 0.06% of the 30,340 cases overall. Of these cases, 96.4% were of the order of less than 10 million yen annually. From this, we can see that Takeda and Kyoto University’s 20 billion yen contract and Chugai and Osaka University’s 10 billion yen contract are very large.

In addition, university–industry collaborative research in the past consisted mainly of project-based joint research contracts that were entered into at the point where there were some prospects of coming up with a product and commercializing it. In contrast, in these two “new-type” collaborations, a more comprehensive contract was concluded from the basic research stages, between a company and a large research center of a university which is a bundle of numerous research projects (the Center for iPS Cell Research and Application (CiRA) in the case of Kyoto University, and the Immunology Frontier Research Center (IFreC) in the case of Osaka University).

**Conclusion**

This paper examined university-industry collaboration in Japan and presented the following two points.

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6 “FY 2016 status of university–industry collaboration in universities, etc” (Ministry of Education, Culture, Sports, Science and Technology, 2018).
(1) Japan has had two boom periods for university–industry collaboration since the 1990s. The first boom occurred in the early 2000s as a result of the legal system reforms of the late 1990s, and the second boom occurred in the 2010s in conjunction with the spread of “open innovation.”

(2) The “new type” of university–industry collaboration that appeared in the second boom was “large-scale, long-term, and comprehensive.”

The “new type” of university–industry collaboration is considered to be effective for industries such as pharmaceuticals, where there is a high degree of uncertainty in research and development, and where product development takes a long time. In such industries, this new type of university–industry collaboration is expected to produce better outcomes than conventional university–industry collaboration. However, this new type of university–industry collaboration has only just begun, and at this point we do not know whether it is really effective or not. This will require further study.

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7 See Kuwashima (2015, 2016) for more information on the characteristics of pharmaceutical research and development.

8 The “new type” of university–industry collaboration focuses more on long-term, rather than short-term, results. Takahashi (2013a, 2013b, 2014) called decision-making rules that emphasize future profits over immediate profits “leaning on future principle.”
References

Adams, J. D., Chiang, E. P., & Starkey, K. (2001). Industry-university cooperative research centers. *Journal of Technology Transfer, 26*(1-2), 73–86.

Baba, Y., & Goto, A. (Eds.). (2007). *Sangaku renkei no jissho kenkyu* [Empirical research of university-industry collaboration]. Tokyo, Japan: University of Tokyo Press (in Japanese).

Branscomb, L. M., Kodama, F., & Florida, R. L. (Eds.) (1999). *Industrializing knowledge: University-industry linkages in Japan and the United States*. Cambridge, MA: MIT Press.

Chesbrough, H. (2003). *Open Innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business School Press.

Chesbrough, H. (2006). Open innovation: A new paradigm for understanding industrial innovation. In Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.), *Open innovation: Researching a new paradigm* (pp. 1–12). Oxford, UK: Oxford University Press.

Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open innovation: Researching a new paradigm*. Oxford, UK: Oxford University Press.

Chugai. (2018). *Annual Report 2017* (in Japanese). Retrieved from https://www.chugai-pharm.co.jp/hc/Satellite?c=CrpAttachDocument_C&cid=1259618804803&dlaid=1249009591206&lc=jp&pagename=Chugai%2FCommonMetaFileRedirectTemplate

D’Este, P., & Patel, P. (2007). University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy, 36*(9), 1295–1313.

Fontana, R., Geuna, A., & Matt, M. (2006). Factors affecting university-industry R&D projects: The importance of searching, screening and signaling. *Research Policy, 35*(2), 309–323.

Harayama, Y. (2003). *Nihon ni okeru sangaku renkei* [University-industry collaboration in Japan]. (RIETI Policy Discussion Paper Series, 04-P-001). Tokyo, Japan: The Research Institute of Economy, Trade and Industry (in Japanese).
Kuwashima, K. (2015). Exploring the characteristics of pharmaceutical product development: A cross-industry perspective. *Annals of Business Administrative Science, 14*, 161–170. doi: 10.7880/abas.14.161

Kuwashima, K. (2016). Drug discovery process: A case study on Takeda. *Annals of Business Administrative Science, 15*, 129–138. doi: 10.7880/abas.0160224a

Kuwashima, K. (2018, April). *University-industry collaboration and open innovation in Japan*. Paper presented at ABAS Conference 2018 Spring, University of Tokyo, Japan.

Lee, Y. S. (2000). The sustainability of university-industry research collaboration: An empirical assessment. *Journal of Technology Transfer, 25*(2), 111–133.

McAdam, M., & Debackere, K. (2018). Beyond “triple helix” toward “quadruple helix” models in regional innovation systems: Implications for theory and practice. *R&D Management, 48*(1), 3–6.

Miller, K., McAdam, R., & McAdam, M. (2018). A systematic literature review of university technology transfer from a quadruple helix perspective: Toward a research agenda. *R&D Management, 48*(1), 7–24.

Nakayama, Y., Hosono, M., Fukukawa, S., & Kondo, M. (2005). *Kokuritsu daigaku no sangaku renkei* [University-industry collaboration of national university] (Research Material, No. 119). Tokyo, Japan: National Institute of Science and Technology Policy (in Japanese).

Owen-Smith, J., Riccaboni, M., Pammolli, F., & Powell, W. W. (2002). A comparison of U.S. and European university-industry relations in the life sciences. *Management Science, 48*(1), 24–43.

Perkmann, M., & Walsh, K. (2006). University-industry relationships and open innovation: Towards a research agenda. *International Journal of Management Reviews, 9*(4), 259–280.

Sawada, Y. (1990). *Gendai shakai ni okeru kagaku to sangyo* [Science and industry in modern society]. *Kyoto Daigaku Kyouiku Gakubu Kiyou* [Kyoto University Research Studies in Education], 36, 163–184 (in Japanese).

Takahashi, N. (2013a). A hypothesis about lukewarm feeling in Japanese
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firms. *Annals of Business Administrative Science, 12*, 237–250. doi: 10.7880/abas.12.237

Takahashi, N. (2013b). On the future parameter. *Annals of Business Administrative Science, 12*, 277–290. doi: 10.7880/abas.12.277

Takahashi, N. (2014). Future parameter explains job satisfaction and turnover candidates in Japanese companies. *Annals of Business Administrative Science, 13*, 129–140. doi: 10.7880/abas.13.129

Takahashi, N., & Nakano, K. (2003). Gijutsu iten no kangaekata: Daigaku ni shozokusuru kenkyusha no tameni [Philosophy of technology transfer: For universities and researchers affiliated with universities] *Akamon Manejiment Rebyu* [Akamon Management Review], 2(10), 481–530 (in Japanese). doi: 10.14955/amr.021002

Takeda. (2015). *Annual report 2015* (in Japanese). Retrieved from https://www.takeda.com/siteassets/jp/home/newsroom/corporate-materials/ar2015_jp.pdf

Tamai, K., & Miyata, Y. (2007). *Nihon no sangaku renkei* [University-industry collaboration in Japan]. Tokyo, Japan: Tamagawa University Press (in Japanese).

Vega-jurado, J., Gutiérrez-Gracia, A., & Fernández-de-Lucio, I. (2009). Does external knowledge sourcing matter for innovation? Evidence from the Spanish manufacturing industry. *Industrial and Corporate Change, 18*(4), 637–670.