EU-Japan Centre for Industrial Cooperation

Japan's Technology Transfer System: Challenges and Opportunities for European SMEs

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Executive Summary

This work has two major objectives. Firstly, to investigate the technology transfer system in Japan and understand its nature, and characteristics by highlighting its strengths, and weaknesses. Secondly, the study aims at being a practical tool, especially for European SMEs (but not just for them), to lower the barriers for the realization of an effective technology transfer pathway when seeking available technologies from Japanese universities and research institutions.

The research for the drafting of this report has been split evenly between the retrieval, and analysis of the existing literature, and in-person meetings, through interviews with key people that operate in the IP Japanese system in academia, and in public research organizations. Several public meetings and conferences concerning the role of IP in Japan have also been attended during the course of the study.

The Japanese tech transfer system as a whole may be on the right track to potentially achieve in the medium term (i.e. 5-10 years) results (especially in terms of licensing revenues) that could be in line with those reported by the U.S. only if the international licensing activity, and a tendency to license-out technologies to spin-off companies will be further developed. The entire ecosystem covering the generation of potential innovations is quite unique as the assistance and services offered by governmental entities in Japan cannot be found anywhere else in the world. Any company or research institution in Japan can benefit from an unparalleled spectrum of services and wealth of information (in some cases even in English), which is second to none. It is clear, though, that in terms of licensing activities, domestic partners are still privileged, and they constitute the major source of the generated licensing revenues. What also appeared clear from most of the interviews is that there is an absolute willingness to operate internationally to find potential licensees or assignees for the existing available technologies, but marketing efforts and techniques should probably be honed to widen the current outreach.

The analysis of the challenges and opportunities shows that in both cases these exogenous elements relate to the quantity, and quality of information being communicated and to the means used to communicate it. Therefore, an external, centralized repository of information (in English) related to available technologies of universities and research centers might be a viable solution to tackle part of the existing challenges, and to create a smoother and streamlined procedure for favoring tech transfer activities at the international

level.

From the analysis, thus, it also emerged that there are indeed some indicators that could be bettered in the future (e.g. number of spin-offs generated by universities and research organizations, and international licensing activities), but the system, overall, seems to have taken giant leaps since the creation of TLOs in the late ‘90s, and the incorporation of national universities, and the opportunities for foreign entities interested in entering into negotiations to license a technology may grow exponentially, allowing smoother, faster, and borderless deals.

Recommendations for European SMEs concern a suggested change of approach when looking for available technologies by turning a general passive approach into a more proactive one. Finally, recommendations for Japanese universities and research centers regard the quality of information being displayed to the public that should probably be more easily retrievable (and maybe more visually appealing), and as much as possible available in English.

In appendix, an exhaustive collection of major of IP-related Japanese laws and regulations, and a contact list to be used when trying to reach out to some of the major Japanese TLOs aim at making this report a useful tool for all those interested in i) understanding the technology transfer ecosystem in Japan and its performance and ii) pursuing effective technology searches for licensing-in or buying Japanese technologies stemming from universities and research organizations.

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"Today, we approved the Intellectual Property Promotion Plan 2014. This plan contains revisions to the employee invention system that make it possible for employee inventions to belong to corporations and includes provisions on the strengthening of trade secret protections. I would like to begin making the necessary legal amendments immediately. Additionally, I would like to promote the overseas expansion of excellent Japanese content and work proactively toward building up the Japan brand. In order to properly reflect these various intellectual property measures in the growth strategy, which will soon be revised, and to make Japan a world-leading intellectual property-based nation, I would like to boldly and swiftly implement the necessary legal amendments and reinforce Japan's intellectual property system. I would like to ask for the continued cooperation of everyone in attendance to promote the various measures cited in the Intellectual Property Promotion Plan 2014."

(Prime Minister Shinzo Abe at the meeting of the Intellectual Property Strategy Headquarters at the Prime Minister's Office)[1]

1. Introduction

1.1. Background and Definitions

Defining the boundaries of "technology transfer" is no easy task. In fact, this expression is being used in different contexts to indicate somehow different activities. The most common definition is probably the one used by mass media indicating operations at the large scale that involve the literal transfer of technologies from one country to another. Especially when talking about defense issues, journalists are used to categorize the transfer of military equipment between countries as a technology transfer. Since there is no officially approved or codified definition of "technology transfer", even the mere physical movement of technologies embedded in different products is sometimes indicated as such. For the sake of clarity, it would be appropriate to provide an overview of the different definitions, and select the one that is going to define the boundaries of this work.

Definition	Source
"Technology transfer, also called transfer of technology, is the process of transferring skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among	Wikipedia[2]

[1] *See* http://japan.kantei.go.jp/96_abe/actions/201406/20chizai.html (Last visited, 30 March 2015).

[2] *See* http://en.wikipedia.org/wiki/Technology_transfer (Last visited, 30 March 2015).

governments or universities and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services".	
A technology transfer agreement is: 1. "a technology rights licensing agreement entered into between two undertakings for the purpose of the production of contract products by the licensee and/or its sub-contractor(s), 2. an assignment of technology rights between two undertakings for the purpose of the production of contract products where part of the risk associated with the exploitation of the technology remains with the assignor"	European Commission[3]
"Technology transfer is the process by which existing knowledge, facilities, or capabilities developed under federal research and development (R&D) funding are utilized to fulfill public and private needs".	Federal Laboratory Consortium for Technology Transfer[4]
"Broadly stated, transfer of technology is a series of processes for sharing ideas, knowledge, technology and skills with another individual or institution (e.g., a company, a university or a governmental body) and of acquisition by the other of such ideas, knowledge, technologies and skills. In the context of transferring technologies from the public sector and universities to the private sector, the term "transfer of technology" is sometimes used in a narrower sense: as a synonym of "technology commercialization"	WIPO[5]

[3] *See* Commission Regulation No. 316/2014 of 21 March 2014 on the application of Article 101(3) of the Treaty on the Functioning of the European Union to categories of technology transfer agreements.

[4] According to the official webpage, *"The Federal Laboratory Consortium for Technology Transfer (FLC) is the nationwide network of federal laboratories that provides the forum to develop strategies and opportunities for linking laboratory mission technologies and expertise with the marketplace".* For more info, please see: http://www.federallabs.org/flc/home/about/ (Last visited, 30 March 2015).

[5] Definition provided in the document titled "Transfer of technology", Standing Committee on the Law of Patents, Fourteenth Session, Geneva, January 25 to 29, 2010, 4-5, available at http://www.wipo.int/edocs/mdocs/scp/en/scp_17/scp_14_4_rev_2.pdf (Last visited, 30 March 2015).

whereby basic scientific research outcomes from universities and public research institutions are applied to practical, commercial products for the market by private companies".	

Table 1 – Definitions

The definition chosen in this study for describing the Japanese technology transfer system is the one mentioned in WIPO's cited document whereby, by "technology transfer", it is intended *"a series of processes for sharing ideas, knowledge, technology and skills with another individual or institution (e.g., a company, a university or a governmental body) and of acquisition by the other of such ideas, knowledge, technologies and skills"*. Usually, this process is carried out through licensing activities and assignments, and these two activities have been considered as the main indicator when the performance of research institutions and universities has been analyzed. In fact, only research institutions, and universities have been considered in this work as to the tech transfer activities they have carried out with regard to domestic and foreign entities. Nowadays, another commonly utilized expression is "knowledge transfer", which is a broader concept that indeed encompasses technology transfer together with the management of research collaborations, etc.[6]

1.2. Objectives

This work has two major objectives. Firstly, to investigate the technology transfer system in Japan, and understand its nature, and characteristics by highlighting its strengths, and weaknesses. Secondly, the study aims at being a practical tool, especially for European SMEs (but not just for them), to lower the barriers for the realization of an effective technology transfer pathway when seeking available technologies from Japanese universities and research institutions. Lastly, recommendations to the Japanese research organizations, and universities as well as to European SMEs are being provided.

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[6] For more info on knowledge transfer practices, see also the 2011 report titled *"A Composite Indicator for Knowledge Transfer. Report from the European Commission's Expert Group on Knowledge Transfer Indicators*", available at http://ec.europa.eu/research/innovation-union/pdf/kti-report-final.pdf (Last visited, 30 March 2015).

1.3. Methodology

The research to write this study has been mainly performed in Japan while at Centre for Industrial Cooperation in the last quarter of 2014 and first quarter of 2015, and it embraces prior professional experiences as well. The research in Japan has been split evenly between the retrieval, and analysis of documents and research papers, and in-person meetings, through interviews with key people that operate in the IP Japanese system in academia, and public institutions. Several public meetings and conferences concerning the role of IP in Japan have also been attended.

2. The Japanese S&T and Technology Transfer System: an Overview

2.1. Technology output and management

Japan played and still plays in 2015 a paramount role in the generation of technologies and innovations that have a global impact. It's important to clarify from the outset of this work what is the definition of "technology", as opposed to "innovation". For the purpose of this study, by "technology" it is intended any output generated by universities and research institutions, which might be potentially applicable at the industrial level or be embedded in products or services. Conversely, an "innovation" is a product or service that thanks to (most of the times) marketing efforts, and commercial success becomes recognized in its specific field, and generally appreciated and utilized by consumers. Universities, and research institutions are originators of technologies, which might be *in nuce* innovations, but they are not such until the commercial success is factored in once the technology is being directly or indirectly[7] commonly known, and appreciated in the market.

Japan's technology transfer system is naturally related, and contained within a much broader national scheme, which regards scientific research and technology development, which is at the forefront in terms of Gross Domestic R&D expenditure ("GERD"), and in terms of output, therefore, it is imperative to understand first how this framework surrounding universities and research institutions operates, and then delve into the details and performance stemming from technology transfer activities carried out by universities and research centers. In fact, there is a wealth of entities in charge of favoring the production and exploitation of research results (i.e. intellectual property) that is critical to have a clear view of the process, and activities to better understand the details, and potential ramifications.

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[7] In the case of a technology, which constitutes part or even the backbone of an innovation, but not the innovation as such.

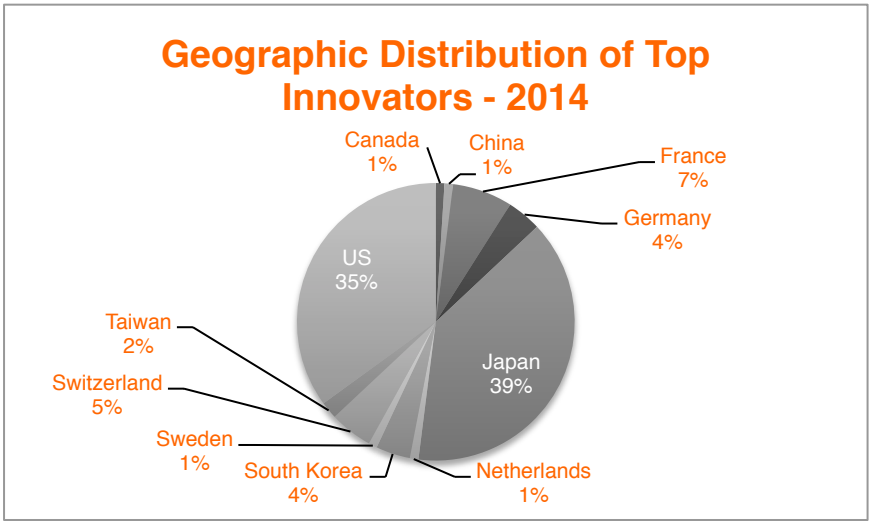

Figure 1- Geographic Distribution of Top Innovators - Source: Thomson Reuters

In terms of technology output, and its deployment at the industrial level, the pie chart above[8] illustrates the results of the latest study carried out by Thomson Reuters on 2014 Top 100 Global Innovators[9] in which Japan plays a dominant role by ranking first with 39 companies out of 100.

Conversely, as far as European patents are concerned, while patent filings at the European Patent Office ("EPO") grew by 3.1% in 2014, the number of applications from Japan reported a decrease of -4.4% in 2014. Nevertheless, the ranking of non-European countries saw the US with 26% of total applications, followed by Japan (18%), China (9%) and Korea (6%).[10] The radar chart here below[11] illustrates how some Japanese

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[8] Data sourced from the Thomson Reuters 2014 Top 100 Global Innovators report, November 2014, p. 12, from the 2014 report, available at http://top100innovators.com (Last visited, 30 March 2015).

[9] While the final methodology used for the study is proprietary, data has been extracted from several proprietary databases owned by Thomson Reuters and then processed according to the following criteria: 1) Volume of inventions; 2) Success of the patent prosecution 3) Global outreach; and 4) Influence. For more information as to the methodology, please see the report, p. 4, available at http://top100innovators.com/pdf/Top-100-Global-Innovators-2014.pdf (Last visited, 30 March 2015).

[10] Press release of February 27, 2015, available at http://www.ag-ip-news.com/news.aspx?id=37485&lang=en (Last visited, 30 March 2015).

[11] For more information as to EPO's 2014 statistics, visit http://www.epo.org/about-us/annual-reports-statistics/annual-report/2014/statistics/applicants.html (Last

corporations are still among the major patent filers at the EPO despite the general decrease in number of applications from 2014.

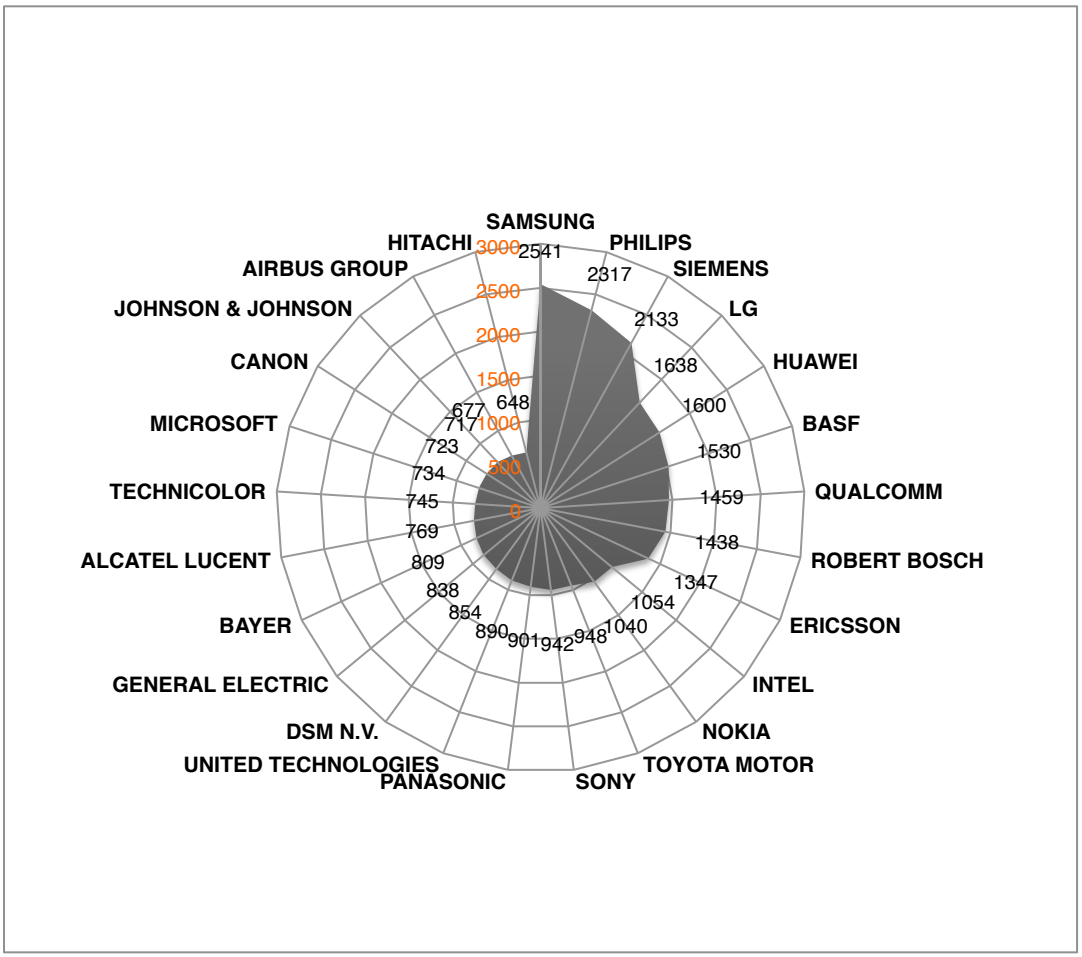

Figure 2 - Top EPO applicants in 2014 - Source: EPO

These are only few of the many indicators in which the great role of the high-tech Japanese industry is acknowledged in terms of research output generation and patenting activities: one of the purposes of this work is also to assess whether this dominance is mirrored by the technology output of research organizations and universities in Japan, and its commercialization.

In terms of domestic filings, it is interesting to note what are the fields of technology most covered by the applications, and confirm what could have been guessed even by a layperson knowing the Japanese industry, that is, that, the top three fields are i) electronics, ii) audio-visual technologies, and iii) optics. The following pie chart represents the shares of

visited, 30 March 2015).

domestic patent applications by top fields of technology in the 1999-2013 period.[12]

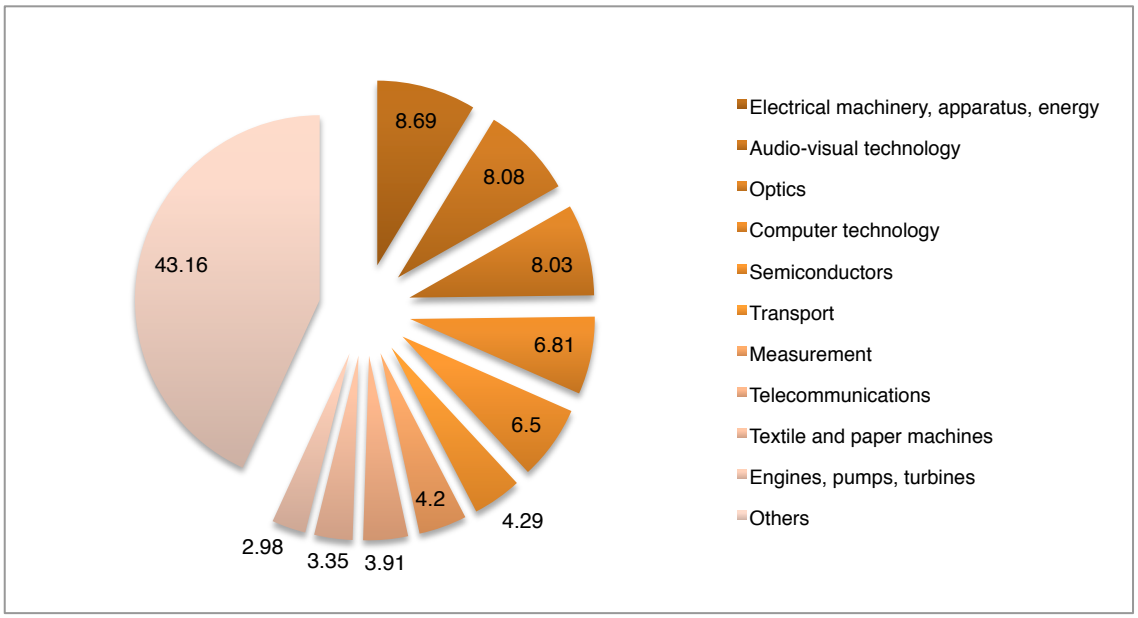

Figure 3 - Shares of patent applications by technology field (1999-2013) - Source: WIPO Statistics Database

In terms of general patent filings, from 2006 Japan has seen a general decline in the number of applications filed with the Japan Patent Office, meanwhile the number of PCT applications increased constantly from ca. 20.000 applications filed in 2004 to ca. 43.000 in 2013.[13]

In the figure below[14] it is possible to have a glimpse of the basic administrative structure supporting the Japanese Science and Technology policy. The astounding number of universities is due to the fact that the number of students per single institution is much lower than the one of European universities. In fact, there are around 3 million university students enrolled in Japan[15] with an average of around 3,800 students per university

[12] For additional statistical data on Japan from WIPO, please visit WIPO Statistics Database at http://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=JP (Last visited, 30 March 2015).

[13] For more information and statistics on the performance of the JPO, please consult the latest version of the Annual Report, available at http://www.jpo.go.jp/shiryou_e/toushin_e/kenkyukai_e/annual_report2014.htm (Last visited, 30 March 2015).

[14] Partly edited slide (no. 27) of Mr. Ema's presentation, obtained during the meeting held at MEXT on 7 November 2015. Please note that the number of universities later on in the report will be higher according to other sources.

[15] For more information and statistics, see the official MEXT's webpage, available at

whereas the University of Rome (La Sapienza) alone hosts more than 100,000 students, for example.

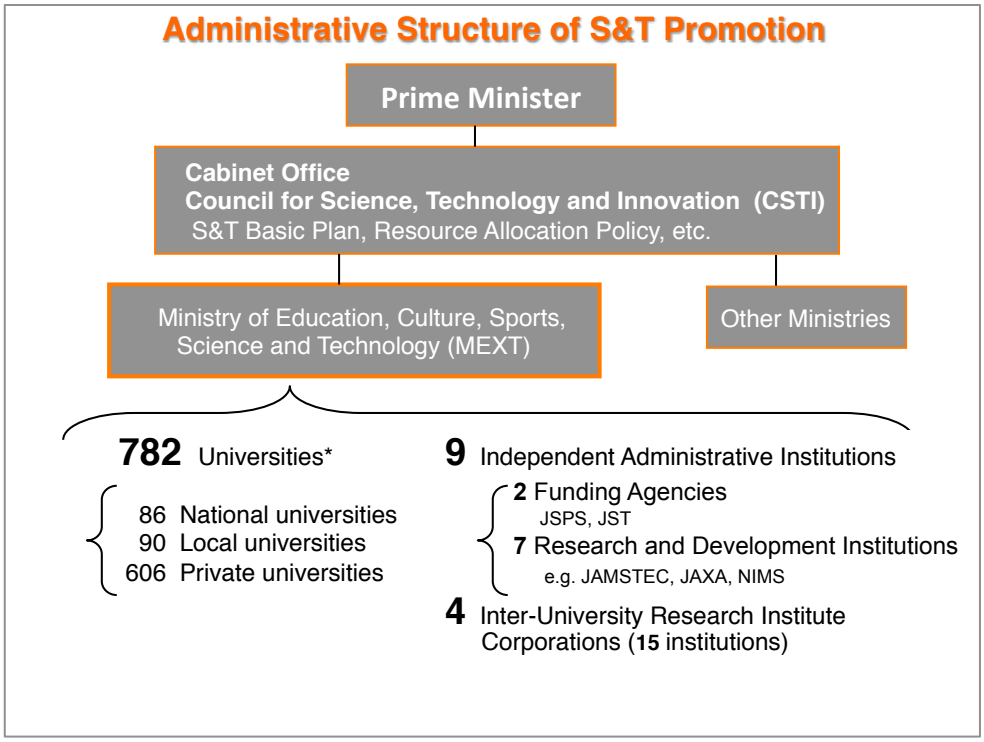

Figure 4 - S&T Administrative structure - Source: MEXT

In Japan, the Science and Technology policy is administered according to the directives and principles contained in the Science and Technology Basic Plan, which is approved every five years according to the "Science and Technology Basic Law" (Law No. 130, effective on November 15, 1995). Currently, the 4rd Science and Technology Basic Plan is about to expire (the basic principles of the 3rd and 4th Basic Plans are reported in the next figure,[16] and the 5th Science and Technology Basic Plan,[17] running from 2016 to 2020, will probably aim at building and/or bettering national innovation systems for the revitalization of Japan and reinforcement of its global competitiveness by looking at the major event of Tokyo Olympics and Paralympics of 2020.

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http://www.mext.go.jp/english/statistics/index.htm (Last visited, 30 March 2015).

16 See *supra* note 14, partly edited slide (no. 6) of Mr. Ema presentation.

17 For more information on the future Basic Plan, see http://www.japanportal.jp/article/432129.html (Last visited, 30 March 2015).

Figure 5 - 3th and 4th S&T Basic Plans - Source: MEXT

The following figure[18] represents the S&T-related budget for 2014, equal to USD 36 billion in which it is clear how MEXT plays a dominant role having at its disposal almost two third of the entire budget.

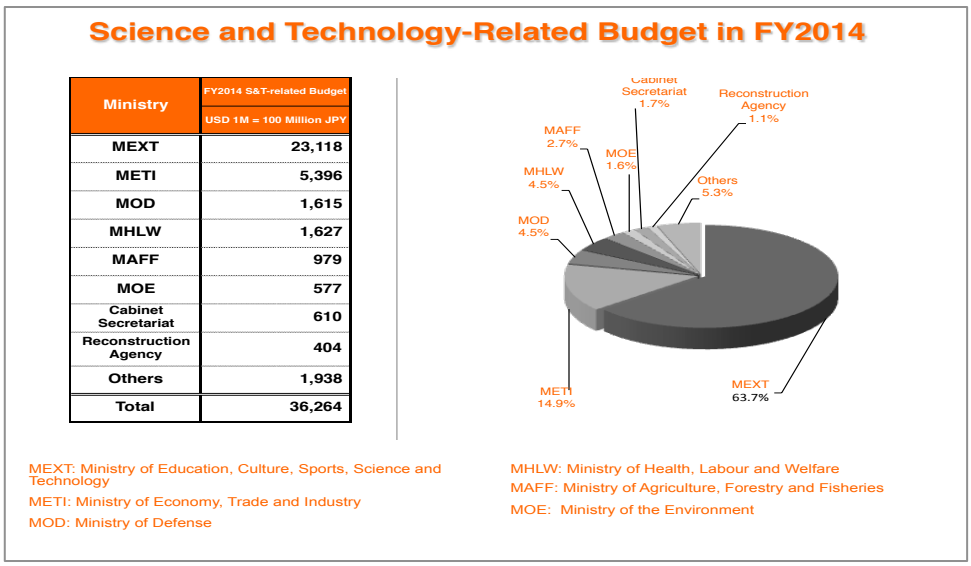

Figure 6 - S&T-related budget - Source: MEXT

18 See *supra* note 14, partly edited slide (no. 5) of Mr. Ema's presentation.

2.2. The Role of Technology Licensing Organizations

There are several legal provisions in Japan that favored and positively affected the existence and development of Technology Licensing Organizations ("TLOs"). A TLO is a peculiar entity in the international panorama of tech transfer institutions, as it will appear clearer later on, therefore it is necessary to provide a comparison with similar entities at the international level, and especially at the EU level, to understand its nature from the outset. In Europe, tech transfer centers or offices, which are usually within universities, and research institutions, might have different denominations, and tasks. The following table[19] will hopefully provide a deeper understanding to move forward.

Name	Tasks/Role
Tech Transfer Office	It is usually in charge of all the activities related to the (i) prosecution of all of the applications concerning patents, designs, etc. generated within the institution, and (ii) commercialization of the IP owned by the institution.
Industrial Liaison Office	It usually has the same functions of a Technology Transfer Office. In some organizations might be a division of a technology transfer office. The main role, as the name suggests, should be to create and manage a liaison between the relevant research institution and industry representatives.
Technology Licensing Organization	It is the Japanese (almost) equivalent of a technology transfer office, but it is characterized for being very peculiar in its legal nature, as it might be internal, external to the organization or a combination thereof.
Knowledge Transfer Office	Knowledge transfer is generally conceived as a much broader activity, if compared to technology transfer since it encompasses other activities on top of the management and licensing of the IP assets owned by the institution.

Table 2 - Definitions, Tasks, and Roles

2.3. Brief History of Technology Transfer, and TLOs in Japan

In the last 20 years the Japanese Government adopted several measures to develop, and streamline the collaboration between universities, industry, and government,[20]

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[19] The list of different offices contained in this table is by no means exhaustive. In fact, there are numerous expressions being used to name offices within universities and research institutions that do what a technology transfer office usually does. On the other hand, the examples provided in the table are the most commonly used.

[20] For additional info as to the numbers related to tech transfer activities with comparisons to the past, please see the presentation of Dr. Nishimura (2013), available at

and the following table aims at offering a short summary of them.

Year	Type of measure and purpose
1995	**The Science and Technology Basic Law:** as previously mentioned, it introduced the promotion of science and technology through effective collaboration among university, university and government under a basic framework. Science and technology efforts are based and regulated by 5-year plans, called Basic Plans, which are drafted according to the principles contained in the Basic Law. Currently, the 4th Science and Technology Basic Plan is in effect from FY 2011 until FY 2015 (ending in March 2015). The current Fourth Science and Technology Basic Plan sets the following as its policy aims: • Realization of sustainable growth and societal development into the future; • Key challenges to the priority issues facing Japan; • Enhancing basic research and human resource development; • Development of policy created together with society.[21]
1998	**Act for promoting technology transfer from universities ("TLO Law"):** in April 1998 the Japanese Diet passed this law whereby the Japanese government would support academia-industry collaborative R&D, and the creation of TLOs in universities in Japan. According to Article 1, *"The purpose of this Act is to contribute to facilitation of the transformation of our State's industrial structure, to the sound development of the national economy and to advancement of learning, as a result of efforts to develop new business fields, improve industrial technologies and vitalize research activities at universities, national colleges of technology, inter-university research institutes and national research and development institutes, etc. by means of measures to promote transfers of research result related to technologies to private business operators (emphasis added)."*[22]
1999	**Act on Special Measures Concerning Revitalization of Industry and**

http://www.eu-japan.eu/sites/eu-japan.eu/files/20130919-Session2-1-Nishimura.pdf (Last visited, 30 March 2015).

[21] To have more information about the Basic Plan and it structure, please see http://www.rieti.go.jp/en/columns/s15_0002.html (Last visited, 30 March 2015).

[22] For an unofficial translation of the Act for promoting technology transfer from universities, see http://www.japaneselawtranslation.go.jp/law/detail/?id=93&vm=04&re=02 (Last visited, 30 March 2015).

	Innovation in Industrial Activities: this law basically introduced into the Japanese S&T system the principles embedded in the Bayh-Dole Act (enacted in the U.S. in 1980).[23] Before the passage of the Japanese Bayh-Dole Act all research results obtained thanks to government funding were owned by the government itself. According to Article 1, "*The purpose of this Act is, in view of the importance of improving productivity for the promotion of the sustainable development of the Japanese economy, as a special measure, to take measures for the facilitation of business reconstruction, management resource reutilization, management resource integration, and resource productivity innovation executed by business operators, while taking into consideration employment stability, and to take measures for the establishment of the Innovation Network Corporation of Japan and for business operations concerning support for specified business activities, measures for supporting the revitalization of small and medium-sized enterprises, and measures for the facilitation of business revitalization, along with promoting the utilization of intellectual property rights on business activities, thereby revitalizing Japanese industrial activities and contributing to innovations in industrial activities in order for Japanese industry to deal with the recent structural changes in the international economy (emphasis added)".* Among other provisions, according to the Act, TLOs were allowed to use national universities facilities free of charge.
2000	**Industrial Technology Enhancement Act:** According to Article 1, "*The purpose of this Act is to further sustainable development of Japanese industries, by clarifying the responsibilities of the national government, local governments, universities and business operators in regard to enhancing the our nation's industrial technology capability, stipulating provisions to form the basis of policies concerning enhancing industrial technology capability, and taking measures to support enhancing industrial technology capability, and thereby to contribute to the stabilization and improvement of the general welfare of the life of the citizens and to the sound development of the national economy."*[24]

[23] Even though it is undisputed that the Bayh-Dole Act in the U.S. has favored an increase in patenting activities of universities and strengthened the relationship with the private sector, in terms of the nature of the relationship with universities, though, it might still be debated whether companies have been more interested in university research because of the change in the ownership provisions or universities actually adopted a more commercialization-driven research approach.

[24] For an unofficial English translation of the Industrial Technology Enhancement Act, see

2001	**Hiranuma plan:** among other suggested reforms, the plan introduced a streamlined procedure for fostering innovation by creating 1000 startups from universities in 3 years through a reform that could facilitate the transfer of technologies from academia to industry.[25]
2002	**Intellectual Property Basic Act:** according to Article 1, "*The purpose of this Act is, for the objective of realizing a dynamic economy and society that is based on the creation of added values through the creation of new intellectual property and effective exploitation of such intellectual property in light of a growing necessity for intensifying the international competitiveness of Japanese industry in response to the changes in the social and economic situations at home and abroad, to promote measures for the creation, protection and exploitation of intellectual property (emphasis added) in a focused and systematic manner by stipulating the basic principles on the creation, protection and exploitation of intellectual property and the basic matters to achieve the principles, clarifying the responsibilities of national government, local governments, universities, etc. and business operators, establishing the Intellectual Property Strategy Headquarters (emphasis added), and providing stipulations on the development of a strategic program on the creation, protection and exploitation of intellectual property."*[26]
2004	**National University Corporation Act:** According to Article 1, "*In order to increase the level of university education and scientific research in our country and to promote a balanced development, while responding to the citizens` expectations with respect to education and research at the university level, this law serves the purpose of making provisions for the organization and administration of both National University Corporations, which establish National Universities and engage in education and research, and of Corporations for Collaborative Organizations of Universities, which establish Collaborative Organizations of Universities and provide for their collaborative use of them by the universities."*[27] In Japan there are three types of universities: 1) national; 2)

http://www.cas.go.jp/jp/seisaku/hourei/data/itea.pdf (Last visited, 30 March 2015).

[25] For more info, please see the informational outline of the Hiranuma plan provided by METI: http://www.meti.go.jp/english/information/data/cPlan010525e.html (Last visited, 30 March 2015).

[26] For an unofficial translation of the Intellectual Property Basic Act, please see http://www.japaneselawtranslation.go.jp/law/detail/?id=129&vm=04&re=02 (Last visited, 30 March 2015).

[27] For an unofficial translation of the National University Corporation Act, please see http://ad9.org/pegasus/znet/docs/TheProposedLaw.pdf (Last visited, 30 March 2015).

	public; and 3) private. The main difference between national and public universities lies in the fact that public universities are run by local governments, either prefectural or municipal.
2006	**Basic Act on Education:** Article 7(1) stated that "*Universities, as the core of scholarship activities, shall cultivate advanced knowledge and specialized skills, inquire deeply into the truth and create new knowledge, while contributing to the development of society by broadly disseminating the results of their activities.*"[28]
2008	**Act on Enhancement of Research and Development:**[29] Article 7 of this Act promotes technology transfer and innovation by providing that universities shall cultivate advanced knowledge while contributing to the development of society by widely disseminating the results of their activities.

Table 3 - Measures Impacting Tech Transfer Activities

Hence, the system basically was subject to a strong revolution in 1998 when the structure of the TLO has been introduced to favor the transfer of research results from university to industry. Before the privatization of universities (occurred in 2004), though, TLOs were dealing with single inventors, who were the owners of the IP generated during their research.[30] From 2004 onwards, after the privatization of national universities, eventually a university could be officially the owner of the IP generated by its researchers when public funding was at stake, and the TLO be the operating arm that performed tech transfer activities on behalf of or together with the university.

Ownership of Inventions Developed in Universities, and Research Institutions

To better understand the history of IP ownership in the Japanese S&T system, it is worth mentioning that before the enactment of the Japanese Bayh-Dole Act, university professors were the sole owners of the research results generated during their research endeavors with the notable exceptions, as already mentioned, of 1) inventions conceived during as a result of specially funded projects, and 2) inventions developed in special research facilities. If compared to the Bayh-Dole Act in the U.S., the Japanese equivalent

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[28] For a provisional English translation of the Basic Act on Education, please see http://www.mext.go.jp/english/lawandplan/1303462.htm (Last visited, 30 March 2015).

[29] No translation available.

[30] Unless the inventions where belonging to two special categories: 1) specially funded inventions; and those conceived within special research facilities. For more information on this topic, please see Takenaka, T., *Technology Licensing and university Research in Japan*, Int.J. of Int. Pro., Law, Economy, and Management, 1 (2005), 27-36.

seems to be far broader as the Act does not provide for any small business preference in terms of licensing activities or domestic industry preference. At the time, the Japanese Bayh-Dole Act did not contain any provision as far as the compensation of inventors was concerned, but this was due to the fact that the Patent Act was already covering this topic. After the introduction of the TLO Law, technologies started being managed by these new offices, and the passage of the Japanese Bayh-Dole Act concerned IP generated from government contracts, in which the university became the owner, but professors were keeping all the rights to the IP in the other cases. In principle, as far as the IP ownership was concerned, Japanese universities were following a MEXT notice that was based on a draft report of the Science Council of 1977.[31] In this report it was made clear that university professors did retain ownership of their research results. In 1978 MEXT adopted this principle by sending out a notice to national universities, which was *de facto* adopted by private universities too[32] whereby universities had to create special committees within the universities that were supposed to meet on a regular basis to evaluate the nature of the inventions that had to be reported by professors to the committees. This procedure was basically abandoned after the privatization of national universities occurred in 2004. In 2002, MEXT established an IP working group that proposed to adopt a new system whereby universities were retaining ownership of the research results generated by their professors so that universities could have managed technology transfer activities. The IP Policy of the University of Tokyo (2004), for example, clearly specifies why technology transfer and university ownership could be beneficial to society:

> *"The greatest mission of a university is to conduct education and research for succeeding generations. At the same time, there is a responsibility to return to society, without delay, the benefits of any results generated by this education and research. These reciprocal interactions with society are of the same importance as education and research. To facilitate such mutual interactions with society, it is essential to establish and smoothly implement mechanisms to protect, manage, and utilize intellectual property, thereby fostering lively research and allowing the benefits to be returned to the public. This Policy is established to protect and*

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[31] Science Council, *Draft Report for handling patents and other intellectual property Rights in inventions and other subject matter developed by professors and other member of universities*, June 1977.

[32] For a broader description of the process followed by universities between 1978 and 2004, see *supra* note 30, 30.

promote the effective use of intellectual property relating to knowledge created at the University of Tokyo."[33]

Similar words have been used also by Waseda University when advocating the importance between research results and their concrete benefits to society.

"A university is a place for the pursuit of universal truth. At the same time, universities exist relative to the times and society. There is also an expectation of a 'contribution to society,' which could be seen as a third mission, in addition to the missions of education (the development of human resources who will bear the future of society) and academic research (the creation of a variety of knowledge to contribute to the development of culture and civilization). This points to a significant issue: Waseda's intellectual outcomes should be shared with society. Waseda University has been striving to intensify its contribution to society, in particular the construction of smooth collaborative relationships with industry. Moreover, Waseda is working proactively to secure its rights to its research outcomes and thus establish a new cycle of intellectual creation. In this sense, Waseda's basic policy regarding the creation and utilization of intellectual property is framed in the Intellectual Property Charter."[34]

Most of Japanese universities have adopted similar policies, and each university adopts its on rules to define employee inventions and the compensation in case of successful monetization of research results. As to research institutions, basically the same rule is followed and the employee invention rule is being applied, therefore, special bodies within the relevant institutions are entrusted to assess whether the inventions reported by the faculty members are inventions developed within the boundaries of the employment contract or not.[35] Once the assessment has been carried out, the relevant institution can decide whether to ask the inventor to assign the rights to the invention, but this is an option

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[33] The University of Tokyo Intellectual Property Policy, 1-2, available at http://www.ducr.u-tokyo.ac.jp/en/materials/pdf/UTokyo-IPPolicy.pdf (Last visited, 30 March 2015).

[34] Intellectual Property Policy and regulation of Waseda University, available at: http://www.waseda.jp/rps/en/alliances/apply/regulation/index.html (Last visited, 30 March 2015).

[35] For example, Article 3 of the University of Tokyo Rules for the Treatment of Inventions defines employee inventions as those "(…) created by Faculty Members through work carried out with publi*c research funds or money or other support from the University, or work carried out using facilities controlled by the University."*

for the institution, which is usually free to decide whether to ask the inventor to make an assignment or not after having considered the nature of the claimed invention.

As far as the compensation of the researchers is concerned, the general principle being applied provides that revenues stemming from the sale or licensing of inventions are shared among the inventors, the relevant lab/department, and the university/research organization itself (represented by its IP Office, for example), based on ratios that vary among different institutions after deducting the costs incurred for filing applications, renewals, marketing activities, etc. The following are some examples of IP policies from three major Japanese universities as far as the inventions developed by their employees are concerned.

Organization	Rule as to employee inventions
The University of Tokyo	**The University of Tokyo Rules for the Treatment of Inventions (Revised Version, 2007)**[36] *4. Principle of Organizational Ownership* *"4.1.* ***The University may succeed to the right to obtain a Patent of an Employment-related Invention made by a Faculty Member*** (emphasis added). *4.2. If an Employment-related Invention has two or more Inventors, the University may succeed to the Faculty Member's share of the right to obtain a Patent.* *4.3.* ***If the University decides that it is not necessary to succeed to the right to obtain a Patent of an Employment-related Invention, the right may belong to the Faculty Member concerned*** (emphasis added). *4.4. A Faculty Member who has made an Invention shall not dispose of the right to obtain a Patent of the Invention by way of assignment or otherwise unless the University has decided not to succeed to such right.* *4.5. If deemed necessary by the University, the University may succeed to the right to obtain a Patent of Other Invention by obtaining the agreement of the Faculty Member concerned.* *4.6. The right to obtain Patents of Other Invention that the University does not succeed to shall belong to the Faculty Member concerned.*

[36] Available at http://www.ducr.u-tokyo.ac.jp/en/materials/pdf/UTokyo-Rule_Invention.pdf (Last visited, 30 March 2015).

	4.7. This Article 4 shall not apply to research results with respect to which it is considered that the exercise of the right to obtain a Patent would not be an appropriate contribution to society."
Waseda University	*"1) All inventions by Waseda faculty while officially conducting research must be reported to the Research Collaboration & Promotion Center. Inventions by students (undergraduate, graduate and post-doctoral students), an invention report must be reported in accordance with the 'Guidelines for Student Inventions.'* *2)* ***After an invention has been reported the Invention Review Committee will deliberate whether it is considered an employee invention or not, and whether the right is inheritable or not*** (emphasis added)***.****The university will decide the management of the invention in accordance with the content of the deliberation by the Invention Review Committee"*[37]
Kyoto University	IP Policy of Kyoto University *1. Intellectual Property Belongs to Institution* *(i) Intellectual Property belongs to Institution in principle* *The title to any invention shall belong to the institution in the case that a researcher makes an invention in the course of his or her duty, using the funds, facilities, equipment and other resources of the institution.* ***Kyoto University shall succeed to the intellectual property right in principle except particular circumstances where the university determines that the right pertaining to intellectual property may belong to the inventor*** (emphasis added). *(ii)Succession to Intellectual Property Right* *In succeeding to intellectual property rights, the institution shall take serious consideration into content and quality, feasible application, and characteristics of each academic field.* *(iii)Rules and Regulations Relating to Intellectual Property Rights* *The institution shall set separate rules and regulations that are necessary for the handling of intellectual property produced within the university.* ***The institution shall also endeavor to secure the rights of researchers as inventors or creators so as to be given incentive for***

[37] From the FAQ section of Waseda University website: https://www.waseda.jp/rps/en/fas/guide/off-campus/i-property.html#anc02 (Last visited, 30 March 2015).

	further efforts on research achievement and help them accomplish their duties, contributing to society through efficient and effective use of intellectual property (emphasis added). *2. Handling of Intellectual Property* *(i)Handling of Inventions* *When an invention is made as a result of occupational research work by a researcher (an employee) of the institution, the inventor shall promptly give notice thereof to the President.[Secretariat; the Kyoto University Business-Academia Collaboration Office] If and when, however, the inventor has judged that applying for a patent is against the intent to contribute to the public interest, the rule above shall not apply. Upon receipt of such notice, the secretariat shall convene an Invention Evaluation Committee and determine whether or not the university will succeed to the right to obtain a patent for the invention, based on the committee's evaluation.* ***With respect to any invention, etc. to which the university has determined to succeed*** (emphasis added)*, the institution is responsible to undertake necessary procedures ranging from application to granting of the right, conduct negotiations on licensing terms and conditions for agreement on technology transfer, and promote its industrial application. All the procedures shall be carried out in an efficient and effective manner in cooperation with technology licensing organizations (TLO) and the likes.* ***In the event that the institution has determined not to succeed to the invention, the right relating to the invention may belong to the inventor*** (emphasis added)"

Table 4 - Employee Inventions Policies

Approved TLOs

TLOs might have different forms. An approved TLO is the one whose plans for the implementation of technology transfer operations has been expressly authorized by the Ministry of Education, Culture, Sports, Science and Technology ("MEXT"), and the Ministry of Economy, Trade and Industry ("METI") according to the provisions set forth in the Act for promoting technology transfer from universities (TLO Law).[38]

Not all TLOs must be approved, but those that are approved benefit from several measures to better carry out tech transfer activities. The following is a non-exhaustive list of

[38] For additional information as to the features of approved TLOs, see http://unitt.jp/en/tlo/approved.

such benefits:

1) **Public Grants for technology transfer activities:** TLOs can receive grants, especially from (METI), for the approved activities. The admissible costs can comprise the following:
   a) Costs for the evaluation of technologies;
   b) Costs for filing applications in foreign countries;
   c) Costs for the dissemination of results;
   d) Costs for mentoring;
   e) Personnel costs for specialists.
2) **Industrial Structure Improvement Fund:** TLOs can receive loan guarantees for performing operations related to the approved plans thanks to the Industrial Structure Improvement Fund;
3) **Fees reduction for patent applications filed by TLOs**: the annual renewals, and examination fees related to applications related to TLOs' approved operations are reduced by 50%;
4) **Free use of university facilities:** approved TLOs can use university facilities free of charge for performing their activities;
5) **Support from technology transfer specialists:** approved TLOs may receive such support from technology transfer experts, from the National Center for Industrial Property Information and Training ("INPIT");
6) **Allowing faculty members of national universities to become TLO directors:** faculty members of national universities are allowed to serve as TLO directors as side business.[39]

Accredited/certified TLOs

Beside the approved TLOs, a TLO might also be accredited or certified by the competent Ministry as long as it meets certain requirements pursuant to the TLO law.[40] The certification may be sought also by national research institutes, and independent

[39] *Ibidem.*

[40] For more information as to the features of certified TLOs, see http://unitt.jp/en/tlo/certified (Last visited, 30 March 2015).

administrative institutes.[41] Major benefits for certified TLOs consist of a reduction in the due fees for patent prosecution and other related activities. The following is a non-exhaustive list of the requirements that the TLO has to meet to be certified:

1) It has to be able to professionally embark on technology licensing activities;
2) It has to treat any potential licensee with fairness by avoiding any form of potential discrimination.[42]

Nature of the TLOs

TLOs may also have a different legal nature as far as the relationship with the university/research organization is concerned. Private universities tend to have the TLO as an internal office of the organization whereas national universities, after their privatizations, started adopting three different models:

1) **Outside TLO:** the university collaborates with an external TLO or it establishes one outside the organization;
2) **Internal TLO**: the TLO is created within the organization;
3) **Internalized TLO**: in this case the university decides to internalize the functions of the external TLO by making it internal.

A forth model is the one adopted, for example, in the Kansai region where the Kansai TLO has been created to support the licensing efforts of several entities and not just one. In fact, this office performs tech transfer activities on behalf of Kyoto University, Kyushu University, Wakayama University, Kyoto Prefectural University of medicine and Okayama University.[43]

TLOs in Japan also differ for the nature of their shareholders and business models.

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41 Independent Administrative Institutions are Japanese organizations that do operate as independent entities from the central government. They have been established after the enactment of the Law for General Rules for Independent Administrative Institutions.

42 See *supra*, note 38.

43 For more info as to the nature and structure of Kansai TLO, please see refer to the relevant section in this report, and the official website: http://www.kansai-tlo.co.jp/english/ (Last visited, 30 March 2015).

Takenaka, in her research[44] on the Japanese tech transfer system, described 4 distinct business models, at least before the privatization of national universities occurred in 2004:

1) **TLO as a corporation:** in which the shareholders were professors and researchers;
2) **TLO as a joint venture**: in this second model TLOs were joint ventures between universities and the private sector;
3) **TLO as a new business model**: in this case, existing companies decided to expand their services by starting a new business model;
4) **TLO as an inter-university organization:** in this model the TLO is the result of cooperation among different universities.

Eventually, it is worth mentioning that there are also other forms of collaborations among TLOs (or similar offices) of several small and medium-sized universities to better leverage their research results. The University Consortium for International Intellectual Property Coordination ("UCIP")[45] offers one successful example of this kind of approach. The establishment of UCIP was based on the assumption that smaller universities cannot afford to enter into global industry-academia-government collaboration schemes, therefore, for the promotion of such schemes, UCIP has been created to provide several services to foster international cooperation and better the dissemination of research results. UCIP's main objectives, and the tools to achieve them are summarized in the following table.[46]

Objective	Tool
Joint human resource development for dealing with IPRs at the international level	• E-learning • Inviting specialists to seminars as lecturers • Overseas training, etc.

[44] See *supra* note 30, 32.

[45] For more information on UCIP, see http://www.ucip.jp/modules/tinyd0/index.php?id=5 (Last visited, 30 March 2015).

[46] For more information, see http://www.ucip.jp/modules/tinyd0/index.php?id=5 (Last visited, 30 March 2015).

Sharing IP-related info and other relevant info	• Creation of repositories for templates (e.g. contracts and forms) • Creation of documents and databases mentioning best practices, international trends, etc.
Increasing the value of overseas branches	• Collaboration with overseas branches • Promotion of international industry-academia-government collaboration

Table 5 - UCIP's Objectives – Source: UCIP

2.4 Performance-related Data of the Japanese Tech Transfer System

As it happens in almost every highly industrialized country/region of the world, Japan is no exception as it also features an organization in charge of monitoring the Japanese tech transfer system and national network. This entity, called University Network for Innovation and Technology Transfer ("UNITT"), was established with the idea promoting potential partnerships between academia and industry and *"through these activities, UNITT also aims to contribute to the development of Japanese academia, the advancement of technology in Japan, and the development of Japanese industry*".[47]

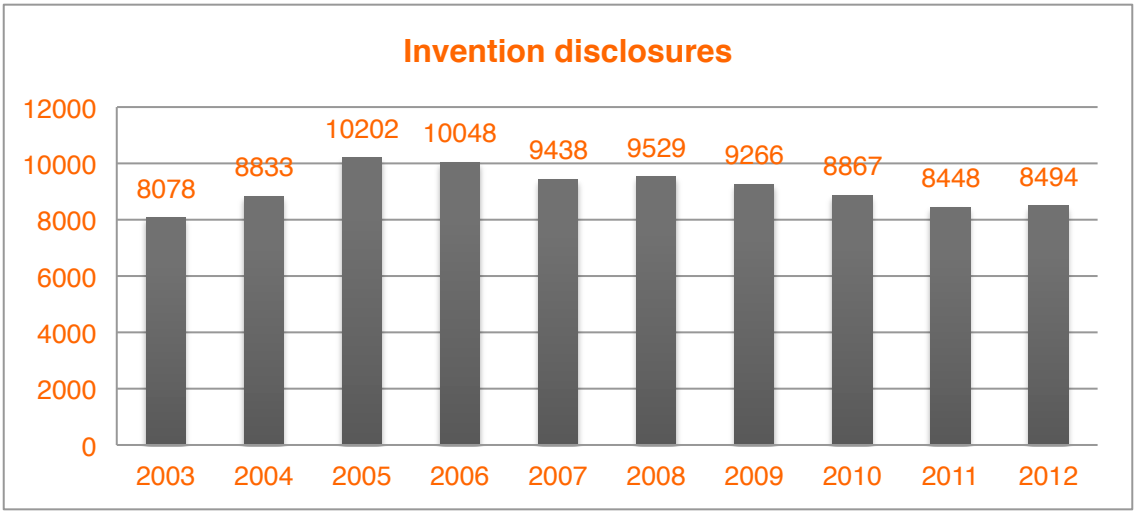

Figure 7 - Number of Invention Disclosures - Source - MEXT

The charts above and below provide[48] figures as to the number of invention

[47] See UNITT's general presentation at http://unitt.jp/en/about (Last visited, 30 March 2015).

[48] From the power point presentation titled "Technology Transfer Activity of Universities and TLOs in Japan" of June 6th, 2014, referring to all Japanese universities, handed out during the interview at UNITT.

disclosures, and patent applications filed[49]by the surveyed sample (by MEXT) in the period 2003-2012. From a comparison with the U.S., it has been noted[50] that the ratio between the invention disclosures and subsequent filing of patent applications (i.e. the filing ratio) is close to 76% in Japan[51]as opposed to ca. 60% in the U.S.

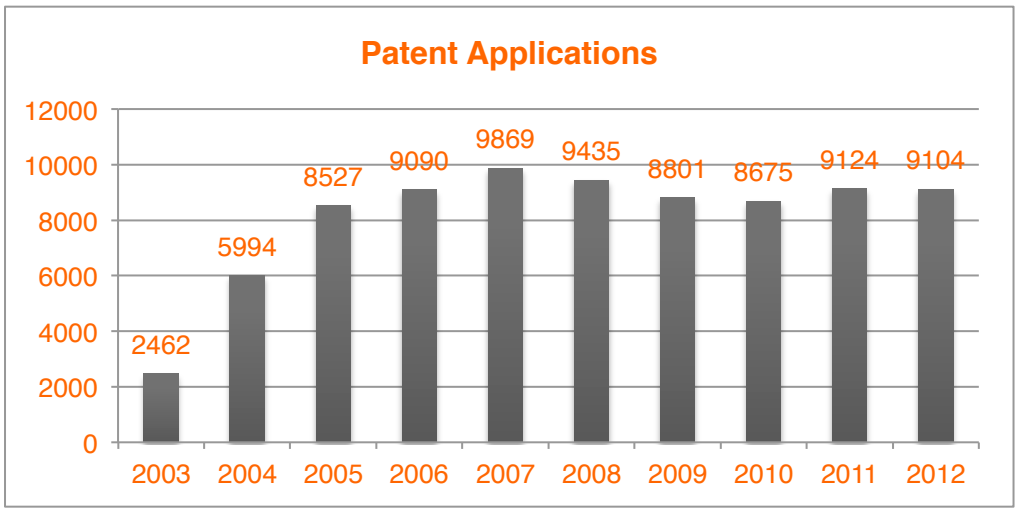

Figure 8 - Total number of patent applications (national and international) - Source: MEXT

As to the total number of issued patents, UNITT reports from its 2012 survey that the number peaked 4831 units, therefore extremely close to the U.S. performance (as shown later in this section). The main highlights of UNITT's survey[52] for FY2012 are the following:

- 100 respondents
- 7619 invention disclosures
- 6368 new patent applications filed
- 4831 issued patents
- 2298 licenses executed
- 6883 active licenses
- 21 startup companies formed

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49 See *supra* note 48, slide 24.

50 *Ibidem,* slide 24.

51 This number refers to all Japanese universities, but the average of the sample surveyed by UNITT scored 83.6%.

52 Which regards a much smaller sample: 100 respondents, 13 TLOs, 86 universities, and 4 public research organizations, and that is why some figures differ from those in Figure 7 and 8.

- JPY 2.28 billions[53] in licensing revenues

To make a comparison, and assess the magnitude of the research output and commercialization results of universities, it can be extremely worthwhile to consult the Association of University Technology Managers' ("AUTM") annual surveys. For example, in the 2013 Licensing Survey, AUTM reported the following highlights:[54]

- 186 respondents
- 24,555 total U.S. patent applications filed
- 14,995 new patent applications filed
- 5,714 issued U.S. patents
- 5,198 licenses executed
- 1,356 options executed
- 469 executed licenses containing equity
- $63.7 billion total sponsored research expenditure (FY2012)
- 818 startup companies formed
- 4,206 startups still operating as of the end of FY2013
- USD 2.6 billion in licensing revenues (FY2012)

Comparing the performance of the US with Japan by looking at some of these numbers might not give justice to the work performed by the universities and their TLOs, (in the U.S. the number of patents issued to universities in the last 50 years showed almost a sixty-fold increase)[55] even though in some cases they compete head to head like for the number of domestic patents issued in which Japan ranks first for having more patents issued per single institution compared to the U.S. sample (100 respondents v. 186). Two major observations should be made at this point looking at the figures. First, in terms of entrepreneurial activity of faculty members, it's no surprise that the US features 818 new startups being the "capital" of entrepreneurship as opposed to Japan, which is way more

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[53] Around $19 million as of March 2015.

[54] Full survey available at: http://www.autm.net/FY_2013_Licensing_Activity_Survey/14317.htm (Last visited, 30 March 2015).

[55] Comparing two systems (and their performance) that are very far apart in terms of implementation dates, and practice might be misleading. In fact, the US underwent an astonishing growth in the last 50 years and universities were able to create a much larger portfolio of technologies, and execute way more license agreements than the Japanese ones because they started owning IPRs only from 2004.

conservative in this regard.[56]

Second, probably the most interesting comparison is the one referring to the revenues generated by the universities. In this regard, the JPY 2.28 billion reported by UNITT's 2012 survey, constitute less than 0.75% of the revenues reported in the AUTM's 2012 survey. It has to be noted, though, that remarkable improvements in the licensing performance has been made in Japan where the licensing ratio (i.e. the number of license/option agreements vs. the number of patents/applications in the portfolio) rose from 15.3% of 2006 to 30.2% in 2012[57]. Moreover, the number of active licenses is proportional to the licensing income as well, and according to the mentioned UNITT's survey,[58] in the US, a sample of 186 universities reported in 2011 that the number of active licenses in their portfolio was equal to 38,600, therefore, around 6 times the number reported by Japanese TLOs (i.e. 6,883, in 2012). Since (national) universities in Japan started managing IPRs in full from 2004, it might be safe to say that there is still room for the whole tech transfer ecosystem to improve its performance in terms of licensing revenues in the next 5-10 years and near the results of U.S. universities, especially if international licensing activities and spin-off creation will be further developed.

The following charts provide some performance results of the Japanese tech transfer system, from 2012 back to 2008. UNITT's surveys are the result of data, directly collected by UNITT, and the 100 respondents of the 2012 survey were divided into public research institutions (4), TLOs (13), and universities (83). The overall number of existing universities in Japan is around 1,000, but the 100 respondents surveyed by UNITT account for almost 75% of the national output in terms of IP output according to UNITT.[59]

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[56] In fact, according to the mentioned UNITT's survey, just 16.9% of the surveyed sample spun off new ventures from technologies developed within the university as opposed to 75.9% of U.S. universities.

[57] See *supra* note 48, slide 28.

[58] *Id.,* slide 37.

[59] Most of the information regarding UNITT has been acquired from the interview had with Mr. Fukuda, Secretary General of UNITT on 7 October 2014.

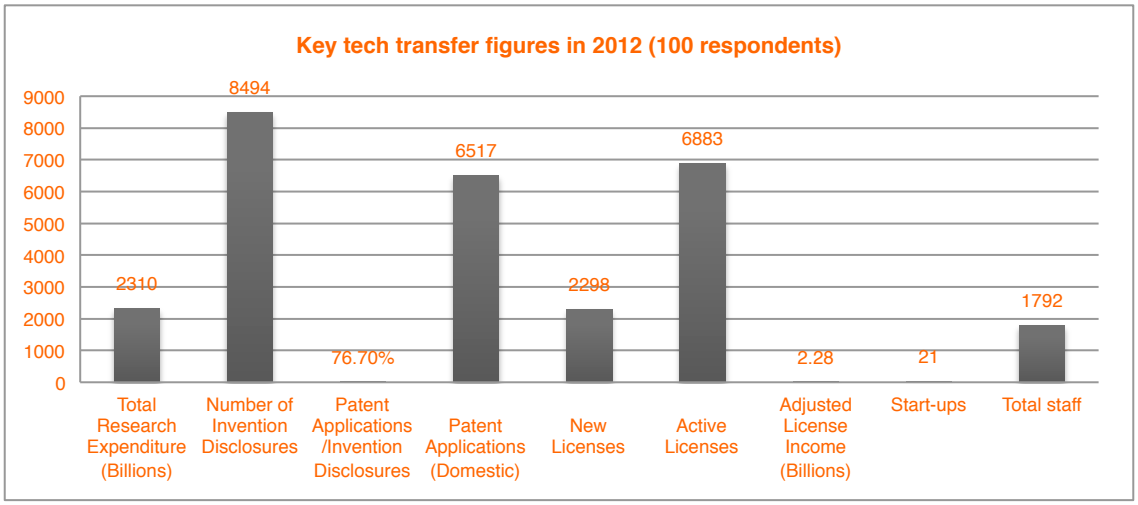

Figure 9 - Key tech transfer figures in 2012 – Source: UNITT

By looking at the previous[60] and following charts,[61] it can be observed that in terms of research expenditure, its magnitude stays pretty constant, which is also a sign of the stagnant past years for the Japanese economy on top of the general economic downturn.

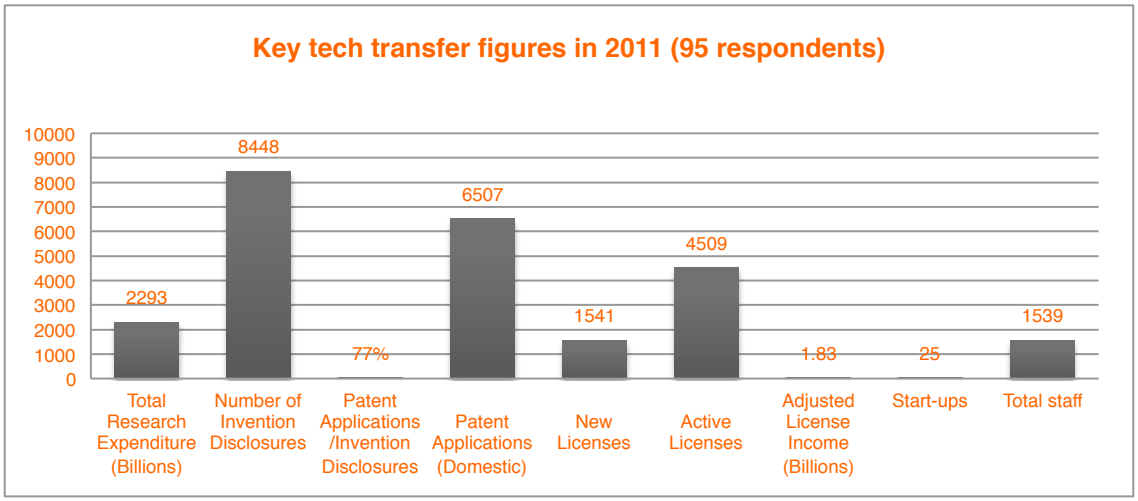

Figure 10 - Key tech transfer figures in 2011 - Source: UNITT

On the other hand, it is interesting to note that the number of invention disclosures declined from 2008. This decrease in the "production" of innovative ideas though has to be considered in conjunction with the next performance indicator in the charts, that is, the ratio between submitted invention disclosures and filed patent applications. It is clearly inferable

60 See *supra* note 48, slide 38.

61 *Ibidem.*

from the charts that this number increased steadily up to the outstanding 76.7% ratio, which means that out of 100 claimed inventions reported by researchers to the competent office, in almost 77 cases, the relevant institution has applied for a patent.

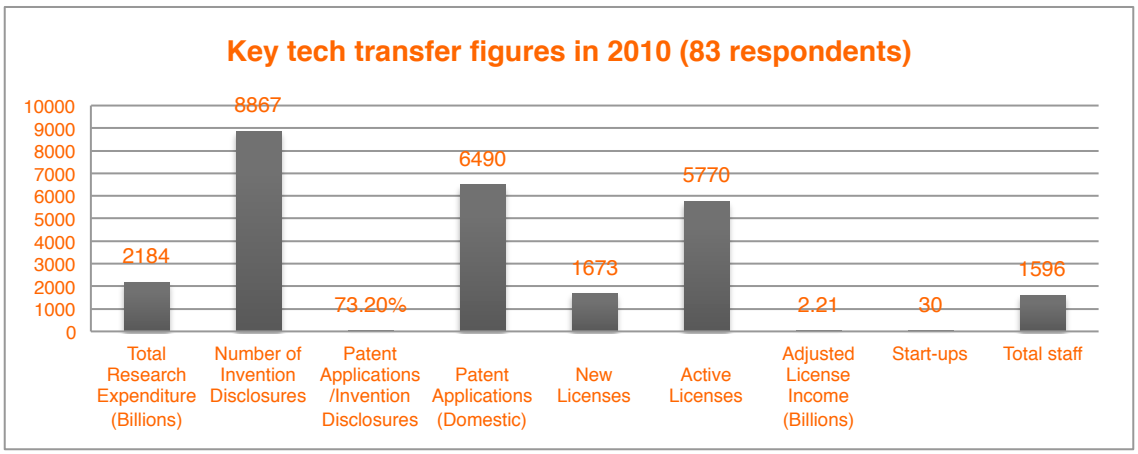

Figure 11 - Key tech transfer figures in 2010 - Source: UNITT[62]

In terms of filed patent applications, the figures are also pretty stable, regardless of the decresed number of disclosures, and this, as it has been mentioned, is due to higher filing ratio of the last years.

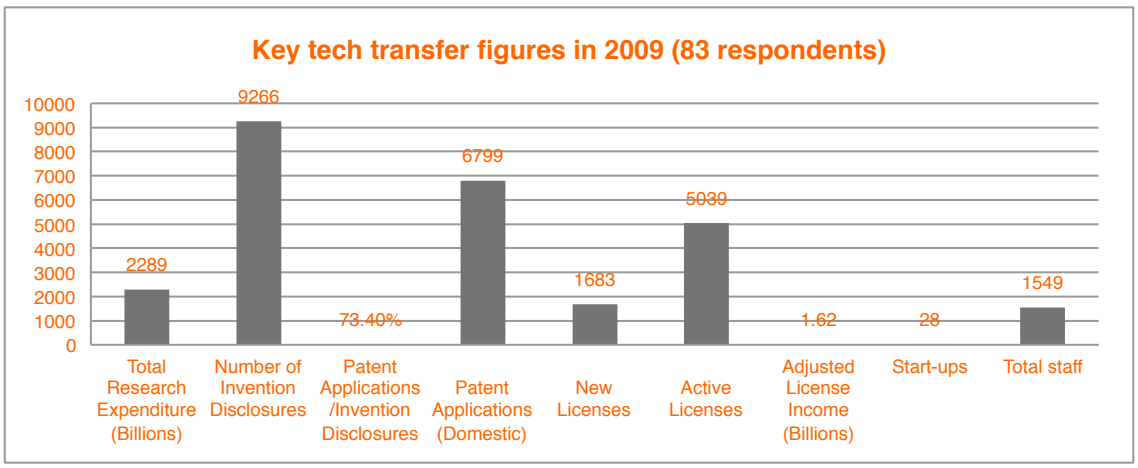

Figure 12 - Key tech transfer figures in 2009 - Source: UNITT[63]

In terms of executed licenses, there has been an important increase in terms of performance from 2011 to 2012 and this might be due to the honed skills of the officers

62 *Ibidem.*

63 *Ibidem.*

involved in tech transfer operations, that are becoming more and more acquainted with tech transfer practices. As to the number of active licenses and income, there is also an evident increase due to the enlargement of the patent portfolios, and therefore offering for potential licensees. The average income of a single license (in 2012) was roughly JPY 330,000 (i.e. roughly equal to $ 2760),[64] therefore not too high, but it might well be that most of the license agreements executed in the last years are still in a phase in which the relevant technologies are not still marketed and therefore generating additional royalties.[65] In the U.S., in 2011, a license according to the AUTM survey, was averaging ca. USD 65,000 in terms of licensing income (i.e. 38,600 active licenses and USD 2.5 billion in revenues).

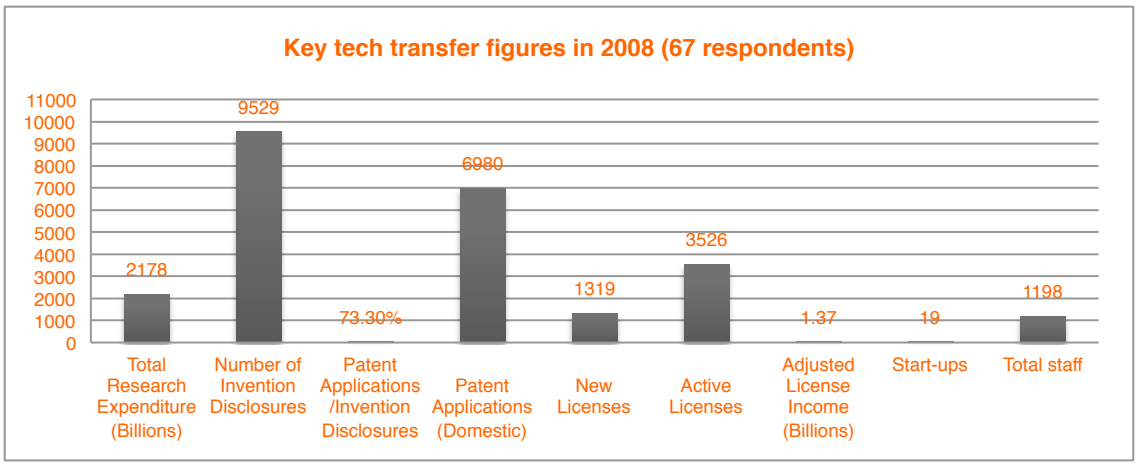

Figure 13 - Key tech transfer figures in 2008 - Source: UNITT[66]

Additionally, in terms of start-up generation thanks to technologies conceived within the research institutions, the numbers show a slight increase and then a return to the original figures with 21 start-ups generated in 2012, which means an average of 0,21 companies per respondent, which is less than 5% of the US output (818 start-ups in 2013).

Lastly, the number of total staff employed by the respondents is growing, but only because the number of respondents to each survey increased overtime. Nevertetheless, 1792 professionals reported in 2012 working for 100 institutions (i.e. 17.9 people per institution) constitute a very important indicator (and a way greater number if compared to

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64 By using the currency exchange rate of March 30th, 2015.

65 These are considerations not taking into account several factors, like, the income generated by the companies spun out of universities that are using university-developed technologies, and other technologies that are co-owned or that have been sold.

66 See *supra* note 48, slide 38.

the average European university/research institution).[67]

MEXT, as briefly mentiond, also publishes an annual report on tech transfer and research statistics, which contains some interesting data in terms of tech university performance. From the report (available only in Japanese),[68] it is possibile to examine data in terms of university rankings by licensing income, and other indicators. 2013, for example, has been a record year for thr University of Tokyo, which ranked first overall int erms of licensing revenues with ca. JPY 660 million.

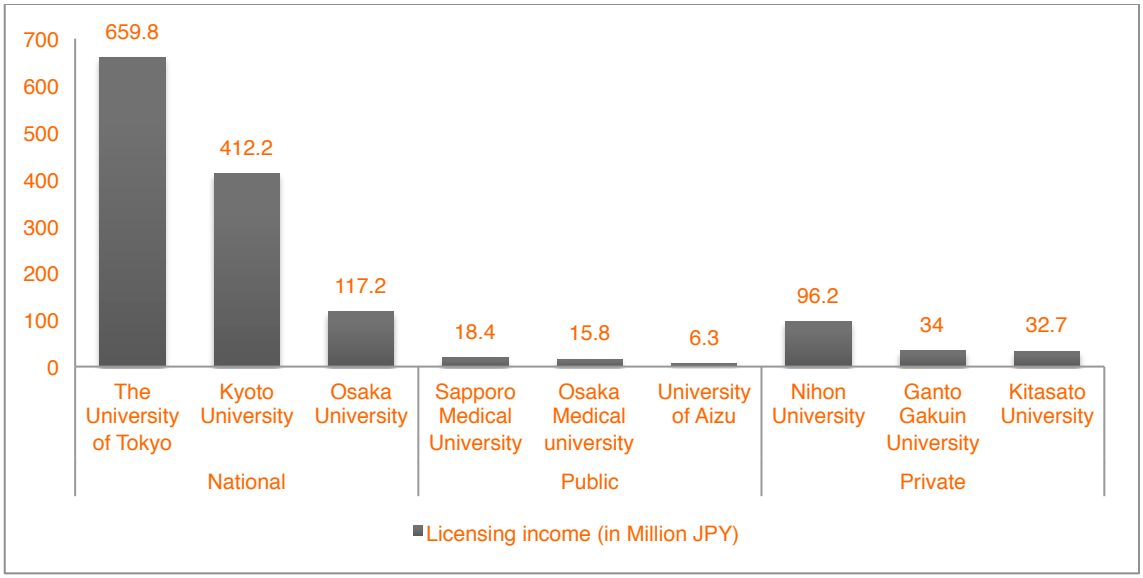

Figure 14 - University rankings (Top 3 per category) by licensing revenues - Source: MEXT

The number of respondents to MEXT's survey was quite impressive. In fact, out of the 1,012 questionnaries sent out to Japanese universities,100% of the national (i.e. 86), and public (i.e. 94) universities replyed whereas 93.5% of private universities (i.e. 778 out of 832) completed the survey. From that report other data can be extrapolated for evaluating other performance indicators in terms of tech transfer activities like the number of invention disclosures, domestic and foreign applications (data labels in the figure below refer to FY 2013).

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67 As shown later in this section.

68 *See* http://www.mext.go.jp/a_menu/shinkou/sangaku/1353580.htm (Last visited, March 30, 2015)

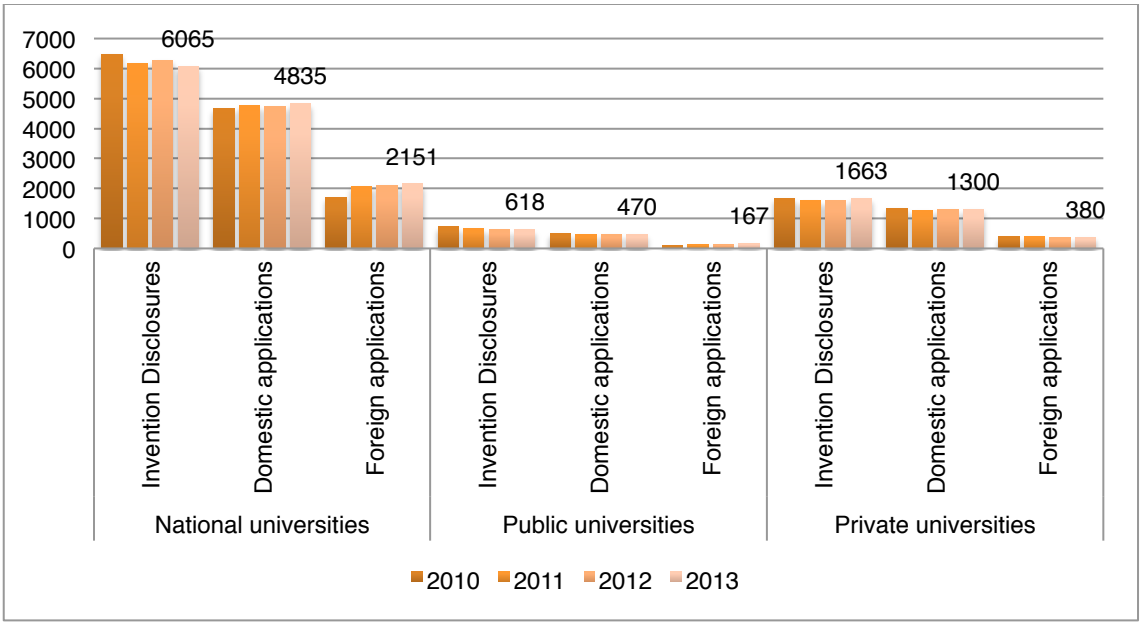
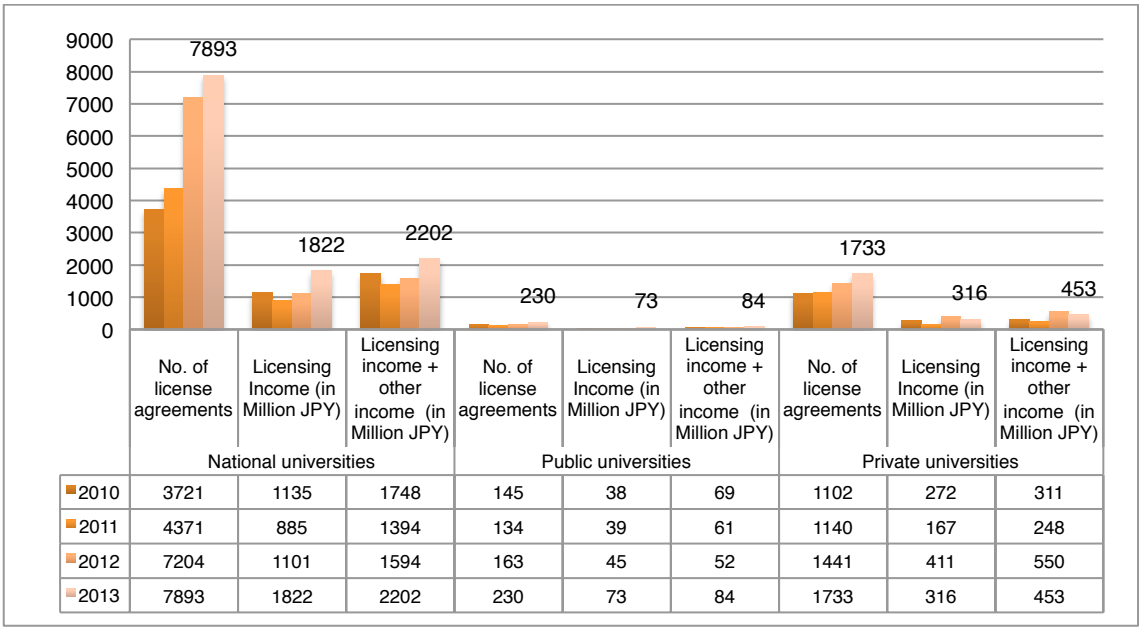


Figure 15 - University performance indicators - Source: MEXT

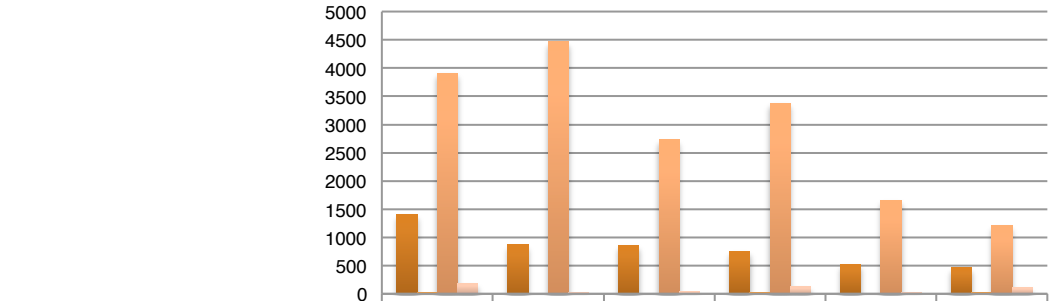
In terms of licensing revenues (figure below), MEXT reported different figures according to the source of income, which show a rapid progress in terms of licensing performance. The number of licenses in 2013 were almost 100% more then those reported in 2011 and the total income generated by IPRs was equal to more than 2.7 billion JPY in 2013, which did not result in a remarkable improvement compared to previous years. In fact, the total income reported by MEXT in 2008, for example, was almost 2.4 billion JPY.



	National universities			Public universities			Private universities		
	No. of license agreements	Licensing Income (in Million JPY)	Licensing income + other income (in Million JPY)	No. of license agreements	Licensing Income (in Million JPY)	Licensing income + other income (in Million JPY)	No. of license agreements	Licensing Income (in Million JPY)	Licensing income + other income (in Million JPY)
2010	3721	1135	1748	145	38	69	1102	272	311
2011	4371	885	1394	134	39	61	1140	167	248
2012	7204	1101	1594	163	45	52	1441	411	550
2013	7893	1822	2202	230	73	84	1733	316	453

Figure 16 - University performance by revenues - Source: MEXT

Lastly, even though there is no direct information in MEXT's report (FY 2013) as to international licensing activities of universities, it can be noted[69] that The Univerity of Tokyo, Tohoku University and Tokyo Institute of Technology are the institutions with the higher number of international partners in collaborative projects. In general, all the interviewed institutions in this report declared to have less than 10% of international licenses in their portfolio of active licenses, and they were not in the position of providing further details for confidentiality obligations.



	University of Tokyo	Kyoto University	OsakaUuniversity	Tohoku University	Kyushu university	Tokyo institute of Technology
Number of collaborative research projects Domestic	1408	871	858	754	528	465
Number of collaborative research projects International	22	10	9	17	8	21
Amount of research funds (in Million JPY) Domestic	3912	4464	2734	3379	1662	1215
Amount of research funds (in Million JPY) International	183	26	33	127	27	118

Figure 17 - International collaborative projects and funding - Source: MEXT

After having compared some figures related to tech transfer activities with the U.S. system, it may be worth looking at Europe's performance as well, which is more difficult to evaluate and measure due to the presence of a bundle of different countries, with different rules, and languages, therefore, the numbers contained in the available reports should be interpreted *cum grano salis*. For example, ProTon Europe, which in 2013 merged with the Association of Science and Technology Professionals ("ASTP"),[70] released in 2012 the (ninth) report related to 2011 fiscal year about the respondents who took part to the survey. There is an important difference between this report and the one released by UNITT or

69 Please note that only the first row concerning the number of collaborative projects is reflecting the actual ranking.

70 ASTP-Proton is the result of the merger between ASTP and Proton Europe, two pan-European associations.

AUTM as in the ProTon sample there are many so called public research organizations ("PROs") together with universities.[71]

The following are some of the most relevant highlights from the survey:[72]

- 329 respondents (from 5 countries: UK, Ireland, Italy, Spain, and Denmark);
- 82.7% of the surveyed institutions are universities, 4.6% hospitals, and the outstanding sample consists of other research institutions;
- 8.3 full time equivalent (FTE)[73] employees in each office
- 6,337 invention disclosures
- 3,358 patent applications
- 5,477 licenses/options executed
- Eur 90 million in licensing revenues[74]
- 549 start-ups companies formed
- Eur 4.8 billion in research expenditure

As to ProTon's survey, there are some remarks that can be made at this point:

- The surveyed sample is not representative of the current European situation as the countries involved in the survey that responded are 5 out of 28, which represent a sample of less than one third of the entire EU population;
- It must be noted that the average licensing income of every office must be intepreted with extreme attention, in fact, out of the Eur 90 M in licensing revenues reported by the respondents, for example, University of Oxford's revenues account for more than one tenth of the total with GBP 8.4 M in 2012[75], and the total income reported by the

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71 For a thorough study on knowledge transfer in Europe, please consider the "*Knowledge Transfer Study 2010 – 2012 Final Report*", which collects findings based on answers from the countries, mostly by representatives of the European Research Area Committee's Working Group on Knowledge Transfer: https://ec.europa.eu/research/innovation-union/pdf/knowledge_transfer_2010-2012_report.pdf (Last visited, 30 March 2015).

72 Available for consultation here: http://www.pg.infn.it/cntt7/sites/default/files/blog_pub/Proton%202011%20report%5B1%5D.pdf (Last visited, 30 March 2015).

73 In 2008 it was 11 FTE employees (2008 AUTM survey).

74 In this case from 270 respondents.

75 For more information, see

top 5 UK universities in 2011 was Eur 37.9 M,[76] which constituted more than 40% of the whole amount reported by all the respondents.

2.5. Export Control Law and Technology Transfer

Japan has its own international security export control system, which aims at avoiding the transfer of goods and technologies leading to the proliferation of weapons of mass destruction, conventional weapons, terrorism, etc.[77] The principles of the export control are set forth in the Foreign Exchange and Foreign Trade Act (no. 228 of 1949). According to Articles 25 and 48, it is necessary to gain approval from the Minister of Economy, Trade and Industry ("METI") when a person intends to export or conduct a transaction concerning specific kinds of goods/technologies to specific regions set forth in the relevant Cabinet Order (i.e. Export Control Order, and Foreign Exchange Order).

A wide range of goods is subject to control, in fact, not only specific goods directly related to weapons of mass destruction and conventional weapons fall into this category, but any good that might be utilized for developing, manufacturing, using or storing weapons.

Goods are mainly examined in two ways. The first, called List Control, requires a comparison between the good in question, and the Controlled Items provided in the mentioned Cabinet Orders. If the good is one of those mentioned in the list, the exporter has to apply for a license to export the good. The second type of control is called Catch-all Control (consisting of the Weapons of Mass Destruction Catch-All control, and the Military Catch-All Control for conventional weapons) in which even if the goods in question might not be directly mentioned in the list of Controlled Items, depending on the nature of the recipient and the inteded use, they might need to undergo the permission procedure.

The provisions applied to individual goods, and technologies may be different, depending on the destination, and intended use. Even though universities, and research centers do not manufacture products, and export them, researchers come from abroad and go visit foreign research institutions very often for seminars, study periods, etc., and there has been also a surge in the last couple of decades in the exchange of equipment, devices,

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http://isis-innovation.com/wp-content/uploads/2014/05/Isis-Annual-Report-FINAL.pdf (Last visited, 30 March 2015).

[76] See *supra* note 71, 57.

[77] Some of the information contained in this section has been extrapolated from the meeting held at the Center for Information on Security Trade Control on 14 November 2014 with Mr. Riko.

materials, and samples, even through digital media, like e-mails, USB drives, etc. That is why nowadays universities, and research centers do have an Export Control Manager who is supposed to be consulted anytime there is a question as to the applicability of the Export Control Law to a specific case. A communication "containing" a technology to another country by e-mail, for example, does require a permission if a listed technology (which includes SW as well) is concerned only if there is a transaction for providing such technology to the counterpart. In terms of geography of the transfer, there are three cases in which permission is required.

- **Tech transfer from Japan to a foreign country:** any person (resident or non-resident)[78] who intends to transfer to a foreign country a listed technology must obatin a license, unless it's for personal use;
- **Tech transfer within Japan:** any resident has to obtain the permission if she intends to transfer the listed technology to a non-resident;
- **Tech transfer in a foreign country:** any resident has to obtain the permission if she intends to transfer the listed technology in a foreign country unless the technology was sourced in a foreign country and the transaction is completed in its entirety in a foreign country.

By way of example, examples of technologies owned by research entities that may fall among the Controlled Items are:[79]

- Software for the devolepment/production of controlled items (e.g. reactors, propulsion systems, high-precision measuring systems, etc);
- Records of know-how concerning the synthesis, separation and refinement of controlled items (e.g. biotoxins, toxic chemicals, etc.);
- Data concerning techniques and procedures necessary for research activities with controlled items.

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[78] For the definition of resident and non-resident, please consult the Act as there are several cases referring to three different types of subjects: Japanese nationals, foreign nationals, and juridical persons.

[79] For more info, see the presentation of METI (2010) titled *"Encouraging Self-Export Control at Academic institutions"*, available at http://www.meti.go.jp/policy/anpo/englishpage/101012guidance_academicinstitutions.pdf (Last visited, 30 March 2015).

Most universities, and research organizations in Japan have an export control manager taking care of the license that may be required from METI. The procedure may take around 3 months, and the manager will likely perform an examination of the submitted documents by checking whether the technology in question is sensitive, the nature of the end-use, and of the end-user. Foreign entities interested in licensing technologies should be sure that the licensor has gone through this procedure if the information has not been plublicly disclosed, and this will happen, for example, in cases concerning the licensing of patent applications, and know-how.

Finally, it is worth mentioning that an important role in the field of training, and research concerning export control is played by the Center for Information on Security Trade Control ("CISTEC"), which is a non-profit entity assisting companies, universities and research institutions in Japan with regard to export control practices. CISTEC was established in 1989 and since then it has operated to support Japanese stakeholders deal with export control regulations. CISTEC's major activities are:

- Research on security export control and integration of industry's feedback;
- Support to companies, universities and research institutions in Japan when dealing with export controls;
- Providing information on security export control;
- Promoting internaitonal cooperation on security export control.

2.6. The Role of Ministries, and Other Government Agencies in the Tech Transfer System

2.6.1. The Ministry of Economy, Trade and Industry

The Ministry of Economy, Trade and Industry ("METI") in Japan[80] operates also through its agencies, two of which are particularly relevant for the present report: the 1) the Japan Patent Office,[81] and the Small and Medium-sized Enterprises Agency. Some of the measures implemented by METI with regards to SMEs might definitely be tangential to technology transfer activities, and therefore they need to be mentioned. In fact, innovation and start-up creation are clearly incentivized by the Small and Medium-sized Enterprise

[80] Some of the information contained in this section is extrapolated from the meeting held at METI on 20 November 2014 with Mr. Tamura and from his presentation.

[81] Please consult the dedicated section of this report to the Japan Patent Office for more information.

Basic Act:[82]

> ***"(Promotion of Business Innovation)***
> ***Article 12****: In order to promote business innovation at SMEs, the State shall promote research and development related to technologies for developing new products and services; promote the introduction of plants and equipment to substantially improve the efficiency of production and sale of products; promote the introduction of new methods of business management for integrated control of product development, production, transportation and sale; and take any other necessary measures.*
>
> ***(Promotion of Start-Ups)***
> ***Article 13:*** *In order to promote start-ups of SMEs, the State shall provide information on and improve training for start-ups, facilitate the financing of start-up expenses, and take any other necessary measures, and shall also endeavor to increase public interest in and understanding of the importance and need for start-ups".*

SMEs are still the backbone of the Japanese economy and they account for 99.7% of all companies in Japan by employing around 70% of the overall workforce. Small enterprises account for 86.5% of the total, and they employ 26% of total workforce.[83] In 2013, the SMEs Basic Act has been revised by adding new incentives especially in favor of small enterprises[84] to allow them to be supported when doing business overseas, using IT tools, etc. The aging management and changes in the demand required a government solution to cope with a crisis that already brought the number of SMEs from 484,000 of 1999 to 385,000 in 2012. SMEs-related policies are implemented by a series of affiliated organizations that work in conjunction with the SME Agency (e.g. JETRO, Japan Finance Corporation, SME Associations, etc.).

METI, as previously mentioned in the preceding sections, is also responsible for

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82 Act no. 154 of 1963 (amended in 1999 and 2013).

83 For an extremely detailed outline and statistics on SMEs, please refer to METI's 2014 White Paper on SMEs in Japan, available at: http://www.meti.go.jp/english/press/2014/pdf/0425_01b.pdf (Last visited, 30 March 2015).

84 Please note that the definition of "small enterprise" may vary. In fact, in the manufacturing industry, for example, a small enterprise can have up to 5 employees as opposed to the retail industry where the number of employees can be up to 20.

implementing and enforcing export control regulations (which indeed have an impact on technology transfer in the academic setting as well), and related matters not handled directly by the JPO, like trade secrets. Very recently, on 28 January 2015, METI released a declaration[85] on "Actions against the Outflow of Trade Secrets" in which future public and private efforts are described aiming to create a system that has zero tolerance regarding the misappropriation of trade secrets from Japanese companies in favor of domestic or overseas entities. METI declared it will hold other meetings in the next year to exchange information on specific practices and efforts with industry, and government representatives. The Division in charge of this task shall be the Intellectual Property Policy Office, belonging to the Economic and Industrial Policy Bureau.

2.6.2. The Ministry of Education, Culture, Sport, Science and Technology

The Ministry of Education, Culture, Sport, Science and Technology ("MEXT") plays a pivotal role within the Japanese S&T policy as already mentioned at the beginning of this work, and its activities, which indeed have an impact on technology transfer as well.[86]

MEXT has performed several surveys on its own referring to the performance in terms of commercialization of research outputs of universities, and research centers in Japan as showed in the previous sections. The following figure shows the number of licensed patents and licensing revenues from 2007 to 2012. The numbers are somewhat different from those reported by UNITT[87]and MEXT in previous figures due to the different composition of the surveyed sample.

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85 For more information, see http://www.meti.go.jp/english/press/2015/0128_02.html (Last visited, 30 March 2015).

86 Some of the information contained in this section is extrapolated from the meeting held at MEXT on 7 November 2014 with Mr. Ema focused on the new policies that are designed to facilitate the commercialization of research outcomes from universities and from his presentation.

87 As a matter of fact, the licensing figures in UNITT's survey show different results ranging from JPY 1.37 billion of 2008 to JPY 2.28 billion of 2012.

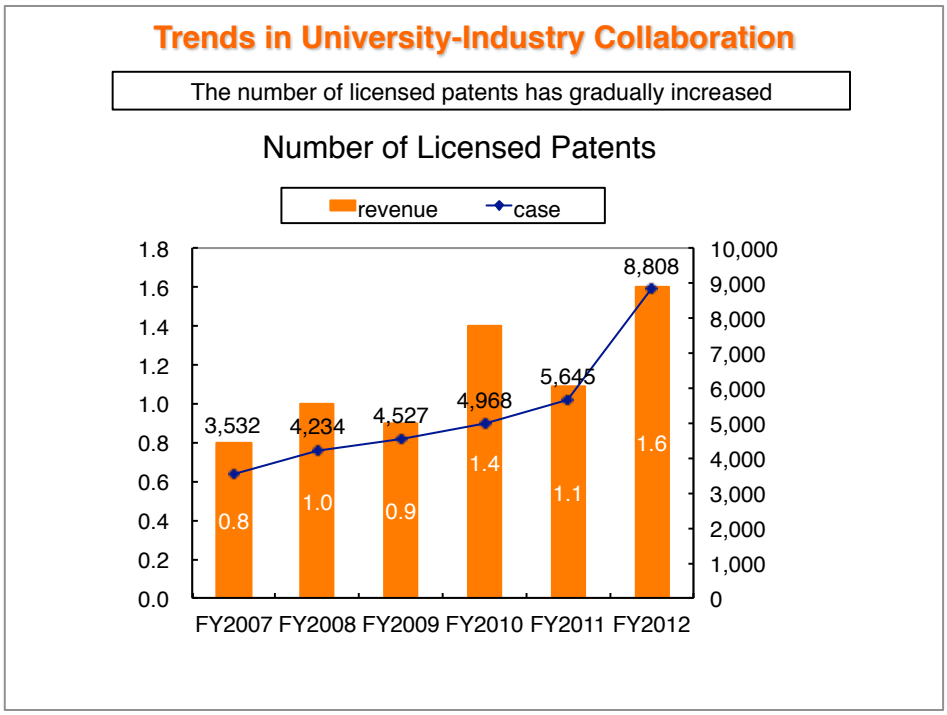

Figure 18 - Trends in University-Industry Collaboration - Source: MEXT

The following chart represents the trends in the 2007-2012 period in terms of nature of the participants of joint research projects, and shows how the number of projects increased meanwhile the magnitude of the funds decreased. Additionally, the pie chart on the right shows how influential is still the role played by large companies when joint research projects are at stake.

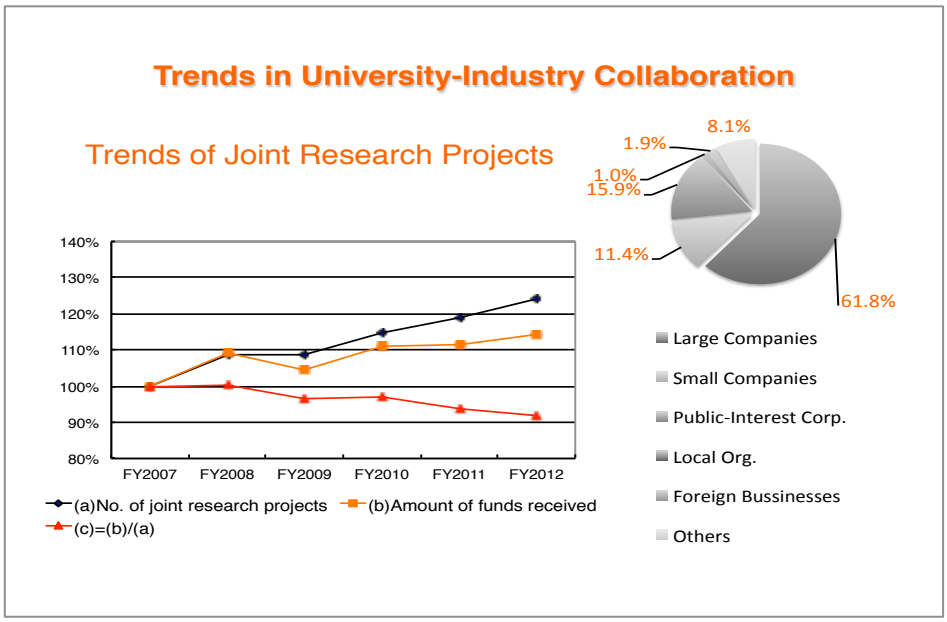

Figure 19 - Funds allocation in University-Industry Collaboration - Source: MEXT

Several initiatives aiming at creating a smoother and profitable relationship between industry and academia are being implemented by MEXT. The following is a non-exhaustive list of such programs.

A-STEP

The A-Step program[88], which covers all fields of science and technology, aims at achieving the following:

- promotion of tech transfer activities between industry and academia based on the research outputs generated by universities;
- providing seamless support during the different R&D phases.

A-Step programs have helped generating revenues for 68 billion dollars since their inception in 1958. Some of the most notable achievements of this program are: the artificial quartz, magnetic materials, the blue LED, Bi-based superconducting wires, etc.

Center of Innovation Program[89] - COI

From the important assumption that collaboration between universities and industry must be fostered, and that the research outputs generated by research institutions have to have a practical use to meet market needs as well, the COI program is an incentive that supports multi-disciplinary R&D projects run jointly by universities and companies. The activities supported by the COI program are based on a back-casting approach. The back-casting approach provides that in order to achieve a result in the future it's important to understand what has to be done from today by going backward from the end result to the first step of the process. Moreover, back-casting is believed to be a more effective method to achieve future results in a more sustainable fashion by also leaving more room to creativity and innovation. The aim of the COI program is to create a virtual roof under which universities and companies may communicate and work seamlessly. The program defines the players within a so-called COI center, which is managed and overseen by a Visionary Leader (coming from the industrial sector).[90] As of November 2014, 12 COI centers were

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[88] The total funding provided for each project is between $17000 and $80000 for feasibility studies and between $200,000 and $20M for full-scale projects within a timeframe ranging between 1 and 7 years.

[89] For more info, please see the joint MEXT-JST presentation at http://www.jst.go.jp/coi/etc/brochure_EN.pdf (Last visited, 30 March 2015).

[90] Every COI center is funded to achieve the expected results in a range between 1 and 10 million dollars for up to 9 years.

working on some key R&D themes like, by way of example: sensors networks, translational medicine, power transmission, energy conservation, and preventive healthcare.

START Program

MEXT introduced the START Program to facilitate the creation of high-tech startups based on the research outputs of universities, in collaboration with venture capital firms. This is a pretty innovative framework in which a Project Promoter (i.e. a VC firm) selects a promising technology from universities, and submits a business plan to MEXT and JST. The selected projects get funded, and R&D is carried out with an aim to commercialize their technologies by creating startups

The support provided is divided in two main categories: 1) Project Promoter Support Type; and 2) Project Support Type. The first form of support subsidizes Project Promoters to scout for technologies (up to $250,000 per year per promoter for up to 5 years).[91] The second form of support provides Japanese universities with the necessary investment to carry out an R&D project (for up to 3 years for an average annual budget of $300,000).[92]

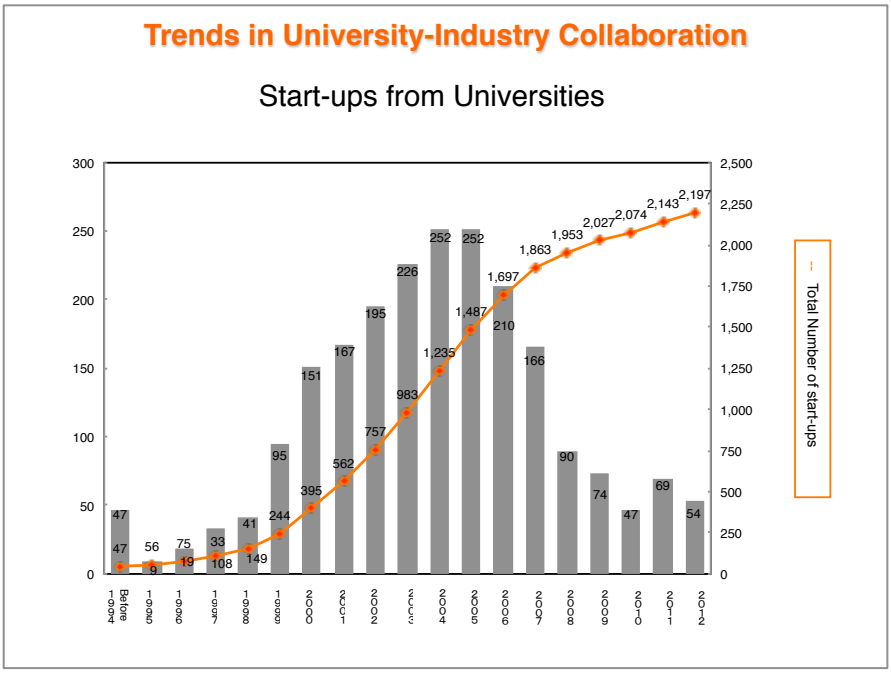

Figure 20 - Trends in university start-ups creation – Source: MEXT

91 In 2012, 7 Promoters have been selected, and 4 in 2013. Each Promoter manages 4-5 projects, on average.

92 In 2012, 27 projects have been funded, and 15 in 2013. As of November 2014, 4 start-ups have been created.

The above chart shows the incremental number of university start-ups (usually called spin-offs outside of Japan) in the last 20 years. The grey bars represent the annual number of formed startups. The numbers are more or less in line with the mentioned UNITT report, considering the greater sample of the MEXT survey, and they show a decrease in the number of university start-ups creation with respect to the peak reached in 2004 and 2005.

2.6.3. The Japan Patent Office

In 2013, the Japanese Cabinet approved the "Japan Revitalization Strategy", and the "Basic Policy Concerning Intellectual Property Policy", and for six months, until February 2014, the Intellectual Property Policy Committee evaluated various policy actions regarding the national IP system, and suggested to follow three major directives for the future:

- support the global registration of IPRs by Japanese companies;
- enhance the support given to SMEs; and
- develop an environment favorable to innovation.

In early 2014, the Japan Patent Office ("JPO")[93] set its new goals on the basis of these directives by, for example, shortening the average examination period required for patents down to 14 months or less and the average period required for the first office action down to 10 months or less within the next ten years.[94] In fact, it is worth noting that through these and other future initiatives the JPO is committed to make the Japanese IP system the fastest in the world by preserving the utmost standards, and the JPO will support, as suggested by the Intellectual Property Policy Committee, the global registration of IPRs by its users, and contribute to the overall enhancement of Japan's industrial competitiveness.

Measures in favor of universities, TLOs, and SMEs

There are several initiatives[95] that the JPO has implemented or intends to implement in favor of universities, TLOs, and other similar entities. For example, the JPO reduces fees or exempts users from paying annual patent fees in favor of universities, and TLOs according to the provisions of the TLO Act, and other related laws.[96] Another

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93 Some of the information contained in this section concerning JPO's measures in favor of SMEs is extrapolated from the meeting held at JPO on 21 November 2014 with Mr. Konuma, Mr. Maki, and Mr. Hayami.

94 *See* Part 4 of JPO Annual Report, 2014.

95 *See* Part 1 and 2 of JPO Annual Report, 2014.

96 Please note that since the Act on Special Measures for Industrial Revitalization was repealed

interesting initiative the JPO has recently started is the so-called "Accelerated Examination System" which allows certain kinds of applications to be dealt with in a shorter timeframe (i.e. on average, two months faster). This kind of procedure is available for:

- applications concerning inventions that have already been put into practice or that are planned to within two years;
- applications with patent families in other countries/regions;
- applications filed by SMEs and venture-backed businesses; or
- applications filed by universities/TLOs and public research institutions that are expected to use results for the benefit of society.

In terms of performance of universities, the JPO, in its Annual Report,[97] also highlighted that the number of patent applications filed by universities was less than 2,000 in 2002, and that the number rapidly increased to more than 7,300 in 2005 after the privatization of 2004 by reaching a peak in 2007 before the economic downturn.[98] In terms of quality of university applications, JPO reported an allowance rate of ca. 70%, which is the highest among all applicants before the JPO.

The number of measures and initiatives promoted by the JPO in favor of SMEs and universities are various, and the following list and figures should be considered as depicting the most relevant to technology transfer activities:

- **Support of information:** this has been achieved through:

  i) the Global IP Databank, which is a website providing IP-related information on emerging countries;
  ii) the Industrial Property Digital Library, which is a website providing information on industrial property since the end of the 19th century up to now,

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after the passage of the Industrial Competitiveness Enhancement Act, the reductions of annual patent fees and examination request fees for TLOs are now provided by the TLO Act.

97 *See* the JPO 2014 Annual Report, 32.

98 Please note that patent applications filed by universities in Japan, according to the Annual Report of the JPO, are those in which the applicants were either university presidents, corporations that own universities, and approved TLOs. In this calculations the numbers also take into consideration the applications filed jointly with companies.

including other countries' IP-related documents, like China. The JPO reported a stunning 290,000 daily visitors in 2013;[99]

iii) the Patent Licensing Information Database (more info in the section dedicated to INPIT);

iv) the Intellectual Property Transaction Specialists Database, which provides the public with info related to the service providers involved in the IP commercialization area.

- **Fees reduction:** this kind of incentive have been performed in different ways, primarily with:

  i) fees reduction/exemption for individual applicants and SMEs from annual patent fees and examination requests;

  ii) fees reduction/exemption for universities and TLOs from annual patent fees and examination requests.

- **Free consultation:** in every prefecture, since 2011, IP Counters have been created to support SMEs on IP-related issues, which are performed through various tools (e.g. prior art searches, contract templates, creation of IP strategies, remote website consultation, etc.).

- **Support by experts:** through various initiatives carried out in conjunction with INPIT (described in detail in the INPIT section) support has been provided for a better understanding of the available tools for the strategic acquisition, and utilization of IPRs.

- **Raise IP awareness:** through different activities like:

  i) the organization of explanatory meetings on the IP system, which are tailored according to the attendee's knowledge of the subject matter;

  ii) the help provided by the so called IPR Specialists offering comprehensive support in terms of IPRs to SMEs, from lectures to *ad hoc* consulting services.

Eventually, to better understand how the JPO operates to support s SMEs through

[99] *See* the JPO 2014 Annual Report, 89.

the entire life of an IPR, the following figure[100] illustrates the process and related selected initiatives from the moment before the filing up to the potential overseas development of a business.

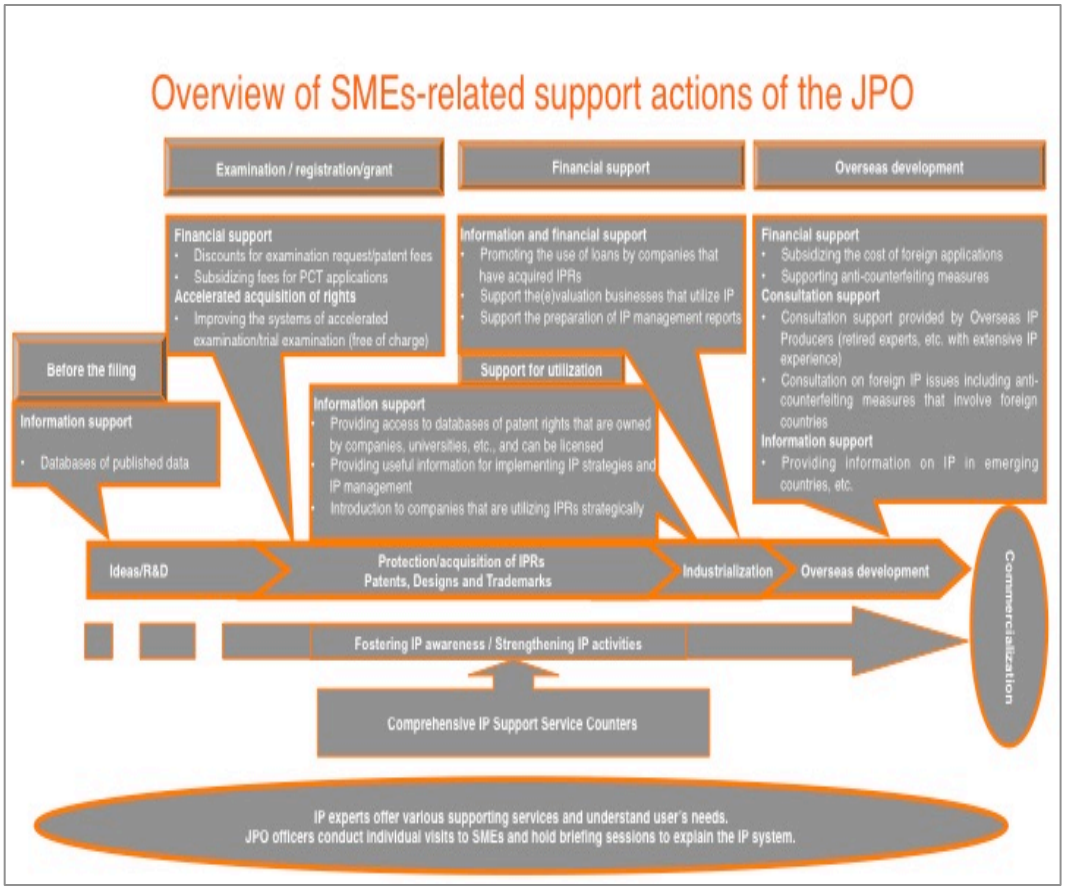

Figure 21 – Overview of SMEs-related support actions of the JPO – Source: JPO

The National Center for Industrial Property Information and Training

In Japan, the National Center for Industrial Property Information and Training ("INPIT")[101] provides comprehensive information on industrial property rights, and operates as the major information provider within the Japan Patent Office's framework. INPIT is engaged in six major service offerings: 1) general consultation on IP; 2) development and dissemination of software for e-filing; 3) information exchange with foreign countries; 4) IP

100 The content of this figure reproduces, with some minor edits, the slide that has been used during the meeting held on 21 November 2014 at JPO.

101 Some of the information contained in this section concerning INPIT's activities is extrapolated from the meeting held at INPIT on 12 December 2014 with Mr. Seto, Deputy Director for Coordination IP Utilization Promotion Department.

databases; 5) promotion of IP utilization; 6) and human resources development.[102] For the purpose of this study, it is important to focus on two of the activities of INPIT, namely, the existence of IP databases and the promotion of IP utilization. As to the first, INPIT runs the Industrial Property Digital Library ("IPDL"), which contains more than 84 million records and for the gazettes issued after 1993, there is an automated translation software, which is surely an interesting tool for foreign users.

As to the second, there are different activities that have been realized, namely:[103]

- Intellectual Property Producers:[104] this scheme provides that IP experts (aka IP Producers) may be seconded to universities and research centers across the country to support create solid IP strategies;
- University Network of Intellectual Property Advisors: this scheme provides that IP advisors may be sent to support regional or technology clusters formed by university networks;
- Global Intellectual Property Producers:[105] this scheme provides that IP experts (aka Global IP Producers) may assist companies interested in receiving support in terms of international IP strategy development, tech transfer and enforcement strategies.

Eventually, the JPO has recently released a notice about a new consultation service on trade secrets, and intellectual property strategy, mainly for SMEs, to be offered by INPIT, with reservations available since January 19th, 2015. In this regard, the JPO argued[106]that when taking into consideration the internationalization of businesses and the prevention of technology/information leakages, the strengthening of trade secret protection is mandatory. The reason behind the creation of this novel service is linked to JPO's full understanding that in recent years there has been a paradigm shift in the creation and management of innovation for high-tech companies, and therefore now there is a need for a more complex and sophisticated intellectual property strategy to support the globalization and dematerialization of technologies and, more in general, of the innovation process.

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102 For more information, see http://www.inpit.go.jp/english/ (Last visited, 30 March 2015).

103 For more info on these services, please see: http://www.inpit.go.jp/english/utili/index.html (Last visited, 30 March 2015).

104 INPIT reported that 36 producers have been seconded as of the date of the meeting across the entire country in the last three years.

105 INPIT reported 233 cases of support in IP infringement situations as of the date of the meeting.

106 JPO Annual Report (2014), 146.

2.6.4. The Japan Science and Technology Agency

The current Japan Science and Technology Agency ("JST"),[107] which became an Independent Administrative Institution in 2003, was originally (1996-2003) called Japan Science and Technology Corporation, which resulted from the merge in 1996 of the Japan Information Center of Science and Technology, and the Research Development Corporation of Japan. The mission of JST is basically to contribute to the prosperity of Japan by favoring the development of a sustainable society in which there is a smooth transfer of technology to industry. Its main activities concern R&D projects focused on innovation and on the establishment of infrastructures to facilitate these activities.[108] Among the various activities of JST to achieve its goals, it is worth mentioning the existence of a series of specific initiatives aimed at favoring Research and Development focused on Technology Transfer, like the:[109]

- **Adaptable and Seamless Technology Transfer Program ("A-STEP")**: this program boosts industry-academia collaborative R&D in order to develop commercial applications for research results generated in universities. Several types of funding schemes are provided under this program;
- **Collaborative Research Program**: this program facilitates the use of the results stemming from basic research labs in universities and allows the latter to get an industrial feedback on academic research;
- **Strategic Promotion of Innovative Research and Development ("S-Innovation"):** this program promotes the development by industry and academia of R&D projects which could lay the foundations of new industries for the benefit of society;
- **Development of Advanced Measurement and Analysis Systems:** this initiative aims at promoting the development of systems and technologies for advanced measurement and analysis;
- **Center of Innovation (COI) Program:** the basic aim of this program is to form large research collaboration platforms between industry and academia to contribute develop their R&D to generate a significant impact at the global level;
- **Next Generation Technology Transfer Program**: this is a very interesting

[107] Most of the information contained in this section is extrapolated from the meeting held at JST on 7 October 2014 with Mr. Amano, and Ms. Yasuda.

[108] The budget of the agency in 2012 was around USD 1.5 billion.

[109] For more info and know all of the programs, please visit http://www.jst.go.jp/EN/operations/operation_b.html (Last visited, 30 March 2015).

program in which JST promotes the commercialization of technologies coming from academia, and used by companies, by supporting the scaling up of the project for coping with future business growth.

Additionally, JST manages programs aiming at the promotion of utilization of university IPRs, like the:[110]

- **Technology Transfer and Innovation Program**: JST promotes the adoption and development of world-class research output from universities and public research institutions by the industrial sector. The basic goal of this program is to guarantee a development in science and technology tied to a positive impact on society;
- **Center for Intellectual Property Strategies Programs:** this program basically supports the creation of IP strategies to be utilized by universities, including support for other IP-related activities both at universities and public research institutions;
- **Patent acquisition support:** the kind of initiative may vary and it ranges from i) patent consulting services to universities, technical colleges and TLOs, to ii) help them cover the costs related to foreign patent applications, and to develop patent portfolios related to extremely valuable technologies;
- **Intellectual Property Utilization Promotion Highway:** there are several initiatives both for the promotion of unused or underutilized university patents and, for those with a high licensing potential, for enhancing their value or marketability through funding opportunities for additional experimentation and research, build prototypes, perform market surveys, etc.

2.6.5. The New Energy and Industrial Technology Development Organization

The New Energy and Industrial Technology Development Organization ("NEDO")[111]is a Japanese public entity that was originally established in 1980 and then reorganized in 2003 (as an incorporated administrative agency), with a twofold mission: addressing energy-related challenges at the global level, and contributing to the dissemination, and deployment of novel Japanese technologies. NEDO's role at the international level is quite remarkable as it promotes the use of domestically tested and

[110] For more info about the full list of programs, please visit http://www.jst.go.jp/EN/operations/operation_e.html (Last visited, 30 March 2015).

[111] Most the information contained in this section is related to the meeting held at NEDO on 23 January 2015 with Mr. Shinohara, and Ms. Isaka.

available technologies for the resolution of global energy and environment-related challenges.[112]

NEDO had a $ 1.5 billion budget in FY 2014, mainly being used for the promotion of research and development and funding of projects coming from academia and industry. International activities and projects span across the globe, from China (with projects on smart communities, biomass, water treatment, etc.) to Europe (with projects on smart communities in different EU countries, photovoltaics, and robotics) to the US (with projects on smart communities, and zero-energy buildings) to India (with projects on solar power, and microgrids, e-waste recycling, etc.) and so forth. When acting internationally, NEDO signs MoUs with the partner a country (usually with a government organization), and appoints a domestic company to run the project in the partner country. The counterparty to the domestic Japanese company is a local company, which usually manages the implementation site working side-by-side with the Japanese company.

The funding of research and development projects requires the creation of an IP policy for the agreements that are poised to generate research results, that most of the times can be protected through patents, for example. Technology development activities, as previously mentioned cover a pretty broad spectrum which ranges from energy conservation technologies, to smart grids and smart community systems to new materials, biotech, water treatments, and robotics.

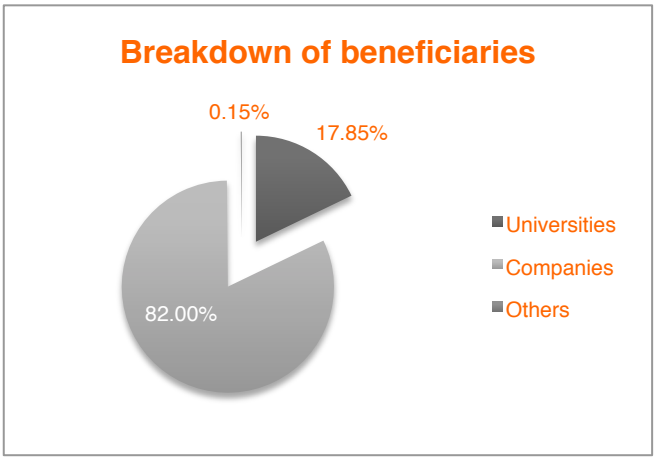

Figure 22 - Breakdown of funding from NEDO - Source: NEDO

[112] For more info about NEDO, it's mission and structure, please refer to the official presentation, available at http://www.nedo.go.jp/english/introducing_index.html (Last visited, 30 March 2015).

In terms of funds distribution, it is quite interesting to observe (figures above,[113] and below[114]) how the allocation schemes of funds provided by NEDO contributes to the development of projects within the private sector, and it perfectly complements the activities of JST.

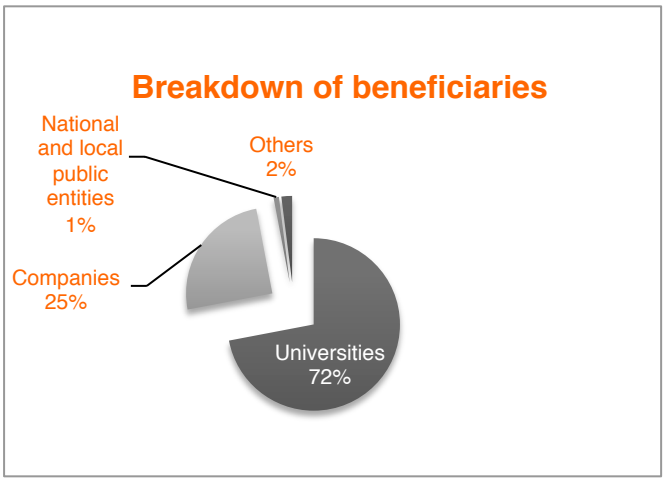

Figure 23 - Breakdown of funding from JST - Source: NEDO

NEDO's IP policy and the management of IP in NEDO's projects

NEDO's projects concern, as it has been already mentioned, a wide array of technology areas, and they basically cover three different stages of the technology development:

- Development of technologies: in which young researchers are getting funded to develop potential industrial applications
- National projects: in which projects that might have a high risk of failure get funded
- Practical application: in which technologies that are nearing the market get subsidies to speed up the process.

The ownership of the results stemming from R&D activities is key in every project, and it is worth mentioning that when Japan introduced in 1999 the new model to regulate the IP generated through government grants by private companies, the participation to public funding schemes started literally taking off as one of the major concerns of the private sector was the fact that the IP was eventually own by the government and therefore the incentive to

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113 Data retrieved from the presentation made by Koji Tose, Technology Development Promotion Department (obtained at the meeting held at NEDO on January 23rd, 2015).

114 *Id.*

apply was not that enticing. In 1999 though, the new law on Special Measures for Industrial Revitalization has been enacted which provided the right for private companies to retain IP rights over the results generated through public funding. This new system, as previously mentioned, somehow mirrored the Bayh-Dole Act in the U.S. (enacted in 1980), which basically established new principles about ownership of inventions conceived with federal funding. Before the Bayh–Dole Act, inventions conceived through federal funding were supposed to be assigned to the government. The Bayh–Dole Act allowed universities, small businesses or non-profit organizations to retain ownership of invention stemming from results generated through public federal funding.

Also, in light of this new industry-oriented regulation, the results stemming from NEDO's projects have generated a myriad of inventions, and patents as well with an average of more than one thousand domestic patent applications per year.[115] What is quite unique in NEDO's IP policy is that the participants are obliged to regulate the IP potentially generated thanks to NEDO's funding beforehand, and they have to undergo a procedure in which the applicants have to clearly state what are the plans for the exploitation of the results and the IP management. This obligation mandates the applicants to submit a proposal (and this is the pretty unique step of this process) concerning the regulation of the IP, submit the agreement once finalized (before the funding), and set up an IP management committee or group that could oversee the correct implementation of the rules contained in each agreement.

The second interesting feature of the process concerns the promotion of unutilized patented results generated in the realization of funded projects. In fact, NEDO aims at maximizing the value of the results by creating lists of available and unused technologies that might be disclosed (for licensing purposes, for example) to potentially interested third parties. A sort of matchmaking activity, which NEDO is capable of doing being aware of the current status of every project and relevant results.

2.6.6. The United Nations Industrial Development Organization Investment and Technology Promotion Office Tokyo

The United Nations Industrial Development Organization ("UNIDO") is one of the

[115] For more information as to the final purpose of these patents, please see NEDO's webpage on the topic at http://www.nedo.go.jp/jyouhoukoukai/shisankanri_chitekizaisan.html (only in Japanese, last visited, 30 March 2015).

specialized agencies of the United Nations whose main aim is to promote industrial development for poverty reduction, inclusive globalization and environmental sustainability.[116]

Within this framework, UNIDO's Investment and Technology Promotion Office, Tokyo ("UNIDO ITPO Tokyo") was established more than 30 years ago. The mission of UNIDO ITPO Tokyo is mainly *"to help developing countries and economies in transition in their efforts to achieve inclusive and sustainable economic development* ***by promoting foreign direct investment, and technology transfer from Japan through various activities*** *(emphasis added) including delegate programme (invitation of government officials to Japan),* ***technology transfer*** *(emphasis added) (identifying and promoting Japanese energy and environment technologies), seminars and events (country promotion, sector promotion, environment exhibitions), capacity building (special programmes for embassies in Japan), and activities overseas (business missions and networking)."*[117] Therefore, even though the definition of technology transfer in this circumstance is different from the one used in this report (as in this case by "tech transfer" it is meant the actual physical translation or reproduction of an industrialized technology from one country to another), it is worth mentioning UNIDO ITPO Tokyo's initiative concerning the creation of a on-line database of available technologies called Environmental Technology Database, which is kind unique in the global IP panorama, and, in principle, open to everyone since the, available information can be accessed by anyone visiting the website.[118]

The tech transfer database is meant to help subjects in developing countries get in contact with Japanese companies active in the following fields: 1) low carbon and energy conservation; 2) prevention and destruction of pollution; and 3) waste treatment and

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[116] For more info, see UNIDO's official website at http://www.unido.org. Some of the information contained in this section had been extrapolated from the meeting held at UNIDO ITPO Tokyo on 27 November 2014 with Mr. Gelegen.

[117] Excerpt from the official webpage: http://www.unido.or.jp/en/about_us/itpo_tokyo/ (Last visited, 30 March 2015).

[118] *See* http://www.unido.or.jp/en/activities/technology_transfer/technology_db/ (Last visited, 30 March 2015). On the other hand, Japanese companies wishing to register their technologies, should contact UNIDO ITPO Tokyo by sending a request message to itpo.tokyo@unido.org. The final decision as to whether the submitted technologies should be contained in the database is strictly left at UNIDO ITPO Tokyo's discretion. Usually ideas must be commercially available when posted, but in some cases prototypes have been accepted too.

management. The following figures show how the categorization has been performed on the website and what are the sub-categories within the main technology areas.

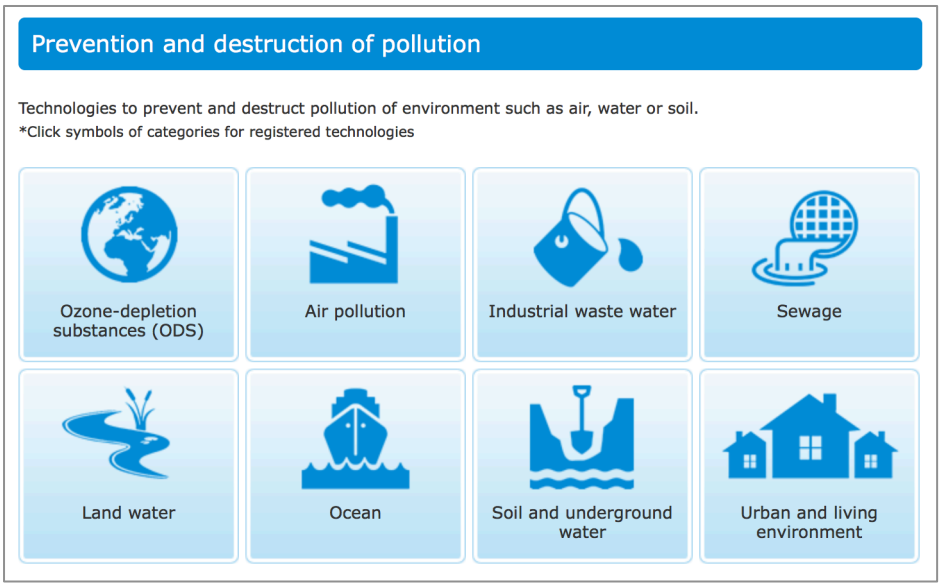

Figure 24 – Source: UNIDO ITPO Tokyo

By clicking on the relevant icons, a window shows the contact details of the Japanese company interested in promoting tech transfer activities. Once again, it has to be noted that in this case the beneficiary of the activity should be an entity in a developing country, but still, the on-line searchable databases implemented by UNIDO ITPO Tokyo constitutes an extremely valid example of how simple nowadays the matching process between technology owners, and seekers could be.

2.7. The role of the major publicly available databases and their importance in the tech transfer arena

Japan's reputation for being a leader as far as the generation and utilization of patented technologies are concerned has been known for decades, but what is not so widely known is what the Japanese government has been doing, through specialized agencies, in terms of amplification of: i) the value of existing patented technologies coming out from domestic research centers, and universities; ii) the number of opportunities for businesses, and research institutions to license or sell their proprietary technologies.

In this regard, there are two major initiatives that need further explanation to be understood, and appreciated in full. One, called J-Store, managed by JST, and the other, named Patent Licensing Information Database ("PLID"), managed by INPIT.

Additionally, even though it is not possible to measure the effectiveness of this new tool for now, it is worth mentioning that the JPO, and INPIT have launched on March 23rd, 2015, the so called Japan Platform for Patent Information ("J-PlatPat"),[119] which is a new on-line service providing information concerning patents, utility models, designs, and trademarks.

2.7.1. J-STORE

J-Store (i.e. JST Science Technology Research Result Database for Enterprise Development)[120] is a free-of-charge database providing the general public with research results stemming from domestic universities, and public research institutions that are collected by JST. The purpose of this database is to primarily[121] favor domestic technology transfer activities by promoting research results to enterprises, and to encourage their industrialization.

J-Store contains information about Japanese patents and patent applications, international patent applications filed in Japan, and research papers. It contains several tens of thousands of documents between Japanese patents and applications, and international applications. Only domestic universities and research institutions can post their available technologies.

The following pie chart represents a breakdown of the countries from which the database is being consulted. Even though the large majority of users are Japanese, it is interesting to note that 17% of the total is represented by US users, which translates in several thousands of inquiries per month.

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119 To see the official webpage of the database, visit https://www.j-platpat.inpit.go.jp/web/all/top/BTmTopEnglishPage (Last visited, 30 March 2015).

120 To consult the database, visit http://jstore.jst.go.jp/index.html?lang=en (Last visited, 30 March 2015).

121 In fact, even though the website is also operating with an English version, still, some content is in Japanese only.

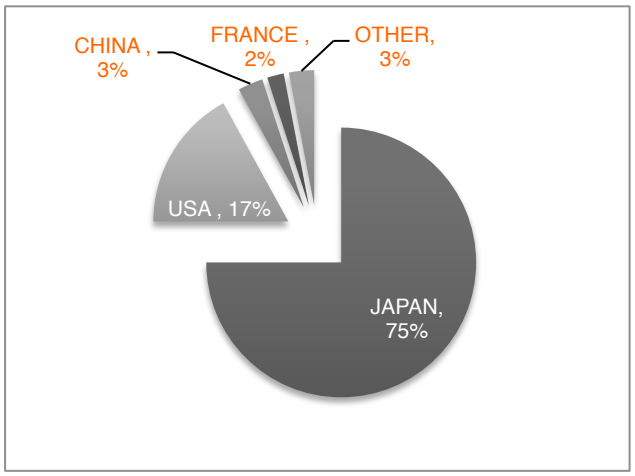

Figure 25 – breakdown of country distribution - Source: JST

The table below shows the monthly number of users of J-Store, which, in 2014, had a lower number of visitors as opposed to the previous years.[122]

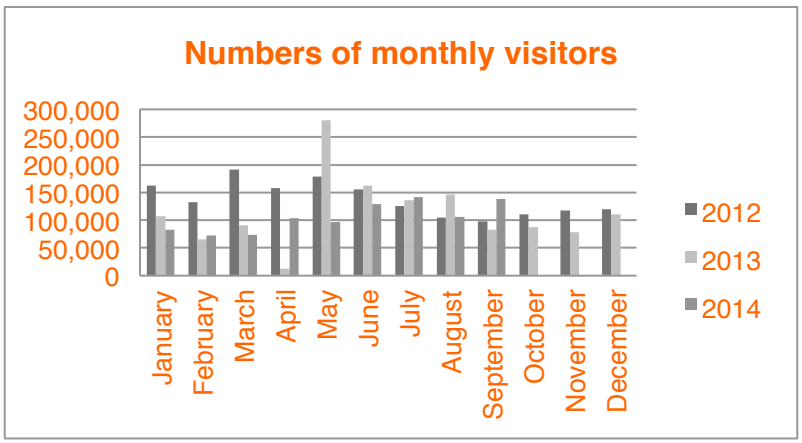

Figure 26 - Number of monthly visitors - Source: JST

2.7.2. INPIT's databases

PLID[123]is an open, free system in which anyone can register information about available technologies linked to (at least) a Japanese patent or patent application. Even businesses interested in selling or offering patent licenses to third parties can register their technology (the possession of a Japanese patent or patent application is a prerequisite) in the database.

[122] Please note that data referring to 2014 is limited to the January-September period. Data provided by JST.

[123] To consult the database, visit http://plidb.inpit.go.jp/en/index_en.html (Last visited, 30 March 2015).

PLID contains info related exclusively to patented (or with pending patent applications) technologies that have at least a Japanese patent application or patent. It contains around 35,000 documents. Both research institutions (and universities) and companies can post a technology, from everywhere. The Japanese website allows the user to have access to a mask for an advanced search which can allow a more targeted search.[124] In terms of performance, INPIT disclosed some information about the number and nature of the entities, which have registered their IP:

- 2011 FY: 42,641 patents (13,658 owned by companies and 28,983 owned by universities);
- 2012 FY: 40,405 patents (12,157 owned by companies and 28,248 owned by universities);
- 2013 FY: 36,648 patents (8,607 owned by companies and 28,041 owned by universities);

It was not possible to retrieve information as to the location of the viewers at this time, but it is clear that the PLID is a valuable tool for all the domestic and foreign entities that might be interested in finding potentially marketable solutions. As a final note, it must be said that if the database is consulted from the English page the search is pretty difficult and the results generated are machine-translated therefore the comprehension and full appreciation of the potential of the database may result diminished for non-Japanese readers.

As to the newly accessible J-PlatPat, which coexists with the PLID for the time being, some info can be provided for the benefit of the interested user. In fact the new platform, which constitutes a leap forward in terms of user interface and operability for non-Japanese users if compared to other on-line resources, allows:

- to perform keyword searches in English from 1976;[125]
- to search for Official Gazettes since 1885;
- to have access to English (machine-translated) versions of patents, and utility models Official Gazettes since 1993, and since 2000 for designs.

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[124] Please note that at the time of the interview the registration was not possible from the English page.

[125] For Japanese patent abstracts ("PAJ").

3. Analysis, and performance of the Japanese tech transfer system: some selected examples

As previously mentioned, the organization managing the interests of (primarily) universities as far as tech transfer activities are concerned is the University Technology Transfer Association[126] (UNITT), whose members are the TLOs and other institutions of higher education. UNITT also publishes annually a report with statistical data which is very comprehensive, unfortunately though, is just in Japanese, so, it may be difficult for a non-Japanese speaking person to have a full grasp of the data contained therein. As to the licensing income generated by the TLOs, it must be noted once again that TLOs started acting on behalf of the institution they refer to only recently, and universities could retain general ownership of the inventions only since 2004, therefore there might be a wealth of executed licenses that will generate an additional income (in terms of running royalties) once a positive feedback from the market will occur. Moreover, international licensing activities, and the generation of spin-offs utilizing technologies conceived by the relevant institutions seem to be the two main activities that could contribute to a substantial growth in terms of revenue generation. The number of the institutions that have been interviewed for this study is somehow limited[127] (since there are around 1,000 universities in Japan), but it offers a good representation of some of the most significant players in the generation and commercialization of research results, that account for the majority of research output, and licensing revenues (e.g. the licensing revenues of 2013 of The University of Tokyo alone account for more than one third of the total income of all national universities combined). For the purpose of comparing the following results with those of a single institution located in the U.S., the chart bellows illustrates the performance in terms of tech transfer activities of the MIT in 2013.[128]

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126 For further information, see http://unitt.jp/ (Last visited, 30 March 2015). The English page contains a limited number of information as opposed to the Japanese one.

127 For those interested in knowing about the innovation process and factors that might affect the research outcome at Riken and JAXA, which are not dealt with in this report, please consult the 2014 RIETI discussion paper titled *Innovation and Public Research Institutes: casexs of AIST, RIKEN, and JAXA*, available at http://www.rieti.go.jp/jp/publications/dp/14e021.pdf (Last visited, 30 March 2015).

128 In 2013, the MIT reported USD 46.14 million in royalties, which is equal to roughly 9 times the record revenues (i.e. 686 million JPY) reported in 2013. For more info on these and other statistics, see http://web.mit.edu/tlo/www/about/faq.html#a1 (Last visited, 30 March 2015).

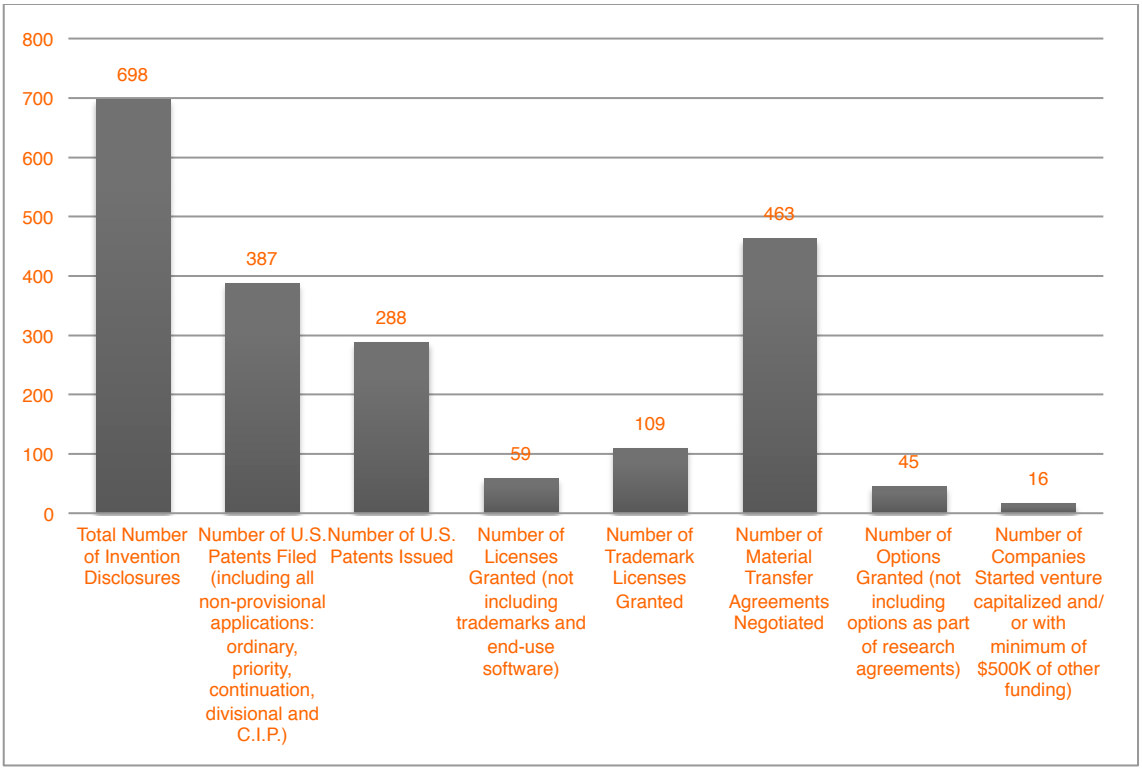

Figure 27 - MIT performance in 2013 - Source: MIT

3.1. The University of Tokyo

From the merging of Tokyo Kaisei School and Tokyo Medical School that gave birth to the four Schools of Law, Science, Letters and Medicine, the University of Tokyo started its life. The University of Tokyo continued to merge then with many different schools and became a comprehensive research university. Nowadays, the University of Tokyo is comprised of 10 Faculties (or Schools), 15 Graduate Schools, 11 affiliated research institutes, 13 University-wide centers, and two institutes for advanced study. The University of Tokyo employs several thousands of research and academic staff with a budget of around JPY 235 billion (2011).

The TLO of the University of Tokyo is one of the leading examples of tech transfer entities in Japan. Todai TLO Ltd. ("Todai TLO" or "CASTI")[129] is fully-owned by the University of Tokyo, and acts as a contact point to access the innovations developed within

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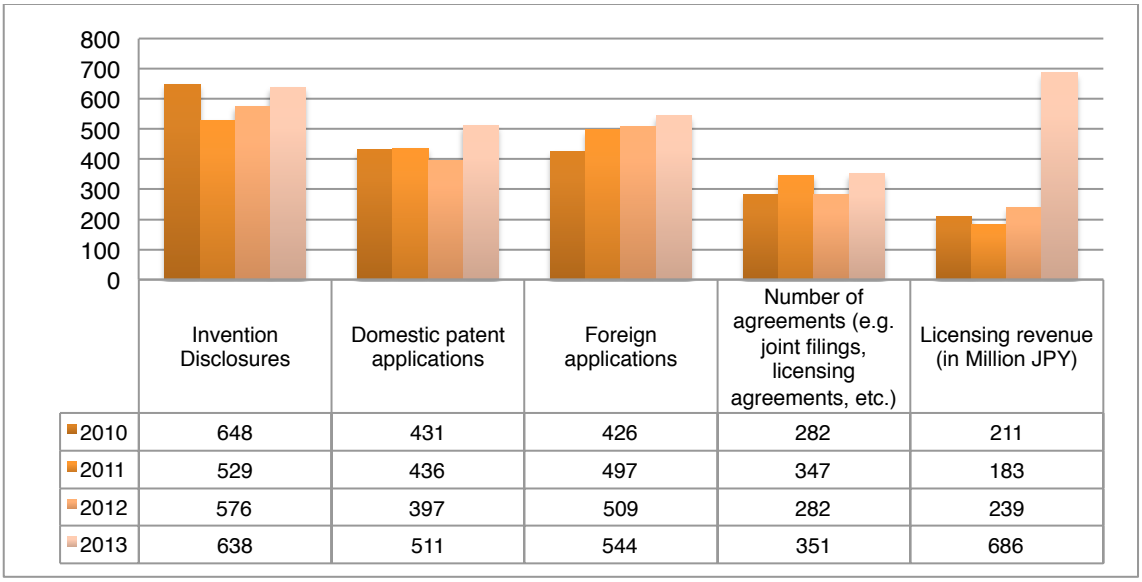
[129] Most of the information contained in this section has been extrapolated from the meeting held on 29 October 2014 at Todai TLO with Mr. Yamamoto, and the official webpage of the TLO.

the University of Tokyo. Todai TLO was established in 1998 just right after the enactment of the law on promoting technology transfer from universities, and it is entrusted by the University to file patent applications and license-out the technologies developed within the university. The University IP system at the University of Tokyo is managed by three separate entities, the Division of University Corporate Relations (DUCR),[130] which is the managing entity for IP,[131] Todai TLO, which takes care of the patenting, and licensing of the inventions after having received the disclosures from DUCR, and the University of Tokyo Edge Capital[132] (UTEC), which supports the creation of spin-off ventures. Figures related to performance of the University of Tokyo in the tech transfer arena are astounding,[133] at a domestic level, especially as far as the pure output of inventions is concerned, not that far from the ones reported by the MIT, mentioned in the previous section.



	Invention Disclosures	Domestic patent applications	Foreign applications	Number of agreements (e.g. joint filings, licensing agreements, etc.)	Licensing revenue (in Million JPY)
2010	648	431	426	282	211
2011	529	436	497	347	183
2012	576	397	509	282	239
2013	638	511	544	351	686

Figure 28 - Performance of the University of Tokyo - Source: CASTI

130 For further information, see http://www.ducr.u-tokyo.ac.jp/en/ (Last visited, 30 March 2015).

131 DUCR also supports joint research schemes through Proprius 21, and other initiatives. To know more about Proprius 21, see the brochure at http://www.ducr.u-tokyo.ac.jp/en/proprius21/index.html (Last visited, 30 March 2015).

132 For additional information on the activities performed by UTEC, see http://www.ut-ec.co.jp/cgi-bin/WebObjects/1201dac04a1.woa/wa/read/120a3bb30cb/ (Last visited, 30 March 2015).

133 Some values (e.g. licensing revenues) in this chart may differ from those reported in previous figures as they are also partly taken from the official website of The University of Tokyo TLO.

3.2. Kansai TLO

Kansai Technology Licensing Organization Co. Ltd.[134] (KTLO) is the external TLO that contributes towards the promotion of the technologies conceived and developed at Kyoto University, Kyushu University, Wakayama University, Kyoto Prefectural University of Medicine and Nara Medical University, and also supports their venture businesses. This is a very interesting model to observe because one organization is managing the interests of several entities locate in a common geographical region by trying to also achieve an optimization of the resources.

The mission of the KTLO[135]is primarily to give back to society the benefits potentially stemming from the use of the research outputs. To do that, the KTLO is engaged in the promotion and licensing negotiations at a global level on behalf of the mentioned five universities. KTLO was established in 1998, and its equity is shared among Ritsumeikan University, Kyoto University and Wakayama University. KTLO has different locations (basically in all of the partner universities), and employs 16 professionals. The services offered to the partner universities concern:

- The evaluation of invention disclosures;
- Patent filings;
- Patent licensing;
- The assistance as to the preparation of grant applications for collaborative projects;
- Training initiatives in the field of tech transfer; and
- The facilitation in collaborative projects to seek for funding.

KTLO has an exclusive contract for marketing and licensing the technologies that the universities decide the KTLO should manage, and thanks to its partners located in four continents is able to select, and bundle technologies coming from other countries to then present them to the potential licensees for evaluation. The University of Kyoto has been consistently among the top universities (e.g., it ranked no. 1 in 2011 with ca. JPY 224 milion) in Japan in terms of licensing revenues and this is also due to the effectiveness of the

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134 Most of the information contained in this section has been extrapolated from the meeting held on 6 November 2014 at Kansai TLO (Kyoto University campus) with Mr. Ohnishi, and Ms. Fujita and from their presentation.

135 For more information about the KTLO, please visit http://www.kansai-tlo.co.jp/english/ (Last visited, 30 March 2015).

KTLO's initiatives. Nevertheless, there is definitely room for additional improvements. In fact, most of the licensees keep being domestic companies, and most of the times the technologies are licensed rather than being used for the creation of new businesses. Moreover, since the vast majority of the potential licensees are inside Japan (according to the KTLO, 99% of the licensees are domestic), the most common tools to get in contact with them are direct calls or e-mails, and potential meetings at conferences and fairs within Japan, and this seems pretty common to all of the entities in the surveyed sample.

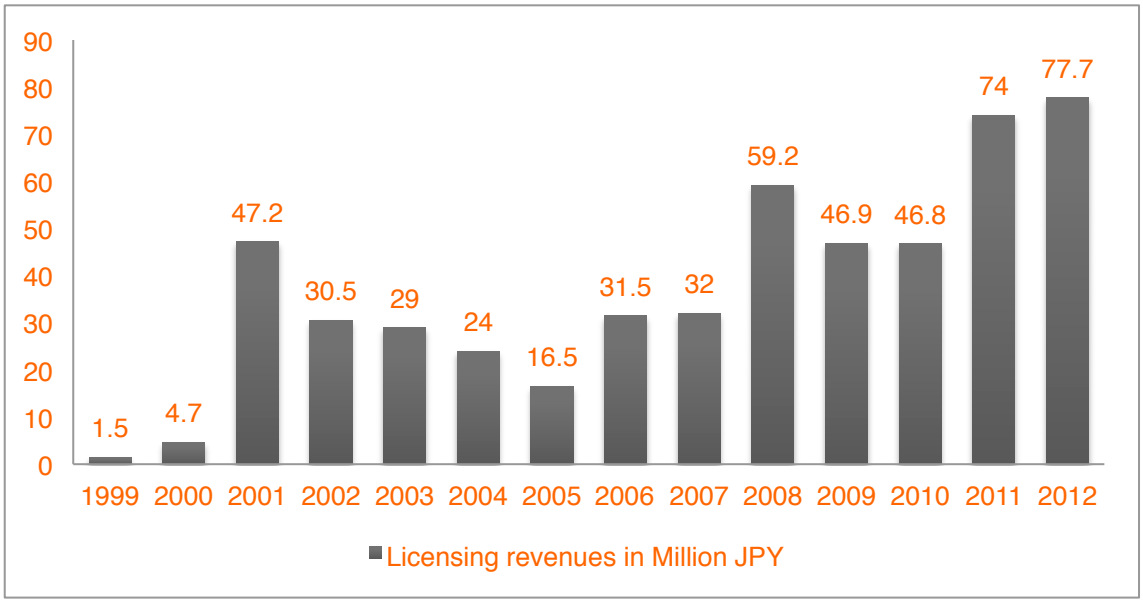


Figure 29 - Licensing revenues of Kansai TLO - Source: Kansai TLO

The figure above show the annual licensing revenues of Kansai TLO, which grew steadily overtime with the only exception of the 2009-2010 in which probably the global economic downturn played a role. These figures are not representing the total amount of the licensing revenues of the five represented universities, but also the amount generated through the activities of the KTLO with regard to selected technologies.

3.3. Tokyo Institute of Technology

Tokyo Institute of Technology ("Tokyo Tech")[136]is ranked in first place as academic institution for science and technology in Japan. The Institute has three undergraduate schools, 23 departments, and six graduate schools with 45 departments, and many satellite research institutes spread over the various campuses. Tokyo Tech employs around 1,200

[136] For additional information on Tokyo Tech, please visit http://www.titech.ac.jp/english/index.html (Last visited, 30 March 2015).

researchers, with a budget of around JPY 50 billion (2013), of which more than one third coming from sponsored funds,[137] the highest ratio in the country. The management of intellectual property[138] at Tokyo Tech is led by the Office of Industry Liaison ("OIL"),[139] which has been established in January 2004 to promote the knowledge and technologies developed within the institution. OIL is also responsible for the registration and management of IPRs, including their commercialization.

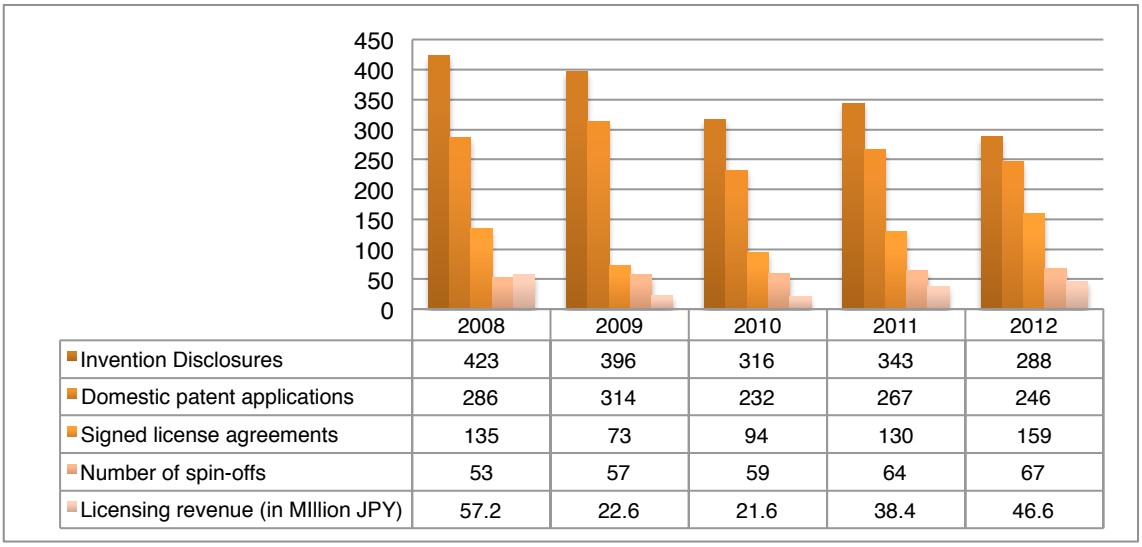
OIL is divided into four offices that run all the activities: i) Planning & International Collaboration, ii) Intellectual Property Managing, iii) Technology Transfer, and iv) Contracts & Management. Even though the figures related to tech transfer activities are remarkable, it seems that the best results derive from university-industry collaborations and start-ups creation. In fact, in 2012, for example, Tokyo Tech ranked second in terms of revenues originating from collaborative research contracts. OIL's policy is based on five principles that underpin every collaboration scheme with third parties, and aim at:

- Seeking collaboration not only with private companies;
- Pursuing collaboration to achieve real innovation;
- Promoting international collaboration among industry, government and academia;
- Collaborating through HR exchange;
- Targeting multidisciplinary collaboration.

[137] USD 164 million in 2013 (see next footnote).

[138] Some of the information contained in this section has been extrapolated from the meeting held on 30 October 2014 at Tokyo Tech with Professor Oi, and from his presentation.

[139] For additional information on the OIL, please visit http://www.sangaku.titech.ac.jp/english/about/index.html (Last visited, 30 March 2015).



	2008	2009	2010	2011	2012
Invention Disclosures	423	396	316	343	288
Domestic patent applications	286	314	232	267	246
Signed license agreements	135	73	94	130	159
Number of spin-offs	53	57	59	64	67
Licensing revenue (in MIllion JPY)	57.2	22.6	21.6	38.4	46.6

Figure 30 - Tokyo Tech performance - Source: Tokyo Tech

The figure above represents some of the performance indicators of Tokyo Tech, which excels in new venture creation (the row in the Figure shows a cumulative number), number of signed license agreements, and showed some signs of recovery in terms of licensing revenues after the general economic downturn.

3.4. Hokkaido University

Hokkaido University, one of the oldest in the country, ranked no. 8th in Japan according to the Academic Ranking of World Universities 2012.[140] Hokkaido University boosts an impressive number of schools and departments ranging from engineering to medicine, pharmaceutical sciences and veterinary. It is an institution with around 2000 researchers and with a budget (2014) of JPY 96 billion.

The management, and promotion of intellectual property at the university has changed overtime.[141] In fact, in 2007, the Management Center of Intellectual Property was replaced by the new Management Center for Intellectual Property and Innovation. After this,

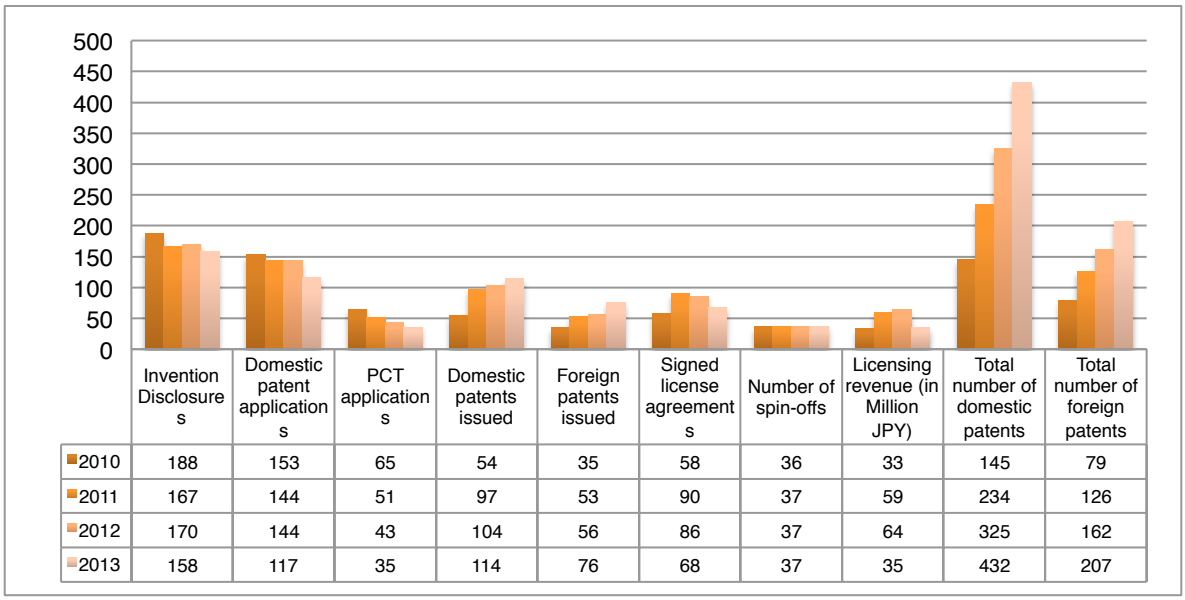
[140] For more information, please visit the official website: http://www.oia.hokudai.ac.jp/prospective-students/why-hokkaido-university/ (Last visited, 30 March 2015). Some of the information in this section has been extrapolated from the meeting held on 4 November 2014 in Tokyo at the EU-Japan Centre for Industrial Cooperation with Professor Sumi, and from his presentation.

[141] For a detailed overview of the IP management at the university, please visit the official webpage at http://www.mcip.hokudai.ac.jp/cms/cgi-bin/index.pl?page=index&view_category_lang=2 (Last visited, 30 March 2015).

the Center was later reorganized and renamed Center for Innovation and Business Promotion ("CIBP") in 2009. Its mission is to contribute to the development of industry and society by leveraging the university IP, and try to create a perfect environment to conceive new ideas and develop them through collaborations with industry.

CIBP reports directly to the President of the university, and tries to offer a series of integrated services, which can be beneficial to researchers so that they could dedicate their endeavors in doing research. CIBP is also in charge of managing the creation of start-ups based on technologies developed within the university.

In terms of tech transfer indicators, the following figure shows how Hokkaido University is among the top Japanese universities in terms of IP output and licensing revenues.[142]



	Invention Disclosures	Domestic patent applications	PCT applications	Domestic patents issued	Foreign patents issued	Signed license agreements	Number of spin-offs	Licensing revenue (in Million JPY)	Total number of domestic patents	Total number of foreign patents
2010	188	153	65	54	35	58	36	33	145	79
2011	167	144	51	97	53	90	37	59	234	126
2012	170	144	43	104	56	86	37	64	325	162
2013	158	117	35	114	76	68	37	35	432	207

Figure 31 - Hokkaido University Performance - Source: Hokkaido University

Looking at the figures above, it is worth commenting that the university owns a sizeable patent portfolio (432 domestic patents and 207 foreign), and that the licensing revenues had a sudden drop in 2013 for the general economic downturn of almost 50% that should be somehow recouped in the 2014~2015 period.

142 Prof. Sumi, during his presentation, mentioned successful cases between the University and companies that led to the development/commercialization of new products (e.g. with Hitachi, and Taiho Electronics in the field of medical equipment, and with Dynax in the field of electric vehicles).

Collaboration with industry is pretty advanced and promoted by the university, which is involved in collaborative projects and licensing deals that actually saw products entering the market successfully. The novel approach adopted by this institution in terms of market outreach has been called "A2B2C",[143] i.e. from Academia to Businesses to Consumers, and it perfectly summarizes the efforts being made by universities and research institutions when trying to conceive technologies that can become innovations by entering the market in a much shorter timeframe than before.

3.5. Keio University

Keio University is another example of extremely known academic institution in Japan. The, founder, Yukichi Fukuzawa (1835-1901) was a man known for his keen passion for the pursue of knowledge and thanks to his ideas and legacy he is regarded as one of the founders of modern Japan. The university was formally founded in 1858, and nowadays is an institution with around 3,000 researchers, a budget of around JPY 225 billion (2013), and schools, and departments that carry out outstanding research at a global level.[144]

As it happens in most of the other universities, Keio's mission mandates that the results stemming from research should benefit society at large. Following the passage of the TLO Act, Keio University established in the same year the Intellectual Property Center, which was considered the university TLO. In April 2010, the university merged the IPC with the Keio Incubation Center, which from 2011 resulted in the creation of the Headquarters for Research Coordination and Administration ("RCA"),[145] which take care of the promotion and commercialization of the university research outputs.

Additionally, the university (through the School of Science and Technology) organizes every year, in December, the so-called Keio Techno-mall held at the Tokyo

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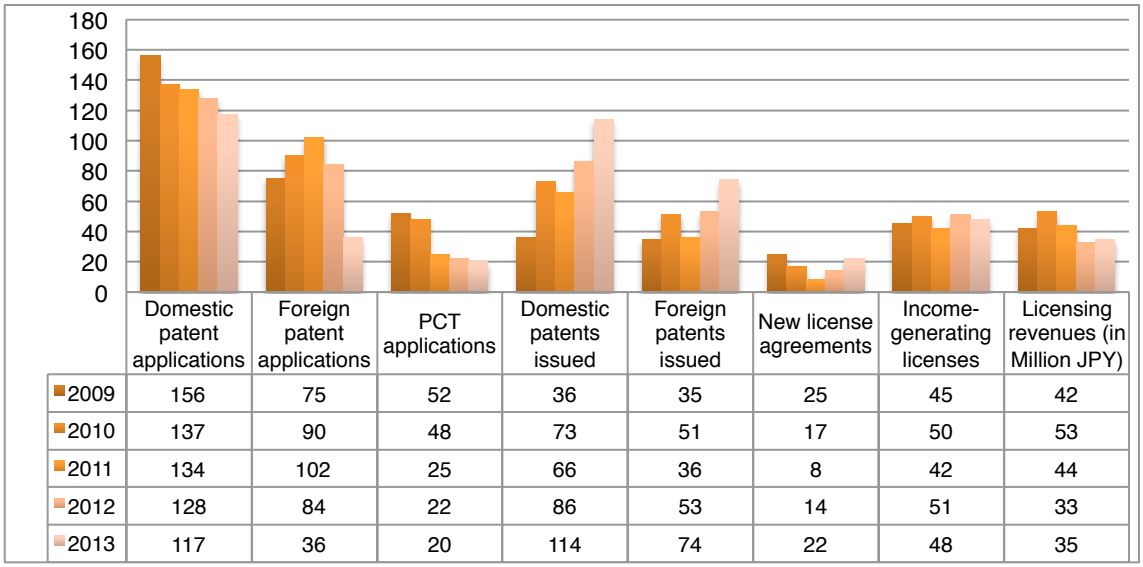
143 Concept mentioned by Prof. Sumi (see preceding footnote) during the Q&A session after the presentation of the research results contained in this report on March 19th, 2015, at the EU-Japan Center for Industrial Cooperation, Tokyo.

144 For more info about Keio University, please visit http://www.keio.ac.jp/en/about_keio/index.html (Last visited, 30 March 2015).

145 For more info about the RCA, please visit the Japanese site http://www.rcp.keio.ac.jp (Last visited, 30 March 2015).

International Forum [146] to showcase cutting-edge research results, and promote industry-academia collaborations. This event, held at the very core of metropolitan area of Tokyo, attracted more than a thousand corporate visitors in its 2013 edition.



	Domestic patent applications	Foreign patent applications	PCT applications	Domestic patents issued	Foreign patents issued	New license agreements	Income-generating licenses	Licensing revenues (in Million JPY)
2009	156	75	52	36	35	25	45	42
2010	137	90	48	73	51	17	50	53
2011	134	102	25	66	36	8	42	44
2012	128	84	22	86	53	14	51	33
2013	117	36	20	114	74	22	48	35

Figure 32 - Keio University Performance - Source: Keio University

Looking at the chart above,[147] it can be noted that almost all the figures of 2013 are showing a decrease with respect to the previous years with the exception of issued patents, both domestic and foreign, but they necessarily refer to filings of previous years, and therefore to do not represent the performance of 2013. Licensing revenues also showed a slight increase from 2012, but they are very far from the record-setting JPY 53 million of 2010.

3.6. Waseda University

Waseda University is one of the oldest universities of Japan and changed its name several times from its foundation (1882) until 1892, when the institution was then formally renamed *Waseda Daigaku* (Waseda University). The mission of this university clearly promotes a practical use of acquired knowledge, and not simply for a question of pragmatism, as the university highlights, but because of the necessity to feed an entrepreneurial spirit, which became one of the pillars of this institution where the promotion

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146 On that occasion, at the 2014 edition, on 5 December, the interview with Ms. Takahashi and Mr. Sato took place, and some of the information contained in this section has been extrapolated from that meeting.

147 Data extrapolated from the charts of the 2013 Annual Research Report, available at http://www.rcp.keio.ac.jp/planning/annual_report.html (Last visited, 30 March 2015).

and global dissemination of research results are definitely recognized as major objectives to pursue.[148]

Since 1999, the Waseda University Research Collaboration and Promotion Center, which is Waseda's approved TLO ("WTLO"),[149]has been actively engaged in managing several cases of industry-academic-government collaboration. WTLO operates according to three major principles: 1) making a better use of IPRs by disseminating the results globally; 2) contribute to the further development of the region and benefit society at large; 3) favor the creation of new businesses. Waseda also intends to revitalize education and research by means of the revenues from its activities, and to further promote industry-academia collaboration.[150]

WTLO works hard to disseminate the innovative solutions developed within the university, which are being called "seeds", a common term among many universities and research centers in Japan to indicate a solution that needs attention, and care to grow. Seeds are then divided in IP seeds and Technology seeds where the former refer to mere patents, and the latter to actual technologies that have been developed in the form of working prototypes (and most certainly are also patented). The recent database introduced by the WTLO (i.e. Seeds N@vi)[151] allows users to make on-line searches between these two categories of solutions by offering all the basic information that might be needed to attract the user to get in contact with the WTLO. The main areas in which the WTLO is involved for carrying out tech transfer activities are mainly life sciences, IT, and manufacturing technologies. WTLO is proud of the international outreach achieved since its inception, which comprises international collaborative projects and licensing to foreign entities.[152] The following figure illustrates the university performance from 2010.

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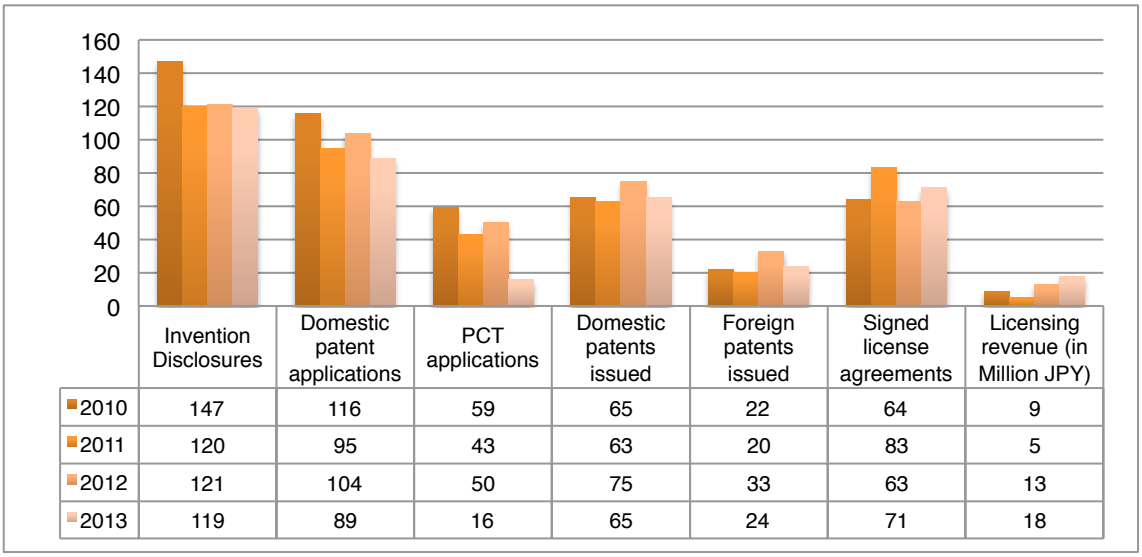
148 For more info about Waseda University, please visit https://www.waseda.jp/top/en (Last visited, 30 March 2015).

149 For more info about the WTLO, please visit http://www.waseda.jp/tlo/ (Last visited, 30 March 2015).

150 Most of the information concerning the WTLO has been extrapolated from the meeting held at WTLO on 20 November 2014 with Dr. Nagao and Mr. Shibata, and from their presentation.

151 For more info, visit https://www.wrs.waseda.jp/seeds/en/ (Last visited, 30 March 2015).

152 Even if the percentage of international licensing v. domestic licensing is less than 10% of the total, it seems above the average among the interviewees.



	Invention Disclosures	Domestic patent applications	PCT applications	Domestic patents issued	Foreign patents issued	Signed license agreements	Licensing revenue (in Million JPY)
2010	147	116	59	65	22	64	9
2011	120	95	43	63	20	83	5
2012	121	104	50	75	33	63	13
2013	119	89	16	65	24	71	18

Figure 33 - Waseda University performance - Source: Waseda University

The numbers in the chart[153] are pretty stable and do not seem to have meaningful changes, with the only exception of the number of PCT applications, which dropped from 2013. In terms of licensing revenues, in the last three years the WTLO reported an important increase, which led to a total of ca. JPY 18 million in 2013,[154] pretty far from the top of the list, but definitely promising, and with probably one of the most efficient websites in English for the dissemination of information and promotion of the IP portfolio.

3.7. Nihon University

Nihon University is one of the oldest and most populated universities in the country, it is usually ranked among the top ten Japanese universities. With a stunning number of researchers, it offers a wide number of schools and departments covering most of the known fields of science and technology. It is an institution with around 3600 researchers, and with a budget (2013) of around JPY 250 billion.[155]

The management, and promotion of IP at Nihon University[156] are carried out by the

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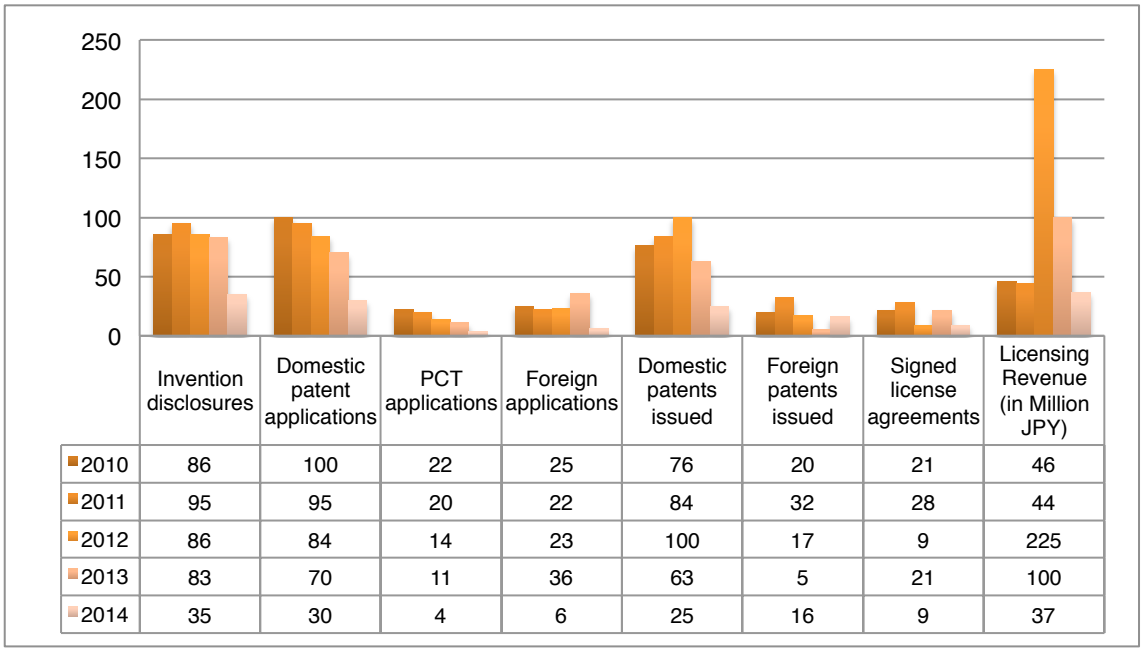
153 Please note that the row indicating the number of signed agreements include joint applications too.

154 It is interesting to note that some universities, like Waseda, are also promoting the assignments of the available technologies, and not just licensing deals.

155 For more information about Nihon University, please see the official page at http://www.nihon-u.ac.jp/en/ (Last visited, 30 March 2015).

156 Some information contained in this section has been extrapolated from the meeting held at Nihon

Nihon University Business, Research and Intellectual Property Center ("NUBIC"), which was one of the first TLOs in Japan. NUBIC promotes the ideas generated inside the university to find potential applications in several industries. In 2004, NUBIC as been selected by METI as a Super TLO for its high achievements in the promotion and commercialization of university technologies. NUBIC serves two functions at the same time, which were originally carried out by the Intellectual Property Headquarters, and the university TLO, therefore the spectrum of services covers all aspects of the innovation path.



	Invention disclosures	Domestic patent applications	PCT applications	Foreign applications	Domestic patents issued	Foreign patents issued	Signed license agreements	Licensing Revenue (in Million JPY)
2010	86	100	22	25	76	20	21	46
2011	95	95	20	22	84	32	28	44
2012	86	84	14	23	100	17	9	225
2013	83	70	11	36	63	5	21	100
2014	35	30	4	6	25	16	9	37

Figure 34 - Nihon University performance - Source: Nihon University

From the figure above, it is inferable that the activities in the last four years, both in term of research output and performance have been pretty much constant with an evident drop in licensing revenues in 2013 that is always due the general economic downturn, and slight decrease in the PCT filings. Also, it has to be mentioned that the figures related to 2014 refer to the April-October window, and therefore is merely indicative of the performance of the university in FY2014.

3.8. National Institute for Materials Science

The National Institute for Materials Science ("NIMS")[157] plays one of the most

University with Mr. Inoue on 10 November 2014.

[157] Part of the information contained in this section is related to the meeting held at NIMS on 20 January 2015 with Ms. Imanishi, Ms. Nio, Mr. Hitachi and Mr. Konuma.

important roles in this report in terms of performance for the scientific output (and licensing revenue) and for championing innovative ways to interpret innovation, like the NIMS Open Innovation Center ("NOIC"). NIMS was an independent administrative institution ("IAI") until March 31st, 2015, and it was Japan's only IAI concerned with materials science research. From April 1st, 2015, NIMS' legal nature has changed to National Research and Development Agency. It originated in 2001 from the merger of two existing and separate institutions: the National research Institute for Metals, and the National Research in Inorganic Materials.

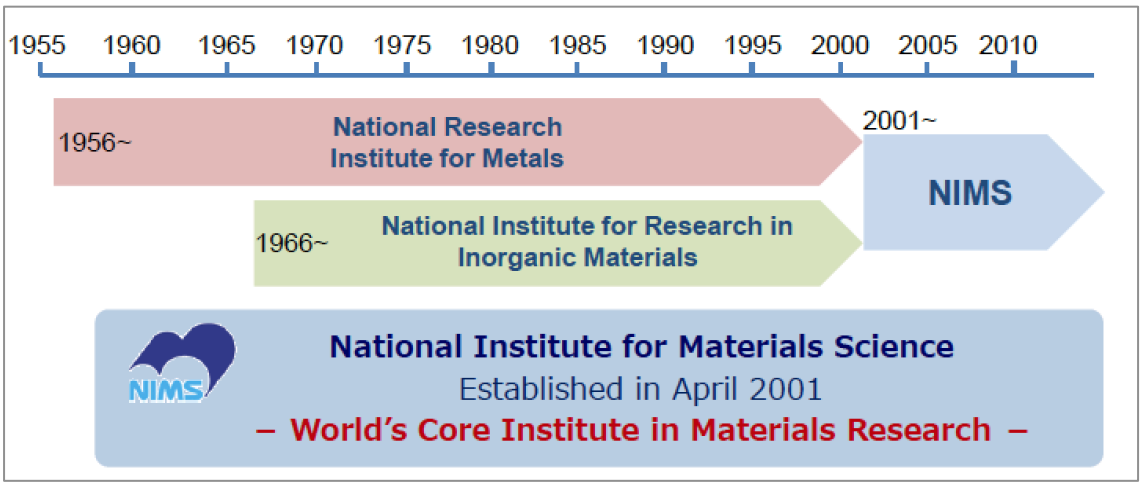


Figure 35 NIMS's history – Source: NIMS

For the 3rd Mid-Term Program,[158] NIMS has prioritized its activities in 19 projects in 3 areas (materials for energy and environment, nanoscale materials, and advanced key technologies) which will address two major research challenges: "R&D for advanced materials responding to social needs" and "Advanced R&D that aims breakthrough with creating innovative materials".[159]

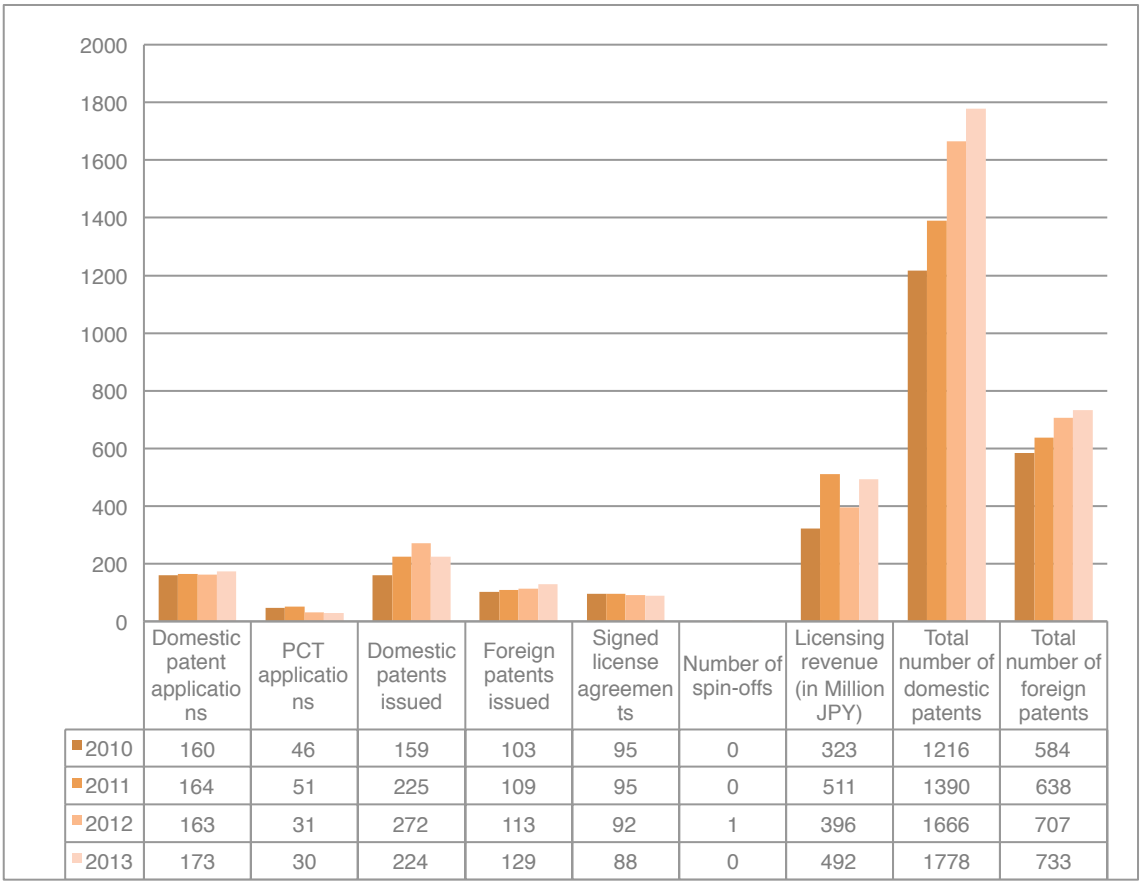
NIMS's mission consists of promoting and doing cutting edge research in the realm of materials science, and it covers materials encompassing not only metals or ceramics but also organic materials and biomaterials. Activities related to the accomplishment of NIMS's mission include:

158 Which lasts 5 years, and started in April 2011.

159 For more info: http://www.nims.go.jp/eng/research/project/index.html (Last visited, 30 March 2015).

- fundamental research, and generic/infrastructural technology research and development;
- the dissemination of research results, and the promotion of their practical applications;
- promoting and offering the shared use of NIMS facilities;
- training for researchers, and engineers.[160]

The figure below[161] depicts some of the numbers related to tech transfer activities at NIMS where, reportedly, international licensing activities are pretty high being in the range 5%-10%.



	Domestic patent applications	PCT applications	Domestic patents issued	Foreign patents issued	Signed license agreements	Number of spin-offs	Licensing revenue (in Million JPY)	Total number of domestic patents	Total number of foreign patents
2010	160	46	159	103	95	0	323	1216	584
2011	164	51	225	109	95	0	511	1390	638
2012	163	31	272	113	92	1	396	1666	707
2013	173	30	224	129	88	0	492	1778	733

Figure 36 - NIMS Tech Transfer activities - Source: NIMS

Overall, taking a look at the licensing revenues collected by the major universities and research institutions in Japan in this study, it can be noted that the performance of NIMS

160 For more info: http://www.nims.go.jp/eng/nims/policy.html (Last visited, 30 March 2015).

161 Please note that in this figure, the total number of patents is cumulative and the number of license agreements is a combination of new licenses and those that are still ongoing.

is outstanding as the institute ranked first in 2012 (in a ranking which takes into account universities and research organizations).[162]

The available data from NIMS shows a steady increase in the number of patents, both domestically, and internationally. The possibility to employ internal resources for the drafting of the application probably facilitates the propensity to file, but only when inventions are considered worthwhile, that is what emerged during the interview with NIMS's representatives. For now, only licensing agreements are being pursued as the assignment option has not been considered at this point.

NIMS Open Innovation Center - NOIC

NOIC is a very interesting experiment of open innovation that NIMS is carrying out together with its members. For those interested in delving into the details, there is a very detailed explanation, and rules as to how the center works, and it is managed.[163] Memberships are annual but they are generally renewable, and participation to the program is not just open to domestic entities, but also to foreign companies, universities, and other institutions. The following figures represent a current list of the corporate and academia

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[162] NIMS's performance in terms of licensing revenues is definitely an example to look at, both domestically, and internationally. In fact, it is worth making a comparison between different industrialized countries at this point beside the U.S. For example, according to the latest survey[162] of the Italian association of tech transfer offices of universities and public research institutions, called Netval**,** all the surveyed universities (with data referring to FY2012) in Italy had an active portfolio of 3,356 patents (49 respondents to this part of the questionnaire), that generated licensing revenues equal to ca. 1.2 million euros (47 respondents to this part of the questionnaire). Comparing the Italian numbers to the performance of NIMS constitutes an interesting experiment. In fact, it can be noted that in the same year (FY2012) a single research institution (i.e. NIMS) with a portfolio of 1,666 patents (almost exactly half of the Italian sample) generated revenues for JPY 396 million, which means basically three times the amount collected by 47 Italian universities combined. Same comparison can be made with The University of Tokyo, that in 2013 ranked first overall in Japan with ca. JPY 660 million in licensing revenues, which is equal to 5 times the amount of the Italian sample.

[163] For more details about the rights and obligations attached to NOIC's memberships and, please consult NOIC's by-laws at: http://www.nims.go.jp/eng/collaboration/openinno/hdfqf1000001c3dm-att/hdfqf1000001c3gs.pdf (Last visited, 30 March 2015).

members.

Figure 37 - Corporate members of NOIC – Source: NIMS

At NOIC, the main topics to be dealt with by the members are research and/or standardization themes. Until the end of FY 2014, five research themes have been selected for discussion and deeper investigation, namely:

- materials for batteries: materials for rechargeable batteries, materials for fuel cells, and common technologies related to battery materials;
- materials for thermal energy conversion: thermoelectric conversion materials, advanced heat-resistant materials, heat-insulating technologies, and analysis of thermo-physical properties of materials;
- materials for magnetic energy conversion;
- materials to be used in nano-electronic applications; and
- materials for hydrogen separation.[164]

In the future, NIMS will add additional themes for easing the collaboration among the members. As to the membership fees, members pay an annual (usually renewable) fee according to they legal nature, and the costs associated to research activities are included in the fee. The table here below provides an outline of the different memberships, together with rights, and obligations attached to each membership.

[164] For more info, please consult NIMS website at: http://www.nims.go.jp (Last visited, 30 March 2015).

Membership	Special	Ordinary	Associate	Partner	Academia
Enrolment limit	Limited	-	-	-	-
Membership fee[165]	20 million JPY	10 million JPY	-	500k JPY	-
Free participation in the Technology Committee and Open Laboratory	YES	YES	YES	NO	YES
Access to IP rights[166]	Free license for the Member the inventor belongs to	Free license for the Member the inventor belongs to	Free license for the Member the inventor belongs to	IPRs can be licensed	Free license only for research

Table 6 – Selected Rights and Obligations attached to NOIC memberships – Source: NIMS

Interestingly, inventions conceived under one of the selected themes, are always considered property of NIMS which then takes care of any potential patent prosecution costs if an application is filed. Members have usually the options of either getting a free license (as shown in the table above, if the researcher belongs to the organization requesting to get a license) or a license with more favorable terms if compared to a third party, which is not a NOIC member. There is also a reward system for the inventors, who will get different monetary rewards on the basis of the status of the prosecution of the applications, and on the amount of licensing revenues collected by NIMS.[167]

The following graph shows how the tech transfer process within NIMS works in a circular, potentially infinite manner, by leveraging the results stemming from the patenting and monetization of the patented ideas to facilitate the beginning of a new research theme.

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165 Membership fees may vary according to the capital of the company, which applies for the membership. The threshold below which the fees are lower is 100 million JPY.

166 Inventions conceived in the OL are owned and managed by NIMS. Pecuniary rewards for the inventors are envisaged in case of licensing of inventions developed in the OL.

167 For more info on how the IP is regulated within NOIC, consult NOIC's by-laws, available at: http://www.nims.go.jp/eng/collaboration/openinno/hdfqf1000001c3dm-att/hdfqf1000001c3gs.pdf (Last visited, 30 March 2015).

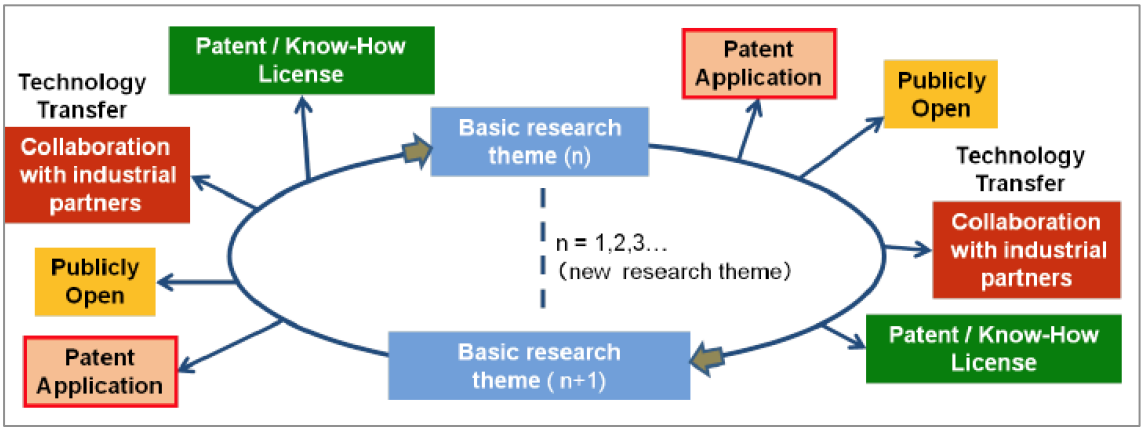

Figure 38 - NIMS's tech transfer process – Source: NIMS

As to the available technologies that might be licensed by third parties, even from outside Japan, it has ben mentioned during the meeting that the nature and magnitude of the patent portfolio might be publicized later on on the official website, but for now the only way to know what are the available technologies is actually to send an e-mail or call the Office in charge of this task.

3.9. The National Institute of Advanced Industrial Science and Technology

The National Institute of Advanced Industrial Science and Technology ("AIST")[168]is the new name of the Agency of industrial Science and Technology, which changed name and legal nature in April 2001. In fact, in that year the Agency became an independent Administrative institution from the original status of a Government Institute. AIST's vision is to contribute to society through the advancement of industrial technology. The institute has several missions to accomplish, among which:

- contribute to create a sustainable society;
- contribute to raise industrial competitiveness;
- contribute to policy-making activities regarding industrial technologies;
- contribute to educate human resources in technology management.

The six major fields of research of AIST in which its researchers are involved,[169]performed in several locations across the country, are:

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168 Most of the information contained in this section has been extrapolated from the meeting held on 26 November 2014 at AIST in Tsukuba with Ms. Maruyama, Mr. Futamura, and Mr. Morimoto, and from their presentations.

169 In 2013, AIST reported to have 2,255 researchers, out of 2921 total employees. Several

- Environment and energy;
- Life sciences and biotechnology;
- Information technology and electronics;
- Nanotechnology, materials, and manufacturing;
- Metrology and measurement science;
- Geological survey and applied geoscience.

Research units at AIST[170] are divided into three categories:

- Research centers (20): in which pioneering projects are conducted for up to 7 years;
- Research institutes (22): in which mid & long-term research is conducted
- Research labs (0): in which new research fields should be investigated.

The importance of IPRs for AIST is undisputable and the numbers related to their protection and performance are among the highest in the country. AIST, while involved in the promotion of technology transfer, aims always and primarily at achieving the greatest national benefit and attraction of additional funding to conduct research. The second objective is achieved by carefully examining the inventions for which patent protections is sought, and specific compensation schemes have been adopted to reward the inventors. To reduce uncertainty in the acquisition and promotion of IPRs, AIST follows a PDCA approach from the very conception of each idea. Among the most successful examples of products and most promising technologies coming out of AIST's labs in these recent years, it is worth mentioning:

- The robot called Paro;[171]
- Humidity-adjustable building materials;

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thousands of other researchers are involved with AIST through industry-academia-government partnerships though.

[170] Figures updated as of July 2014.

[171] For more info, check the official website at http://www.parorobots.com (Last visited, 30 March 2015).

- A new membrane material called CLAIST®;[172]
- New kinds of carbon nanotubes.

The following chart[173] represents the key figures related to AIST's performance in terms of research outputs for which some supplementary information is needed:

- The number of domestic patents decreased after 2004 as up until that moment there was an exemption from the renewal fees. This led to a more focused strategy for choosing which technology to protect, and that is why there is a slight increase in the last years of international applications, nevertheless the number of domestic patent applications (740 in 2013), even if slightly decreased, still constitutes an amazing result both at the national and international level. Domestically, for example, NIMS filed 173 applications in 2013 and The University of Tokyo 511. In the U.S., the MIT filed 387 applications in the same year.
- Licensing revenues are steady in the last fours years but much lower than the previous years in which there has been a peak up to JPY 619 million in 2008. In 2013 they represented 0.3% of the total revenues.[174]
- The number of domestic patents granted to the institute is also comparable to very few other institutions in the world: 837 patents in 2013 almost equal one fifth of all the patents obtained by the 100 respondents of the last UNITT's survey, and they amount to more than three times the number of domestic patents granted to the MIT in 2013 (288).

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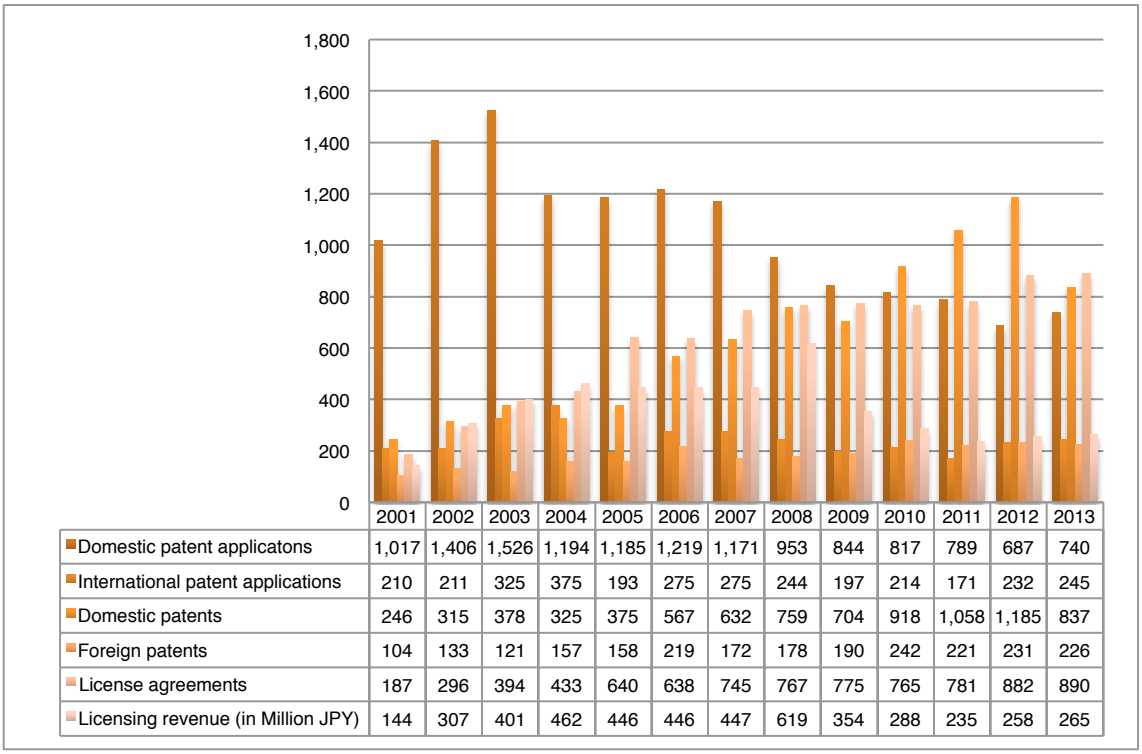
[172] CLAIST® is a film material with superior heat-resistance properties. The aim of AIST is to develop CLAIST® and expand its use in various industrial areas through a network of industrial, academic and government players. For more info about the product and project, see https://unit.aist.go.jp/ccs/clayteam/clayteam_e/claist/about.html (Last visited, 30 March 2015).

[173] Please note that all figures refer to a single fiscal year with the exception of the "License agreements" row/bar, which refers to all the active licenses at the end of the relevant fiscal year.

[174] In 2013 the revenues of the institute were equal to ca. JPY 94 billion against an overall expenditure of around JPY 102 billion.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Domestic patent applicatons	1,017	1,406	1,526	1,194	1,185	1,219	1,171	953	844	817	789	687	740
International patent applications	210	211	325	375	193	275	275	244	197	214	171	232	245
Domestic patents	246	315	378	325	375	567	632	759	704	918	1,058	1,185	837
Foreign patents	104	133	121	157	158	219	172	178	190	242	221	231	226
License agreements	187	296	394	433	640	638	745	767	775	765	781	882	890
Licensing revenue (in Million JPY)	144	307	401	462	446	446	447	619	354	288	235	258	265

Figure 39 - AIST Tech Transfer Activities - Source: AIST

The chart here below depicts a breakdown of research areas by percent of employees and the technology breakdown of domestic patent applications.

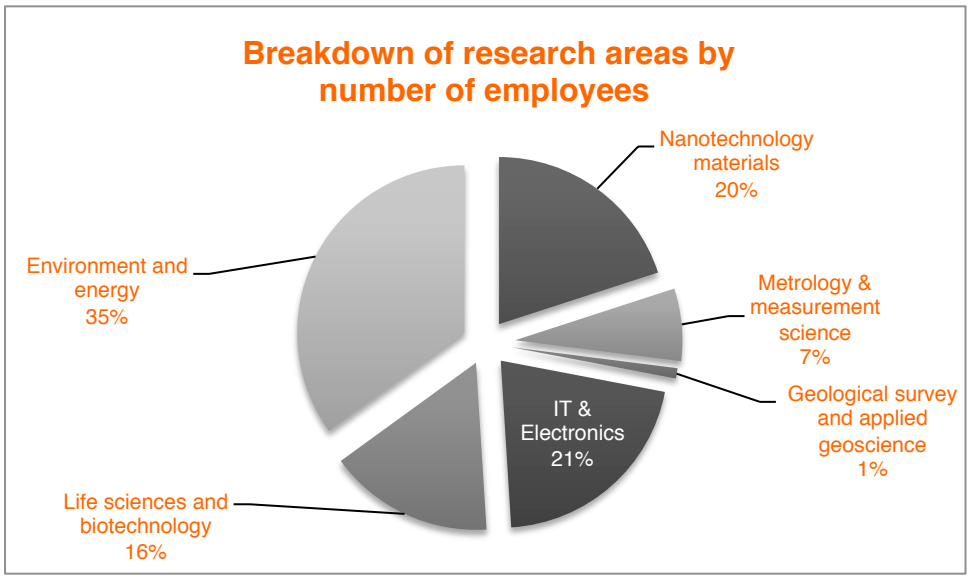


Figure 40 - Breakdown of research areas by number of employees - Source: AIST

The figure below goes a little bit deeper into the details of the scientific fields in which the patent applications have been filed by also providing an idea of the performance

in terms of research outputs by technology area.

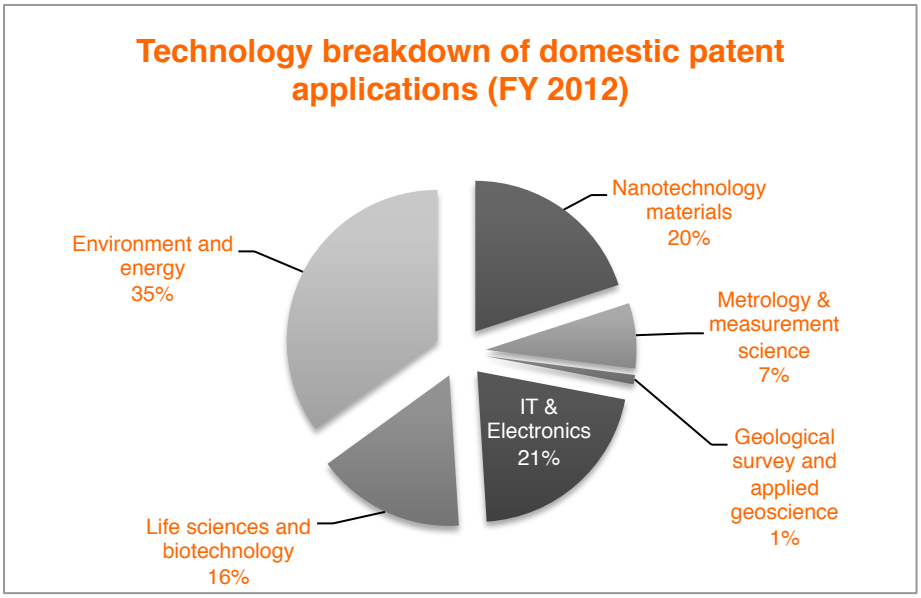


Figure 41 - Technology breakdown of domestic patent applications - Source: AIST

By making a comparison between the two charts most of the sectors show a certain proportion between the number of employees and the number of patent applications with two notable exceptions. First, 24% of the total researchers involved in the Environment & Energy sector are related to an output of 35% of the reported patent applications. Second, the Geological Survey & Applied Geoscience group is outperforming all the other groups with a 10% portion of the filed domestic patent applications generated by only 1% of the overall AIST's researchers' population.

4. Challenges and Opportunities for European SMEs Interested in Acquiring or Licensing Japanese Technologies

Challenges and opportunities are exogenous elements that may influence the successful pathway of a company, and therefore they have to be known in advance.[175]

175 A short survey has also been sent to the scientific attaches of the EU embassies in Tokyo during the research phase to understand whether tech transfer activities are at times performed through the help of embassies as well, but the response has been unsatisfactory has only a couple of recipients replied, therefore not allowing their response to have a real statistical value. The survey consisted of two questions: "*i) Are you aware of any technology transfer activity occurred between companies headquartered in your Country, and Japanese universities and/or research centers? If so, can you please provide more information?* and *ii) What is the most complex hurdle to overcome, if any, for companies headquartered in*

Their number and nature have also been discussed during the presentation of the research results of this work on 19 March 2015, in Tokyo, in front of an audience of technology transfer professionals that have been interviewed during the course of the research performed to write the report, with a general consensus as to the major challenges, that have been identified as follows:

- Language barrier. When dealing with the tech transfer ecosystem as a whole, language barriers can still pose a problem;
- Lack of an easy-to-find repository with available contacts. It would be very useful to have a unique, easily-accessible, virtual venue (i.e. a website) where to find contact information of all the stakeholders;
- Distance between the parties. It seems that especially as far as European companies are concerned, distance still constitutes a real obstacle between the parties;
- Little attractiveness due to a general the lack of visual representations. It would be highly recommended to adopt a new approach to advertise available technologies through novel media to better entice potential licensees/assignees;
- Quantity of available info in English v. Japanese. Japanese governmental websites have more information in Japanese than in English as the cost of the translations would be too high to manage, and it is not a priority being the domestic market the first target.

Whereas the major opportunities might be summarized as follows:

- No domestic preference by law (i.e. the Japanese Bayh-Dole Act) as far as licensing activities are concerned;
- Licensing agreements can be executed remotely, there is no real need to meet in person nowadays;
- Presence of qualified personnel in several institutions able to negotiate in English. All the major universities and research institutions have qualified personnel able to negotiate tech transfer agreements in English;
- Great wealth of advanced technologies available for licensing.

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your Country when dealing with technology transfer activities with Japanese universities and/or research centers?"

Apparently, the mentioned challenges and opportunities may not be necessarily related to European SMEs, as they could be applied indiscriminately to all companies coming from outside of Japan, nevertheless, most of the interviewees, mentioned[176]how different is the approach of European companies as opposed to U.S. ones, for example. In fact, it seems, that the proactive approach of European researches when dealing with Japanese research partners is not comparable to the one showed by European companies engaged in licensing agreements that, reportedly, are not that easy to deal with as the corporate hierarchy is way more complex to manage than the US one. Therefore, from the Japanese side, there is a challenge that should definitely be overcome when dealing with European businesses. Luckily though, smaller entities like SMEs may be more prone to adopt a much quicker and less bureaucratic approach when dealing with potential Japanese universities and research institutions due to their very nature that could make them more agile in negotiations as opposed to large corporations. Lastly, during the presentation of the research results, the interviewees have been asked whether an external repository, with the purpose of promoting an international exposure of technologies showing what Japanese universities and research organizations might be willing to license-out or assign would be appreciated, and the response has been generally positive with representatives showing their sincere interest in such a proposition.[177]

5. Conclusions

The Japanese tech transfer system as a whole may be on the right track to potentially achieve in the medium term (i.e. 5-10 years) results (especially in terms of licensing revenues) that could be in line with those reported by the U.S. only if the international licensing activity, and a tendency to license-out technologies to spin-off companies will be further developed. The entire ecosystem covering the generation of potential innovations is quite unique as the assistance and services offered by governmental entities in Japan cannot be found anywhere else in the world. Any company or research institution in Japan can benefit from an unparalleled spectrum of services and wealth of information (in some cases even in English), which is second to none. It is clear, though,

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176 During the presentation of the research results at the EU-Japan Center for Industrial Cooperation occurred on 19 March 2015.

177 As a matter of fact, the EU-Japan Centre for Industrial Cooperation is evaluating whether to start a service that could implement such a project for the benefit of European companies, and Japanese universities, and research organizations.

that in terms of licensing activities, domestic partners are still privileged, and they constitute the major source of the generated licensing revenues.

Unlike it happens in other countries (e.g. in the U.S.), there is no limit or preference that should be given to domestic companies when tech transfer activities are concerned, therefore the horizon of potential licensees should be borderless. What also appeared clear from most of the interviews is that there is an absolute willingness to operate internationally to find licensees or assignees for the available technologies, but marketing efforts and techniques should probably be honed to widen the potential outreach.

Current challenges may well we be turned into fruitful opportunities by taking a more proactive approach. All of the interviewed entities are capable to enter into negotiations in Japanese and English, therefore lowering the major barrier that foreign entities may fear when dealing with a Japanese counterparty. Moreover, some interviewees reported to have conducted negotiations and signed license agreements remotely without meeting in person. As noted, there are still some indicators that could be bettered in the future (e.g. number of spin-offs generated by universities and research organizations, and international licensing activites), but the system seems to have taken giant leaps since the creation of TLOs, and the incorporation of national universities, and the opportunities for foreign entities interested in entering into negotiations to license a technology may grow exponentially, allowing smoother, faster, and borderless deals.

In appendix, an exhaustive collection of major of IP-related Japanese laws and regulations, and a contact list to be used when trying to reach out to some of the major Japanese TLOs complement this report by offering useful tools for all those interested in i) understanding the technology transfer ecosystem in Japan and its performance, and ii) pursuing effective technology searches for licensing-in or purchasing Japanese technologies stemming from universities and research organizations.

5.1. Recommendations to European SMEs

European SMEs should take advantage of the wealth of information concerning available technologies that are already present on most of the official websites. Moreover, additional information can be provided on demand by simply contacting a TLO of a university or research organization. Most of the IPRs and especially patents have a domestic coverage, but there is also a great number of PCT, and foreign applications, which may be enticing for a foreign entity if the technology at stake can be profitable. What is

needed, therefore, is a more proactive approach on behalf of the foreign companies that should take advantage of the existing resources without any fear as there will always be a response to any inquiry. Hence, European SMEs, if really interested in having more information, should:

- carefully check all the available resources already present on several institutional websites (e.g. J-Store, and university websites);
- feel free to contact the TLOs of the major universities and research institutions to get a feedback and additional info;
- more in general, take a more proactive approach if really interested in exploring the available opportunities.

5.2. Recommendations to Japanese Universities and Research Organizations

Japanese universities and research centers that have been interviewed during this study showed an undisputed interest in increasing their international outreach in terms of tech transfer negotiations, and a realistic confidence in being able to enter into negotiations with foreign partners. Overall, the ratio of international licensing agreements is below the 10% threshold, but it could probably show an important increase in the near future if the following recommendations will be implemented:

- **On average, the dedicated webpages for available technologies in Japanese and English should be ameliorated. For example, contact details on webpages should be easier to retrieve (a contact point for international licensing activities should be appointed and "advertised");**
- **If possible, success cases of tech transfer operations with businesses should be made available so to better advertise the potential outcome of a tech transfer activity with new partners;**
- **Webpages in English should be kept updated with the relevant info, and the upload of the technologies on other on-line repositories should be considered as an additional viable and effective solution;**
- **More visual representations of the technologies should be offered for review. The general creation of videos (rather than mere documents) to show the available technologies and their applications may significantly increase the interest of potential licensees.**

Main IP Laws

- Code of Civil Procedure (Law No. 109 of 26 June 1996, as last amended by Law No. 151 of 1 December 1999, Law No. 128 of 25 July 2003 and Law No. 102 of 21 October 2005)
- Unfair Competition Prevention Act (Act No. 47 of 1993, as amended up to Act No. 62 of 2011)
- Designs Act (Act No. 125 of April 13, 1959, as amended up to the revisions of Act No. 63 of 2011)
- Patent Act (Act No. 121 of April 13, 1959, as amended up to Act No. 63 of 2011) (2011)
- Trademark Act (Act No. 127 of April 13, 1959, as amended up to the revisions of Act No. 63 of 2011)
- Utility Model Act (Act No. 123 of April 13, 1959, as last amended by Act No. 63 of 2011)
- Copyright Act (Act No. 48 of May 6, 1970, as last amended by Act No. 65 of December 3, 2010)
- Plant Variety Protection and Seed Act (Act No. 83 of May 29, 1998, as last amended by Act No. 49 of May 18, 2007)
- Law on the Circuit Layout of a Semiconductor Integrated Circuits (Act No. 43 of May 31, 1985, as last amended by Act No. 50 of June 2, 2006)
- Intellectual Property Basic Act (Act No. 122 of December 4, 2002, as last amended by Act No.119 of July 16, 2003)
- Law on the International Applications under the Patent Cooperation Treaty (Act No. 30 of April 26, 1978, as last amended by Act No. 47 of May 23, 2003)
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IP-related laws (enacted by the Legislature)

- Code of Civil Preservative Procedure (Law No. 91 of December 22, 1989, as last amended by Law No. 110 of June 26, 1996, Law No. 138 of August 1, 2003 and by Law No. 50 of 2 June 2006)
- State Redress Law (Law No. 125 of October 27, 1947)
- National Public Service Act (Act No.120 of October 21, 1947 as last amended by Act No.42 of 2012)
- Penal Code (Law No. 45 of April 24, 1907, as last amended by Law No. 91 of May 12, 1995, Law No. 138 of August 1, 2003 and Law No. 36 of May 8, 2006)

- Civil Code (Law No. 89 of April 27, 1896, as last amended by Law No. 79 of May 21, 1991, Law No. 149 of December 1, 1999 and Law No. 138 of August 1, 2003)
- Code of Civil Procedure (Law No. 29 of April 21, 1890, as last amended by Law No. 30 of April 2, 1992 and Law No. 109 of June 27, 1996)
- Civil Provisional Remedies Act (2011)
- Code of Civil Procedure (2011)
- Consumer Product Safety Act (Act No. 31 of June 6, 1973, as last amended by Act No. 105 of August 30, 2011) (2011)
- Household Goods Quality Labeling Act (Act No. 104 of May 4, 1962 as last Amended by Act No. 122 of 2011) (2011)
- Customs Act (Act No.61 of April 2, 1954, as last amended by Act No. 13 of March 31, 2010) (2010)
- Code of Criminal Procedure (Act No. 131 of July 10, 1948, as last amended by Act No. 26 of April 27, 2010) (2010)
- Law on Punishment of Organized Crimes and Control of Crime Proceeds (Act No.136 of August 18, 1999, as last amended by Act No.79 of July 15, 2009) (2009)
- Law against Unjustifiable Premiums and Misleading Representations (Act No. 134 of May 15, 1962, as last amended by Act No. 49 of June 5, 2009) (2009)
- Law on Prohibition of Private Monopolization and Maintenance of Fair Trade (Act No.54 of April 14, 1947, as last amended by Act No.51 of June 10, 2009) (2009)
- Customs Tariff Act (Act No. 54 of April 15, 1910, as last amended by Act No. 14 of March 31, 2009) (2009)
- Law for Prevention of Unauthorized Recording of Films (Law No. 65 of May 30, 2007) (2007)
- Patent Attorney Act (Act No. 49 of April 26, 2000, as last amended by Act No. 91 of June 20, 2007) (2007)
- Law on Protection of Cultural Properties (Act No. 214 of May 30, 1950, as last amended by Act No. 7, March 30, 2007) (2007)
- Companies Act (Act No. 86 of July 26, 2005, as amended by Act No. 109 of 2006) (2006)
- Bankruptcy Act (Act No. 75 of June 2, 2004, as last amended by Act No.109 of December 15, 2006) (2006)
- Limited Partnership Act for Investment (Act No. 90 of June 3, 1998, as last amended by Act No.109 of December 15, 2006) (2006)
- Code of Criminal Procedures (Law No. 131 of July 10, 1948, as last amended by Law No. 138 of August 18, 1999, Law No. 61 of May 30, 2003, and by Law No. 36 of

May 8, 2006) (2006)

- Act for Establishment of the Intellectual Property High Court (Act No. 119 of June 18, 2004) (2004)
- Law on Promotion of Creation, Protection and Exploitation of Contents (Act No. 81 of June 4, 2004) (2004)
- Arbitration Act (Act No. 138 of August 1, 2003, as last amended by Act No. 147 of December 1, 2004) (2004)
- Basic Law for the Promotion of Culture and the Arts (Act No.148 of December 7, 2001) (2001)

IP-related provisions (issued by the Executive)

- Enforcement Order of the Plant Variety Protection and Seed Act (Cabinet Order No. 368 of November 20, 1998, as last amended by Cabinet Order No.285 of December 11, 2009) (2009)
- Enforcement Order of the Act on Exceptional Provisions for the Registration of Program Works (Cabinet Order No. 287 of August 29, 1998, as last amended by Cabinet Order No. 240 of September 11, 2009) (2009)
- Enforcement Order on Prohibition of Private Monopolization and Maintenance of Fair Trade (Cabinet Order No. 317 of December 1, 1977, as last amended by Cabinet Order No.253 of October 28, 2009) (2009)
- Enforcement Order of the Copyright Act (Cabinet Order No. 335 of December 10, 1970, as last amended by Cabinet Order No. 299 of December 28, 2009) (2009)
- Design Registration Order (Cabinet Order No.41 of March 24, 1960, as last amended by Cabinet Order No.404 of December 26, 2008) (2008)
- Patent Registration Order (Cabinet Order No. 39 of March 24, 1960, as last amended by Cabinet Order No. 404 of December 26, 2008) (2008)
- Trademark Registration Order (Cabinet Order No. 42 of March 24, 1960, as last amended by Cabinet Order No. 404 of December 26, 2008) (2008)
- Utility Models Registration Order (Cabinet Order No. 40 of March 24, 1960, as last amended by Cabinet Order No. 404 of December 26, 2008) (2008)
- Enforcement Order of the Patent Act (Cabinet Order No.16 of March 8, 1960, as last amended by Cabinet Order No. 404 of December 26, 2008) (2008)
- Enforcement Order of the Utility Model Act (Cabinet Order No. 17 of March 8, 1960, as last amended by Cabinet Order No. 404 of December 26, 2008) (2008)
- Order for the Patent Law and Other Related Fees (Cabinet Order No. 20 of March 8, 1960, as last amended by Cabinet Order No. 404 of December 26, 2008) (2008)

- Cabinet Ordinance Regarding Transitional Measures Accompanying Enforcement of Revised Trademark and Design Law (2007)
- Cabinet Order Concerning the Transitional Measures for Partial Revision of the Patent Law (2007)
- Enforcement Order of the Act on International Applications under the Patent Cooperation Treaty (Cabinet Order No.291 of July 14, 1978, as last amended by Cabinet Order No. 235 of August 3, 2007) (2007)
- Cabinet Order Concerning the Transitional Measure for the Partial Revision of Enforcement Law of the Design Act (2006)
- Enforcement Order of the Trademark Act (Cabinet Order No. 19 of March 8, 1960, as last amended by Cabinet Order No. 342 of October 27, 2006) (2006)
- Cabinet Order Concerning the Transitional Measure Partially Amending Enforcement Law of the Patent Act (2005)
- Enforcement Order of the Law on Exceptional Provisions to the Copyright Act, required as a consequence of the Enforcement of the Universal Copyright Convention (Cabinet Order No. 259 of July 18, 1964, as last amended by Cabinet Order No. 24 of February 18, 2005) (2005)
- Government Ordinance Partially Amending Patent Law Enforcement Order Concerning the Accelerated Patent Examination (2004)
- Government Ordinance Partially Amending Patent Law Enforcement Order Concerning the Accelerated Patent Examination (2004)
- Order for Industrial Property Council (Cabinet Order No.294 of June 7, 2000, as last amended by Cabinet Order No.378 of December 18, 2002) (2002)
- Cabinet Order Concerning the Transitional Measures for Partial Revision of the Patent Law (1970)

Appendix 2 - Contact info of selected Japanese TLOs

Institution	Type of Contact	E-mail	Phone	URL
Waseda University - Research Promotion Department	Office	contact-TLO@list.waseda.jp	+81-3-5286-9867	http://www.waseda.jp/tlo/index-e.html
University of Tsukuba - Industry Relations and Tech Transfer Office	Office	renkei-honbu@ilc.tsukuba.ac.jp	+81-29-853-2903	http://www.sanrenhonbu.tsukuba.ac.jp/en/
Tokyo Me dical and Dental University - Industry-University Collaborative Research Center	Office	TLO@tmd.ac.jp	+81-3-5803-4737	http://www.tmd.ac.jp/tlo/en/index.html
Tokyo Institute of Technology - University-Industry Liaison Office	Office	sangaku@sangaku.titech.ac.jp	+81-3-5734-2445	http://www.sangaku.titech.ac.jp/english/index.html
Tohoku University - TLO	Office	http://www.t-technoarch.co.jp/cgi-bin/postmail/contact_en.html	+81-22-222-3049	http://www.t-technoarch.co.jp/en/index.html
The University of Tokyo - TLO	Office	casti@casti.co.jp	+81-3-5805-7661	http://www.casti.co.jp/en/
Meiji University - Intellectual Property Division (Only in Japanese)	Office	TLO@mics.meiji.ac.jp	+81-3-3296-4361	http://www.meiji.ac.jp/TLO/
Kanazawa University - TLO	Office	e-mail-to@kuTLO.incu.kanazawa-u.ac.jp	+81-76-264-6115	http://www.o-fsi.kanazawa-u.ac.jp/en/
Nagoya Institute of Technology - Industry-Academia-Government Collaboration Center (Only in Japanese)	Office	patent@adm.nitech.ac.jp	+81-52-735-5301	http://www.tlc.nitech.ac.jp
Nagoya University - Industry-Academia-Government Collaboration Promotion Division	Office	chizai@sangaku.nagoya-u.ac.jp	+81-52-788-6003	http://www.aip.nagoya-u.ac.jp/en/
Osaka University - Office for industry-university coollaboration	Office	ipm@uic.osaka-u.ac.jp	+81-6-6879-4861	http://www.uic.osaka-u.ac.jp
Kyoto University - Office of Society-Academia Collaboration for Innovation	Office	info@saci.kyoto-u.ac.jp	+81-75-753-5536	http://www.saci.kyoto-u.ac.jp/en/
Kansai TLO (marketing technologies from Kyoto University, Kyushu University, Wakayama University, Kyoto Prefectural University of Medicine and Nara Medical University)	Office	http://www.kansai-tlo.co.jp/english/contents/company/contact/index.html	+81-75-353-5890	http://www.kansai-tlo.co.jp/english/
Nara Institute of Science and Technology - Center for Industry-Government-Academia Collaboration	Office	ip-3f@ip.naist.jp	+81-743-72-5930	http://ipw.naist.jp/sankan/index_en.html
Hiroshima University - Center for Collaborative Research & Community Cooperation (IP Division)	Office	chizai@hiroshima-u.ac.jp	+81-82-424-5597	http://www.hiroshima-u.ac.jp/en/sangaku/
Kyushu Institute of Technology Innovation Promotion Organization (Only in Japanese)	Office	chizai@jimu.kyutech.ac.jp	+81-93-884-3499	http://www.ccr.kyutech.ac.jp/
Kyushu University - Industry-University-Government Collaboration Management Center	Office	transfer@imaq.kyushu-u.ac.jp	+81-92-832-2128	http://imaq.kyushu-u.ac.jp/
Tokyo University of Science research strategy , University Research Administration Center (Only in Japanese)	Office	ura@admin.tus.ac.jp	+81-3-5876-1530	http://www.tus.ac.jp/ura/
Nihon University - Nihon University Business, Research and IP Center	Office	nubic@nihon-u.ac.jp	+81-03-5275-8139	http://www.nubic.jp/english/index.html
Hokkaido University - Center for Innovation and Business promotion	Office	https://reg31.smp.ne.jp/regist/is?SMPFORM=tcl-mjock-0c39ab213124628d9dc449168ef6933d	+81-11-706-9561	http://www.mcip.hokudai.ac.jp/cms/cgi-bin/index.pl?page=index&view_category_lang=2
Keio University	Office	toiawasesaki-ipc@adst.keio.ac.jp	n.a.	http://www.rcp.keio.ac.jp/sip/HTML_video/videoindex.html
National Institute for Materials Science - Research Collaboration Office - Tech Transfer Section	Office	info@nims.go.jp	+81-29-859-2000	http://www.nims.go.jp/eng/index.html