

Mission-oriented Innovation Policies in Japan: focusing on function of intellectual property and technology transfer

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Abstract

In the MOIP, key players of research and development are academic sectors, such as universities and public research institutes, and industrial sectors, such as existing large companies and start-ups. Usually the players in academic sectors cannot bring new knowledge into market for themselves. Therefore, in order to solve most of the social problems, it is essential to actually make products and services based on new knowledge, by cooperation between academia and industry. In this paper, function of intellectual property and technology transfer in social implementation of new knowledge is discussed, Japanese policy surrounding it is reviewed and future tasks are described.

Keywords: Patent, Industry-academia cooperation, intellectual property, technology licensing

Introduction

According to OECD (2021), Mission-oriented innovation policies (MOIPs) are defined as “a co-ordinated package of policy and regulatory measures tailored specifically to mobilise science, technology and innovation in order to address well-defined objectives related to a societal challenge, in a defined timeframe”. It also describes that “these measures possibly span different stages of the innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, and cut across various policy fields, sectors and disciplines”.

As mentioned by JST-CRDS (2022), in Japan, a lot of government-funded research programs aiming at solving social problems have been carried out so far. Since 2000, various projects such as “The Science and Technology for Society Research System (later Research Institute of Science and Technology for Society,

RISTEX)”, “Center of Innovation (COI) Program”, “Science and Technology Research Partnership for Sustainable development (SATREPS)”, and “JST-Mirai Program”, have been implemented. JST-CRDS (2022) also mentioned large-scale R&D programs led by the Cabinet Office, such as “Cross-ministerial Strategic Innovation Promotion Program (SIP)”, “Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT)”, and “Moonshot Research and Development Program”, in any of which solving social problems is positioned as an important goal.

At the rearrangement of governmental ministries in January 2001, Council for science and Technology Policy (CSTP) was established and it was renamed into Council for Science, Technology and Innovation Policy (CSTI) in May 2014. Basic Act on Science and Technology was enacted in 1995 and it was renamed into Basic Act on science, Technology and Innovation in 2021. Since 1996 Basic Plan for Science and

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Technology had been formulated by every 5 years. From the 6th version from 2021, it was renamed into Basic Plan for Science, Technology and Innovation Policy. Those changes reveal that innovation was got emphasized in Japanese political framework. The 6th Basic Plan mentioned promotion of mission-oriented R&D and social implementation, to achieve innovation.

In the MOIP, key players of research and development are academic sectors, such as universities and public research institutes, and industrial sectors, such as existing large companies and start-ups. Usually the players in academic sectors cannot bring new knowledge into market for themselves. Therefore, in order to solve most of the social problems, it is essential to actually make products and services based on new knowledge, by cooperation between academia and industry.

In this paper, function of intellectual property and technology transfer in social implementation of new knowledge is discussed, Japanese policy surrounding it is reviewed and future tasks are described.

Function of intellectual property and technology transfer in social implementation of new knowledge

In order to generate innovation by cooperation between academia and industry, the first channel is a “technology transfer” approach in which university-based research findings are transferred to a specific company or institution. The second channel is a “joint or commissioned research” approach in which university researchers undertake research and development by incorporating the needs of a specific company at the stage of setting a research theme. In cases a “university startup” approach in which a startup company is established based on university research findings to pursue further development. In these processes knowledge is exchanged and transferred between industry and academia, through both directions. Knowledge exchange and transfer is also realized when multiple institutions in the

industrial, government, and academic sectors form a research and development consortium as well as when researchers from different sectors provide technical guidance and advice to each other through formal and informal activities.

Whichever of the aforementioned three approaches—i.e., technology transfer, joint or commissioned research, and university startup approaches—is chosen as a channel of industry-academia collaboration, what is of particular concern to a collaborating private-sector company is whether it will be able to obtain an exclusive license to any invention made at its partner university in conducting development of products by using the invention. This is an important consideration for the company in deciding whether to make an investment for development because, even when the company succeeds in product development, it would not be able to secure a sufficient market share and its investment might be wasted if other companies develop the same products. As a prerequisite to enable collaborating companies to obtain exclusive use of university inventions, such inventions must be turned into patent rights. Accordingly, the acquisition of intellectual property such as patent or secrecy is an important factor in considering how to bring industry-academia collaboration to a successful end.

Japanese policy on intellectual property arisen from university¹

(1) Up until the end of the 1980s

In the postwar Japan, there was a strong tendency to perceive industry-academia collaboration in a negative light out of regret for the role played by the wartime partnership between industry, academia, and military during World War II (Odagiri, 2001). During the student movement that began in 1968, industry-academia collaboration became a target of criticism, making it difficult for engineering departments at universities and private-sector companies to engage in joint research (Nakayama, 1995). However, from around the latter half of the 1970s, industry-academia collaboration began to be seen in a positive light within universities as they became aware of the need to develop basic and advanced technologies (Odagiri,

² The contents of the Chapter 3 and 4 were partially described in Sumikura (2021) and Sumikura and Yasuda (2021).

2001).

Yet, for many years thereafter, industry-academia collaboration has in no way been carried out efficiently. Postwar Japanese companies were engaging in industry-academia collaboration based, not on an explicit contract mutually agreed upon, but on an implicit understanding, donating research funds to collaborating universities, for instance, in the form of scholarship funds. In other words, it was all left to collaboration at the individual level. Here, it was typically the case that no attempt was made to acquire a patent for an invention resulting from such collaboration or that university researchers transferred their ownership in such an invention to their partner company for free (Watanabe and Sumikura, 2002), which was far from “putting the right invention in the right hands”, i.e., an ideal situation in which university-invented technologies would be transferred to the most appropriate company. Kneller (2003) notes as follows: “While the only data available on technology transfer via donation funds are those based on survey studies on inventions arising under various types of research funding in specific fields, such data suggest that a significant number of university-invented technologies are transferred informally to the private sector. More specifically, approximately 90% of inventions resulting from engineering research are passed informally to the private sector without being reported to university invention committees”.

Prior to 2004, when Japanese national universities were transformed into national university corporations as discussed later, rights to inventions made in national universities were vested in either the government or individual inventors. In the 1970s, detailed discussions took place on rules for the handling of inventions made in national universities. Then, in 1978, then Ministry of Education, Science and Culture issued a notice stipulating that “inventions resulting from research performed by using government research funding specifically designated for research projects aimed at the development of practical applications” and “inventions resulting from research performed by using special large-scale research facilities, such as nuclear reactors, nuclear fusion facilities, and accelerators, established by the government for specific research purposes for use in research projects aimed at the development of practical applications” would in principle belong to the nation while all the

other inventions would fall under the ownership of individual inventors.

In accordance with this notice, each university concerned established an invention committee to deliberate on the ownership of each invention reported thereto, i.e., whether it belongs to the nation or individual inventors. Inventions examined by national university invention committees in fiscal year 2001 were mostly assigned to individual ownership, accounting for 86.4%, according to the report by the Ministry of Education, Culture, Sports, Science and Technology (MEXT)’s Intellectual Property Working Group mentioned below.

(2) From the 1990s onward

Following the burst of the economic bubble in the first half of the 1990s, the Japanese economy fell into a serious situation. In response to this situation, the government began in 1995 to allocate budgetary resources to support research and development at universities with an eye to creating new industries and thereby achieving economic development (Kobayashi, 1998; Nishimura, 2003).

In November 1995, the Basic Act on Science and Technology was enacted, followed by the adoption of a Cabinet decision in July 1996 to approve the First Basic Plan for Science and Technology. Then, in the latter half of the 1990s, the government implemented policy measures for industry-academia collaboration in the face of rising expectations on universities as a source of technological innovation to achieve economic revitalization as well as of growing calls for bringing the benefits of research findings—i.e., the results of research carried out by using massive public funds amid the economic stagnation—to society.

It was in 1998 that Japan introduced technology licensing organizations (TLOs; this term is used as a generic reference for licensing organizations, including those in the United States, where such an organization is more often referred to as the “office of technology licensing” or “OTL”) as a symbolic vehicle for promoting the patenting of university inventions. The Act to Facilitate Technology Transfer from Universities to the Private Sector (commonly known as the “University Technology Transfer Promotion Act”) enacted in the same year set forth conditions that must be met to be approved by the government as an “approved TLO”. In 1998, the first

four organizations were designated as approved TLOs under this law.

Inventor faculty members may file patent applications or grant a license for their inventions on their own. However, since most university faculty members are not equipped with necessary know-how to do so, there needs to be an organization that determines whether a patent application should be filed and take care of patent application and licensing procedures on behalf of inventor faculty members. TLOs are meant to fulfill this role. As their name indicates, the primary function of TLOs is to transfer technology from universities to private-sector companies. Typical activities undertaken by a TLO include: acknowledging the presence of inventions upon receiving reports from university laboratories; deciding whether to file patent applications for inventions; filing patent applications with the help of an external agent such as a patent attorney; selling patented or patent-pending inventions to specific companies; and concluding licensing agreements with licensee companies. Licensing revenue is distributed in a fixed proportion among parties concerned—i.e., the university, department, laboratory of inventor, inventor, etc.—after the actual expenses incurred by the TLO and its management fees are subtracted. Specialized TLO staff for technology transfer propose business plans based on new technology with the full knowledge of which companies are in need of what sorts of technology. As such, TLOs basically play the role of facilitating the flow of academia-to-industry technology transfer, which is to transfer university knowledge to the industrial sector. In addition, some TLOs are, in effect, also serving in such role as introducing suitable university researchers to companies in accordance with their needs and supporting the establishment of university startups.

In 1999, the so-called Japanese version of the Bayh-Dole provision was introduced as Article 30 of the Act on Special Measures for Industrial Revitalization, setting forth that intellectual property rights arising from government-funded, commissioned research and development projects may be brought under the 100% ownership of the commissioned contractor, provided that the contractor fulfills certain conditions. Specifically, the commissioned contractor is required to agree to: i) report to the government any results obtained in the research project; ii) grant

the government the right to use intellectual property resulting therefrom without charge if the government finds it necessary to use it for the public interest; and iii) grant a third party the right to use such intellectual property upon request from the government in cases where the contractor has not utilized it for a considerable period of time. However, this provision was not applicable to national universities as they had not yet been incorporated at the time. Thus, the right to obtain a patent for an invention made in a national university was given to either the inventor or the nation, and it was left to the university's invention committee to determine whether the right should be given to the inventor or the nation. The system in place at the time was designed in such a way that a university, as an organization, was unable to own and manage patents. Subsequently, the Japanese version of the Bayh-Dole provision was incorporated into Article 19 of the Industrial Technology Enhancement Act in 2007.

In 2002, the Intellectual Property Strategy Outline and the Intellectual Property Basic Act were established. Article 13 of the law calls for, among other things, “improving systems in universities, etc. to utilize human resources that have expert knowledge on intellectual property and improving such proceedings pertaining to registration for establishment on intellectual property”. In July 2003, the Intellectual Property Strategy Headquarters, which had been established in March 2003 pursuant to the law, announced a strategic program to be discussed later.

In 2002, the Ministry of Education, Culture, Sports, Science and Technology (MEXT)'s Intellectual Property Working Group examined how the rules for the ownership of patent and other rights should be redefined and how patents should be managed following the expected incorporation of national universities. In its report published in November 2002, the working group noted as follows: “Universities, as a universal good for human society and a social good that changes with time, need to work head on to contribute more directly to society, making it its third mission, in addition to the existing primary missions of providing education and engaging in academic research”. Also stating that intellectual property rights, etc. should, as a general rule, be placed under institutional ownership, the report blazed a trail toward the incorporation of national universities a

year and a half later.

July 2003 turned out to be a historic turning point for Japanese national universities. On July 8, 2003, the government's Intellectual Property Strategy Headquarters announced the Strategic Program for the Creation, Protection and Exploitation of Intellectual Property. The very next day on July 9, a bill for the incorporation of national universities was approved and passed into law at the plenary session of the House of Councillors. Then, on July 15, the MEXT announced 43 institutions selected as subject to the government's project for promoting the establishment of university intellectual property headquarters. The enactment of the National University Corporation Act, effective from April 2004, paved the way for national university corporations (NUSc) or incorporated national universities to own and manage intellectual property rights on their own. Thus, national university corporations began to manage intellectual property by setting up university intellectual property headquarters, etc. within their organizations.

(3) University intellectual property headquarters and TLOs

While some of the TLOs approved were regional TLOs engaging in the management of technology transfer from universities in specific regions to the industrial sector, others were providing services only to specific universities. Thus, there were cases where a TLO as an external organization was in place along with intellectual property headquarters as an internal organization within a single university, with both organizations staffed by those playing a coordinating role for industry-academia collaboration. Ideally, it was hoped that those two organizations would work in collaboration to promote technology transfer both efficiently and effectively, while clearly demarcating their respective functions.

For instance, the university intellectual property headquarters may undertake the tasks of (a1) setting internal rules such as intellectual property policy, regulations for employee inventions, and conflict of interest management policy, (a2) serving as a point of contact in case of any trouble associated with the recognition of inventors, conflicts of interest, etc., and (a3) receiving reports on inventions from inventor researchers, while the TLO may fulfill the

tasks of (b1) filing patent applications in collaboration with an external patent attorney, (b2) serving as a point of contact for companies to sell the seeds of technology developed by university researchers, and (b3) negotiating with prospective licensee companies to conclude licensing agreements. Among them, starting with the report on invention, filing patent applications, selling technologies, and negotiating licensing agreements are an inseparable process, thus require close communication between the university intellectual property headquarters and the TLO. The same is the case when making decisions over whether to file patent applications for inventions as well as when responding to requests from companies for the seeds of technology. Even if either of the two organizations has the final say, things would not go well unless they closely collaborate and share information as needed. In addition to university intellectual property headquarters and TLOs, other offices and units within universities—such as those serving as a contact point for concluding joint research agreements and managing external research funds, and providing support to university startups—are also deeply involved in the process of industry-academia collaboration. It was necessary to implement management that would effectively prevent the undesirable effects of such compartmentalization. However, it appeared that some universities had difficulty making a clear demarcation of functions across those organizations. After years of trial and error, most universities have by now clarified the division of roles and eliminated overlaps in functions across different organizations through their consolidation and realignment.

As of September 2021, there were 32 approved TLOs, of which 21 are non-university entities such as joint-stock companies and incorporated foundations while the remaining 11 are organizations within universities.

Future tasks

Nakayama, Hosono, and Tomizawa (2017) developed a patent application database covering inventions by national university researchers by taking a multi-layered approach including the search of applicants for patent applications filed by universities, TLOs,

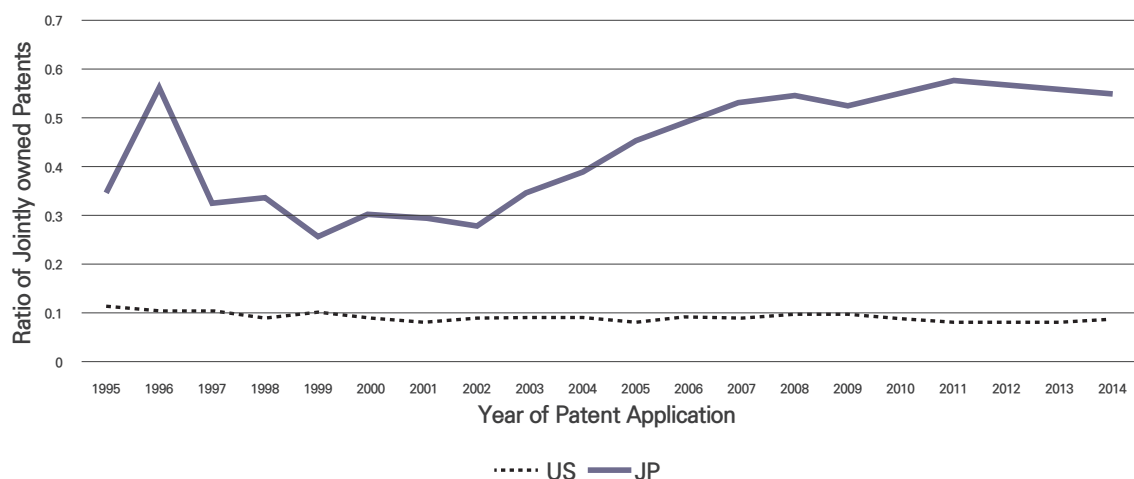
and funding institutions as well as the extraction of applications based on inventor's address and by identifying inventors. According to this database, the number of patent applications filed by national universities increased significantly from 1999 to 2006 but has been almost flat since then. The ratio of patent applications filed solely by national universities has been on an almost consistent downward trajectory since 1999. Meanwhile, on the other side of the same coin, the ratio of joint applications by national universities and their partner companies has been on an almost consistent upward trajectory, accounting for 50% or more in 2007 and thereafter.

As such, it has become a common practice for universities and collaborating companies to file joint patent applications for inventions resulting from their joint research, shifting from the situation in which research funds were provided by collaborating companies typically in the form of scholarship funds and patent applications for the resulting inventions were filed solely by the funding companies while the university researchers only had their names listed as inventors. This can be seen as progress in that industry-academia collaboration, which used to be carried out somewhat informally, has been formalized with universities involved systematically. However, as we may recall, the original purpose of an intermediary

for industry-academia collaboration is to find good matches for university inventions or to put the right invention in the right hands by specialized staffs, those who understand the nature of university inventions and the needs of the industrial sector, keeping good communication with collaborating companies. And seen in this light, the current situation—in which so much time is being spent on filing joint patent applications for inventions resulting from existing joint research activities, i.e., work that would not create any new match, in the majority of patent applications—may be considered as a sort of unexpected turn of events.

Sugai, Sumikura, et al. (2018) compared Japanese and U.S. universities in the ratio of patent applications filed joint with collaborating companies, using patent data from the April 2018 version of Patstat. We examined patent applications filed in the period from 1995 to 2014 based on the earliest filing date in a family of patent applications (i.e., a set of patent applications filed in multiple countries for an identical invention). The results are plotted in Figure 1. The ratio of joint applications has been significantly higher in Japanese universities than in their U.S. counterparts. Here again, it is shown that more than half of the patent applications filed by Japanese universities are being filed jointly with collaborating companies.

Figure 1 Chronological Change of the Ratio of Joint Ownership between University and Industry in University Patents in US and Japan.



Meanwhile, the ratio of such joint applications in total patent applications filed by U.S. universities has been around 10% throughout the period examined. In the United States, a common practice is to entitle universities to sole ownership of patent rights resulting from joint research with companies, while the partner companies are given the first refusal right, i.e., the right to decide whether or not to enter an exclusive licensing agreement prior to other potential licensees. It is considered desirable to have such a practice take root in Japan. For companies, it would eliminate the need to feel obligated, for the sake of partnership, to file joint patent applications for inventions resulting from joint research even when they find such inventions of no use in their business. It would also facilitate better utilization of research findings by enabling universities to sell their inventions to other companies once their partner companies have determined that such findings are of no use for them. In reality, however, as there is a limit to the budget universities can spend on filing patent applications, it is inevitable to ask their partner companies to bear the cost of patent applications by filing joint applications. Thus, it is necessary to work out a better institutional design. It is hoped that sole ownership of patent rights by university would be promoted, aiming at decreasing the number of unused patents that is jointly owned by university and industry and at facilitating start-ups to use and make a development on university patents. Reflecting this situation, Intellectual Property Strategic Program 2022 mentions that a guideline on governance of university intellectual property should be formulated this year, to promote sole ownership of patents by university and utilization of existing jointly-owned patents. This seems to be a reasonable policy trajectory. However, further steps will be needed in future.

As discussed above, the majority of patent applications filed by Japanese universities have been filed jointly with their partner companies, and thus there are many patents owned jointly. In Japan, rules for who can use such jointly owned patents and how are provided for in Article 73 of the Patent Act.

According to the provisions thereof, when a patent is owned jointly by Parties A and B, 1) each party may make use of the patent without consent from the other party (unless otherwise agreed upon in their contact), but 2) it is necessary to obtain consent from the other

party to assign or license the patent to a third party. This provision is reasonable in that it prevents a patent under joint ownership from being assigned or licensed at the discretion of one co-owner without consent from the other to a company in competition with the other co-owner. However, in a situation where Party A is a company and Party B is a university, there is an asymmetric relationship between the two parties. Universities do not produce or sell any products themselves. Thus, in principle, they do not make use of their patents but just license them to others, that is, universities never have a chance to enjoy the benefit described in 1) above. This has prompted universities to engage in the practice of requesting their partner companies—i.e., those that are positioned to receive the benefit in 1) by practicing patents—to pay monetary compensation referred to as “compensation for non-practice”. However, since the payment of such compensation has no legal ground, companies are often reluctant to comply with such requests. This has been one of the factors making it difficult to build collaborative relationships between universities and companies.

Under the U.S. patent law, when a patent is owned jointly by Parties A and B, either party may make use of the patented invention itself and assign its patent rights to a third party, without consent from the other party. According to court precedents, it is considered established that each of the co-owners of a patent may license it to a third party without consent from the other. As discussed above, in the United States, only a small percentage of university patents are under joint ownership with companies. However, even when a patent for an invention made in joint research is subject to joint ownership, the university can enter into a licensing agreement with any company without any constraints from its partner company. If the company wants to prevent the assignment and licensing of the patent to its rival companies, it needs to conclude an agreement to that effect with the university.

I believe that Japan needs to amend Article 73 of the Patent Act to shift to a system that allows each co-owner of a jointly held patent to assign and license the patent to a third party without consent from the other co-owner. Then on that basis, universities should be able to grant their rights to assign and license jointly held patents to their partner companies, which would then be required to pay certain amounts of money in

compensation. This would provide legal grounds for companies to make payment to universities and better contribute to the development of harmonious and healthy industry-academia relationships and hence to the sustainable development of industry-academia collaboration in Japan, that is, compared to relying on the payment of “compensation for non-practice” with little legal grounds.

References

- JST-CRDS (2022). STRATEGIC PROPOSAL: Promotion of Mission-oriented Science, Technology and Innovation Policy and Research and Development Funding in Japan, CRDS-FY2022-SP-01 (in Japanese)
- Robert Kneller (2003). US-Japan Comparison of Industry-Academia Cooperation, In: Akira Goto and Sadao Nagaoka (Eds.), *Intellectual Property system and Innovation*, pp.51-99, University of Tokyo Press (in Japanese)
- Shin-ichi Kobayashi (1998). Change of Knowledge Production system and Science Policy, *Bulletin of Institute for Higher Education*, 16, 52-62 (in Japanese)
- Larrue, P. (2021). The design and implementation of mission-oriented innovation policies: A new systemic policy approach to address societal challenges, *OECD Science, Technology and Industry Policy Papers*, No. 100, OECD Publishing, Paris.
- Shigeru Nakayama (1995). *Post-war History of Science and Technology*, Iwanami-shinsho. (in Japanese)
- Yasuo Nakayama, Mituaki Hosono, and Hiroyuki Tomizawa (2017). *Comprehensive Survey on Patent Applications Based on Inventions by National University Researchers*, NISTEP RESEARCH MATERIAL, No.266, National Institute of Science and Technology Policy, Tokyo. (in Japanese)
- Yoshio Nishimura (2003). *Industry-Academia Cooperation*, Nikkei BP. (in Japanese)
- Hiroyuki Odagiri (2001). Role of University in Technological Innovation in Japan, In: Masahiko Aoki et al. (Eds.), *University Reform: Problems and Issues*, 117-134, Toyokeizaishinpo-sha. (in Japanese)
- Naito Sugai, Koichi Sumikura, Yuta Fukudome, Hiromi Nagane and Kanetaka Maki (2018). *Analysis of Patents in Japan and US Focusing on Star Scientists*, *Proceedings of the 16th Annual Conference of Intellectual Property Association of Japan*, 1E11. (in Japanese)
- Koichi Sumikura (2021). Transfer of the Knowledge Originated from University, *The Journal of Science Policy and Research Management*, 36, 271-289. (in Japanese)
- Koichi Sumikura and Satoko Yasuda (2021). Knowledge Production in University and its Transfer, In: Jun Suzuki, Satoko Yasuda and Akira Goto (Eds.), *Transformation of the National Innovation System of Japan (145-178)*. Yuhikaku. (in Japanese)
- Toshiya Watanabe and Koichi Sumikura (2002). *TLO and Licensing Associates*, BKC. (in Japanese)