# Heightened Expectations For National Universities As The Source Of Knowledge For Innovation

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## I. Heightened Expectations for National Universities as the Source of Knowledge for Innovation

### 1. Expectations for University-Originated Venture Businesses and Issues Related to Collaboration

In Japan, in the Japan Revitalization Strategy 2016 adopted by the cabinet in 2016, the promotion of full-fledged industry-university-government collaboration was advocated as an "organization" to be "organization" involving top executives of universities, national research and development (R&D) institutes, and enterprises. As a specific target of the Strategy, the public and private sectors agreed to increase the amount of investments into universities and national R&D institutes from private three times by fiscal year 2025. As a result, investments in university-originated venture businesses (UVBs)[1] and business alliances with UVB have been increasing.

In addition, the government and industries are increasingly expecting universities, which are the sources of knowledge, to realize the new "Society 5.0,"[2] an economic society promoted by the Cabinet Office and the business community.[3]

The expected roles of UVBs with innovative technologies expanding new areas of business to (i) preparing for disruptive innovation and (ii) creating and strengthening businesses.

It has been pointed out that in Japan's traditional large enterprises, the core business is mature, and there are limits to innovation on their own. Large enterprises are also vulnerable to disruptive innovation because of their rational management. Against this background, number of industrial companies, including large companies, seeking to collaborate with venture businesse (VBs) with innovative technologies is increasing to prepare for disruptive innovation and to accelerate their own innovation.

Despite the growing expectations for UVBs, there are still few successful cases of collaboration between VBs, including UVBs, and business entities in Japan. One of the reasons for this is the lack of parameters for collaborations between industrial companies including large enterprises and VBs. According to a survey conducted by the Ministry of Economic, Trade and Industry (METI) in 2017, collaboration between industrial companies and VBs involves big issues concerning industrial companies such as lack of understanding of the constraints and strategies of VBs and lack of understanding of differences between (i) subcontractors or affiliated companies and (ii) VBs. Based on this survey, in June 2018, METI released the "Guidelines for Collaboration between Business Entities and R&D-based Venture Businesses (Second Edition)" (Guidelines for Collaboration). The Guidelines for Collaboration are guidelines that can be used by practitioners of both R&D-based venture businesses and business entities to advance collaborative projects. It is also intended to promote mutual understanding of issues and initiatives of collaborating companies.[4]

In the Guidelines for Collaboration, the following were introduced as case studies of actual collaborations between R&D-based venture businesses and business entities.

### 2. Cases of Collaboration Between UVBs and Business Entities[5]

*(1) Examples of Collaboration for Exploring New Areas*

CYBERDYNE is a VB originating from the University of Tsukuba; it is a company that develops wearable-type robots that can read, amplify a bioelectrical signal and assist the physical functions of the wearer. The collaborative scheme is that Daiwa House Industry Co., Ltd. (Daiwa House), a major house manufacturer in Japan, will invest in a pre-listing CYBERDYNE, and CYBERDYNE will grant Daiwa House the exclusive distributorship in Japan. As a new business, Daiwa House has launched the sale of medical and nursing care robots. In addition, the Daiwa House Group has created new businesses in the nursing care and welfare industries through robotics products by leasing CYBERDYNE products to nursing care and welfare facilities.

*(2) Examples of Collaboration to Create and Strengthen Business in Existing Fields*

DAIICHI SANKYO COMPANY, LIMITED (DAIICHI SANKYO) is a major pharmaceutical company. PeptiDream Inc. (PeptiDream) is a VB that originated from the University of Tokyo; it is a company that has realized the improvement of stability and biopermeability and the construction of a screening library, which have been the issues of ordinary peptide drug discovery through its unique special cyclic peptide-related technologies. The goals of the collaboration include the following: (i) the depletion of targets that were easy to develop for conventional low-molecular-weight compounds, increas-

1. Generally speaking, there is no strict distinction made between "venture business (VB)" and "startup" in Japan. In this article, "VB" is used as a synonym for "startup."

2. The Cabinet Office defines "Society 5.0" as the fifth new society in human history, following "hunting society," "agriculture society," "industrial society," and "information society," and aims to realize Society 5.0, a new society that integrates advanced technologies such as Internet of Things (IoT), robots, artificial intelligence (AI), and big data into all industries and social lifestyles, thereby achieving both economic development and solving social issues.

3. The Japan Business Federation (Nippon Keidanren) defines "Society 5.0" as "a creative society" and "a society that solves social issues and creates value by combining digital innovation and creativity of diverse people."

4. METI, Guidelines for Collaboration between Business Entities and R&D-based Venture Businesses (Second Edition) (*http://www.meti.go.jp/policy/tech_promotion/venture/tebiki2.pdf), http://www.meti.go.jp/english/press/2018/0627_004.html*

5. Extracted from the Guidelines for Collaboration

ing the difficulty of developing drugs, and (ii) DAIICHI SANKYO's aim was to promote efficient drug development by utilizing VB's biodrug discovery technology and using peptide technology, which is a medium-molecular-weight compound. Collaboration schemes are joint R&D, in which DAIICHI SANKYO pays PeptiDream an initial fee, milestone fee, and royalty according to the research results.

*(3) Examples of Collaboration to Prepare for Disruptive Innovation in Existing Areas*

Toyota Motor Corporation (TOYOTA) is a leading global mobility company. Preferred Networks (PFN) is a VB created by spinning off a business specializing in artificial intelligence from a company originated from Tokyo University. PFN proposes "Edge Heavy Computing," a method of distributed cooperative processing of vast amounts of data at the edge of the network, with the aim of making use of deeper learning technologies in businesses. Collaboration schemes are a combination of equity investments and joint technical research, in which TOYOTA invests in PFN, carries out joint research with PFN, is granted a license to use the research results by PFN, and pays a license fee to PFN. In 2016, as a comprehensive result of TOYOTA's in-house development and collaboration with other companies, including the above collaborations, as one of the application concepts of PFN technical, a demonstration of "collision-less" deep learning technology was carried out.

**3. Future Industry-University Collaboration in Japan**

On December 17, 2018, It is reported that Daikin Industries have concluded an industry-university collaboration agreement with the University of Tokyo. In fiscal 2019, a total of 20 researchers will be dispatched, and collaboration with start-up companies from the University of Tokyo will be accelerated. Daikin will provide 10 billion yen in research funds over 10 years to jointly develop new technologies for artificial intelligence (AI) and air conditioners. Daikin Chairman Inoue said, "We will overcome our self-reliance and take on the challenge of collaborative creation that creates new value."[6]

Although the number is still small, successful cases of industry-university collaboration through UVBs, as described in section 2 above, have started to appear in Japan. In addition, expectations for university research from the industry are growing, with the emergence of large-scale industry-university collaborations as described above. Although there are still issues that must be overcome to have successful collaborations, the impact of university research results on the industry is expected to increase in the future, particularly in the areas of robotics, artificial intelligence, software development, and medical/healthcare.

## II. Increasing Attention to the Role of UVBs in Industry-Academia Collaboration

In Japan, UVBs are becoming the key to strengthening industry-university collaboration. In recent years, to encourage the practical applications of university research in society, there has been an increase in investments in and support for UVBs as a national policy.

*1. Various partnerships from industry, including investment in UVBs*

Based on the goal of the public-private agreement to "triple the current amount of investment from industry to universities, etc.," which was launched in spring 2016, joint developments and business alliances with UVBs and corporate venture capital (CVCs) have been increasing since 2017 with the purpose of supporting technological development and commercialization. The current situation of collaborations between business entities and UVBs is described in I. above.

*2. Birth of a national university venture capital*

To promote the practical applications of university research in society, the Industrial Competitiveness Enhancement Act enforced in January 2014 made it possible "for national universities to invest in VCs, etc. " to promote the commercialization of research results of national universities through the provision of funds, etc. Accordingly, four national universities, namely, the University of Tokyo, Kyoto University, Osaka University, and Tohoku University were granted approval to offer business programs in which the universities will invest in approved venture capital ("UVC"s), which invest in UVBs.

The Japanese government distributed a total of 100 billion yen to the four universities mentioned above. According to a survey by the Nihon Keizai Shimbun, as of the end of March 2018, 13.3 billion yen was invested in 51 VBs. The rate of fund investment achieved by UVCs after deducting operating expenses was only 26 percent. As a background to the cautious investment of UVCs, some of the UVCs commented that "it is difficult to find a balance between investment and risk because the funds are provided by the government." Another reason why investment by UVCs has not progressed is "the shortage of talented personnel who have discovered seeds and made them commercialized and implemented the process for gaining return on investment."[7]

Investments from UVCs in UVBs will continue, but it will take a considerable amount of time for the results to become apparent. The authors believe that this is because the research themes of national universities so far have a significant emphasis on basic science, and there are relatively few cases in which national universities independently conduct research on themes that can be commercialized in a short period of time; in addition, it is necessary for UVCs to select and develop promising technology seeds from themes that require time to commercialize. Efforts are being made by relevant parties to ensure that the enormous amount of funds provided by the government contributes to the practical applications for university research in society.

*3. Promote the use of Equity in exchange for the transfer of technologies from universities to UVBs*

As mentioned above, UVBs are expected to play a major role in practical applications for university research in society. Accordingly, it is necessary to smoothly transfer intellectual property rights such as patents, which are the result of university research, from universities to UVBs (Technology Transfer), but UVBs often do not have the financial leeway to pay for the transfer.

As a consideration for Technology Transfer from universities to UVBs, universities are considering acquiring shares (kabushiki) or share acquisition rights (shinkabuyoyakuken) issued by UVBs rather than receiving cash.

Although the Ministry of Education, Culture, Sports, Science

6. The article of Nihon Keizai Shimbun distributed on December 17, 2018. *https://www.nikkei.com/article/DGXMZO39038940X-11C18A2LKA000/.*

7. "The National Venture Capital Currency: Achieving a 26% Rate of Capital Slowdown-Nikkei Survey" (*https://www.nikkei.com/article/DGXMZO28902260S8A400C1SHA000/*) published by Nikkei Shimbun on April 2, 2018.

and Technology (MEXT) had issued a notice ten years ago clarifying that the acquisition of shares and share acquisition rights as license consideration would be permissible under certain conditions, it was difficult for national universities to judge to what extent the profitable business would be permissible, and so far the cases of utilization of shares or share acquisition rights have been extremely limited.[8] The authors believe that one reason for this is that MEXT, which controls national universities, and the national university have a deep-rooted belief that publishing an academic research paper is a mission of a university which is operated with tax money, but raising profits is not.

However, a notice from MEXT to national universities on August 1, 2017 (2017 Notice) acted as a trigger for national universities to begin serious consideration to utilize share and share acquisition rights as license consideration.

In the "Reform towards Realization of the Future Strategy 2017 to Society5.0" approved by the Cabinet on June 9, 2017, it is stated that, as a specific measure for good ecological system to generate innovation and VBs, it is necessary that "if universities, etc. support VBs, (i) they should be allowed to acquire share acquisition rights as consulting fees and facility use fees, and (ii) they should be allowed to hold shares after exercising the share acquisition rights for a certain period of time even after the initial public offering." Based on this statement, MEXT stated that as part of measures to support UVBs, it is "necessary" to acquire share and share acquisition rights as consideration. MEXT has also stated the guidelines for acquiring share and share acquisition rights in place of cash as consideration for "profit-making business" to promote efforts by national universities. The authors believe that the direction confirmed in the 2017 Notice was a trigger (i) for national universities to inject various resources and know-how possessed by them into UVBs and (ii) to revitalize them to promote the commercialization of research results.

In this report, we conducted interviews with persons in charge of industry-university collaboration at the University of Tokyo, Kyoto University, Tsukuba University, Kyushu University, and Nagoya University (note that this is not an exhaustive survey) between November and December 2018 to confirm the extent to which efforts to acquire share and share acquisition rights (New Approach) have progressed in each university as a consideration for licensing.

As a result, it has become clear that universities are actively promoting the New Approach, and after establishing internal regulations, they have actually acquired share and share acquisition rights in consideration of licensing, use of facilities and so on.

However, there are differences in approach methods between universities in the following areas, and there are few examples at present. Therefore, there is a possibility that the approach methods will change in the future. In addition, at conferences held by the University Network for Innovation and Technology Transfer (UNITT), where persons in charge of industry-university collaboration interact with each other and form networks, active research on New Approach and exchanges of views are being carried out, creating a foundation for the promotion of New Approach at universities.

Each university has a common policy to acquire share acquisition rights in consideration of licensing, use of facilities and so on, from UVB, in principle, but not to acquire shares from the start. However, there were differences in the following points.

- Standards for the case of share acquisition rights as consideration (some universities are positive about acquiring share acquisition rights as a consideration, others accept share acquisition rights in a complementary manner when cash consideration is difficult for VBs. Furthermore, there are differences in opinions among universities on whether or not they acquire share acquisition rights as consideration only from the UVB in which VC has invested.
- Contents of the design of the share acquisition rights (the consideration for the share acquisition rights includes the "issue price" and the "exercise price." However, there are differences in the design of the rights.)
- Positioning of the share acquisition rights as a consideration for licensing, use of facilities and so on (mostly in combination with cash, with different stances depending on the university as to which range of consideration the cash part is composed).

Regarding the valuation of university-generated VBs, it is difficult for universities to independently conduct the valuation by outsourcing the valuation to a third party, and some universities have adopted a method of relying on the valuation made by VCs.

There are very few cases in which the following steps have been completed:

(i) National universities, TLOs funded by national universities, and UVC acquired the share acquisition rights issued by the UVB;

(ii) The shares for the share acquisition rights are listed;

(iii) That national universities etc. exercise the share acquisition rights and acquire the shares; and

(iv) That national universities etc. sell the shares and gain profits from such sales.

In the future, it will be necessary to carefully consider the timing and method of selling shares acquired by universities, etc. after the share of a UVB has been listed, so that universities, etc. do not violate the rules for preventing insider trading.

## III. Active Tech Transfer Offices and Other Organizations That Try to Improve the Industry-Academia Collaboration in Japan

### 1. TLO

As an organization that seeks to strengthen industry-university collaborations in Japan, the TLOs (Technology Licensing Organization) established under the Law for the Promotion of Transfer of Technology Developed at Universities and Other Academic Institutions to Industry, which came into effect in August 1998, have played a major role for many years. The TLO was established as a corporation that patents the research results at universities or other academic institutions and transfers them to companies. The TLO plays the role of an "intermediary" between industry and academia. This is an organization that plays a key role in industry-university collaboration, acting as the driving force of the "cycle of intellectual creation" that creates new industries developed by universities and returns a portion of the profits earned to researchers at universities thereby generating research funds and bringing about further revitalization of university research.

In addition to TLOs, initiatives by other organizations that play a role in promoting industry-university collaboration have become more active in recent years. The following are some of these.

8. At the University of Tokyo, the utilization of share acquisition rights as license consideration was advanced from the early stage through the University of Tokyo TLO.

**2. Support for UVBs by VCs, Seed Accelerators, etc.**

In Japan, too, the role of UVBs is increasing as institutions for transferring university research results to industry.

VCs and seed accelerators (Accelerators), which provide financial and management support to seed-stage UVBs, are becoming more prominent.

According to METI's survey report for FY2016 (2016 Survey Report), VCs and Accelerators not only provide funds, but also provide support to UVBs in management aspects, such as entering the management team as a director, advising on capital policies, advising on business plans, and advising on exit strategies such as initial public offerings (IPOs). The UVBs have also recognized some effectiveness in such support provided by VCs.[9]

In addition, the 2016 Survey Report indicates that, in case of UVB, (i) the founding CEO's background in many UVBs is "Researcher at university or public institution (science and technology)" which falls under the category of the low-growth and (ii) many UVBs in which the CEOs are part of "top management" or "engineers and researchers in companies" fall under the category of high-growth.

For UVBs to grow at a high level, it is extremely important to be able to receive management support, including management personnel. VCs and Accelerators that invest in VBs at seed stage have begun to acquire such people as successful entrepreneurs, and engineers and researchers worked actively in a major company. It is expected that VCs and Accelerators that provide such support will assume a more active role for business growth of UVBs in the future.

**3. Other Activities to Strengthen Industry-Academia Collaboration**

*(1) Japan Association for the Advancement of Research Cooperation (JAREC)*[10]

On the other side of Haneda Airport, "KING SKYFRONT" (h*ttp://www.king-skyfront.jp/*) in Kawasaki City runs three National Project, COI and Research Complex, Regional Innovation Ecosystems. One such initiative is the active development of open innovation activities in Regional Innovation Ecosystems to build platforms for the discovery of middle-molecule IT-based drugs such as peptides and nucleic acids. The "Industry-Academia Collaboration Coordinator" apply the research results of universities and other academic institutions as a value-added technology to society which is competitive on the global market to create new industries in the region. Shoji Suzuki of Kawasaki Institute of Industrial Promotion is one of the " Industry-Academia Collaboration Coordinator " who planned and formulated a Ecosystems of Kawasaki City and Tokyo Institute of Technology and works beyond local boundaries to apply Emerging Technology in society.

On the other hand, support for the development of human resources for industry-academia collaborations has been provided for a quarter of a century by JAREC (founded in 1992). JAREC's mission is to contribute to the creation of new regional industries by applying the emerging technologies of universities and other academic institutions to enterprises through donations from local governments. Currently, commissioned by the national government, JAREC is conducting National Project monitoring surveys at 19 sites. The aim is to accelerate business development by identifying regional models having potential to be widely applied. JAREC's particularly focuses on the development of human resources for industry-academia-government collaborations. In Japan, where there are many large-scale projects and there are few angel investors, the key to the creation of new industries is the human resources who can identify from a global perspective the best research results (Science), to understand process models, to compile data stirring interest of business enterprise, and to maximize added value of the research results. Last year, more than 10,000 people participated in the "Apprenticeship Training" sponsored by JST.[11]

*(2) IPAS (IP Acceleration Program for Startups)*[12] *provided by the Japan Patent Office*

In recent years, the Japan Patent Office (JPO) has started to consider that the support measures about intellectual property for startups shall be specialized, because startups and small and medium-sized enterprises (SMEs) are totally different in their nature concerning business valuation, methods of funding and exit strategy. In 2018, the JPO released "Survey and Research Report on Intellectual Property Issues Facing Startups and Approaches to Support" (JPO2018 Survey). In the JOP2018 Survey, based on a questionnaire survey targeting startups, it was revealed that there are issues for startups such as (i) not being aware of the importance of intellectual property strategies, (ii) not having the opportunity to meet intellectual property experts, and (iii) feeling a lack of speed in support, that does not match the company's growth speed.

In July 2018, a venture support team was established within JPO to specialize in startups and provide further support. As one of the measures to support the solution of these issues, JPO started to implement IPAS (IP Acceleration Program for Startups) as the first measures in the fiscal 2018.

The IPAS is a hands-on support program that consistently provides such support for startups. The startups are selected by committees consisting of experts from candidates that had applied to public offering by JPO. The IPAS provides support to startups by making a diagnosis on and building strategies for seeds of technology, integrating into intellectual property strategies, and supporting the patent application on seeds of technology that should be patented, through the dispatch of business experts and intellectual property experts. It is probable that only the JPO is promoting a program to dispatch (i) venture capitalists and management consultants as business specialists, and (ii) patent attorneys and external experts with extensive experience in large enterprise intellectual property departments as intellectual property specialists. The authors believe that it would be effective for startups to enroll in IPAS under which startups are able to receive practical advice from the external experts based on their practical experiences.

By deepening the understanding of the patent system and acquiring patents closely related to the business, startups are expected to be able to cite the patents they possess as one of their advantages when they receive future investment or when they are listed in the Tokyo Stock Exchange. JPO is collecting model cases and considering ways to share them with other startups. JPO also intends to continue expanding IPAS in the fiscal 2019. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=3380525*

9. Ministry of Economy, Business and Industry, Fiscal 2017 Survey of Industrial Technology (Survey of University Ventures and Research Seeds) (*http://www.meti.go.jp/policy/innovation_corp/start-ups/h29venturereport.pdf)p*) dated March 9, 2018.38

10. The following contents are received from Kumiko Suzuki, Senior Researcher at team 01 of Business Promotion Department of JAREC.

11. Human resource development programs for technology transfer (*http://www.jst.go.jp/tt/mekiki/*)

12. Dr. Hashimoto, former vice chairman of the Licencing Executives Society, prepared texts and gave lectures on the licensing courses. The following is a summary of the results of interviews conducted by the authors with Mr. Kenji Kaionuma, Assistant Manager, Venture Support Division, Planning and Research Division, General Affairs Department, Japan Patent Office.